EFFECTS OF SCAFFOLDING HIGHER ORDER THINKING QUESTIONS ON READER SELF-EFFICACY AND CRITICAL THINKING OF SIXTH GRADE STUDENTS

Jason L. McKinnon
Western Connecticut State University, mckinnon.jason@newfairfieldschools.org

Follow this and additional works at: http://repository.wcsu.edu/educationdis

Part of the Curriculum and Instruction Commons, Educational Assessment, Evaluation, and Research Commons, and the Educational Methods Commons

Recommended Citation
McKinnon, Jason L., "EFFECTS OF SCAFFOLDING HIGHER ORDER THINKING QUESTIONS ON READER SELF-EFFICACY AND CRITICAL THINKING OF SIXTH GRADE STUDENTS" (2012). Education Dissertations. 44.
http://repository.wcsu.edu/educationdis/44

This Dissertation is brought to you for free and open access by the Education and Educational Psychology at WestCollections: digitalcommons@wcsu. It has been accepted for inclusion in Education Dissertations by an authorized administrator of WestCollections: digitalcommons@wcsu. For more information, please contact ir@wcsu.edu.
EFFECTS OF SCAFFOLDING HIGHER ORDER THINKING QUESTIONS ON READER SELF-EFFICACY AND CRITICAL THINKING OF SIXTH GRADE STUDENTS

Jason L. McKinnon

BA Flinders University of South Australia, 1995
MA Flinders University of South Australia, 1997

A Dissertation
Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Education in Instructional Leadership in the Department of Education and Educational Psychology at Western Connecticut State University
2012
EFFECTS OF SCAFFOLDING HIGHER ORDER THINKING QUESTIONS ON READER SELF-EFFICACY AND CRITICAL THINKING OF SIXTH GRADE STUDENTS

Jason McKinnon
Western Connecticut State University

This study examined the potential benefits of instructional strategies that scaffold the development of higher order thinking (HOT) questions on reader self-efficacy and critical thinking. Another goal of this study aimed to investigate the relationship between reader self-efficacy and critical thinking. The explicit instruction of HOT questions involves four steps: (a) selecting Bloom’s revised taxonomy to identify effective question strands; (b) assessing HOT questions use through the Classroom Practice Record (CPR); (c) implementing strategy instruction focusing on explicit scaffolding techniques and allowing time to practice the implementation of strategies during assigned lessons for a period of eight weeks; and, (d) evaluating student self-efficacy, critical thinking, and HOT question use.

Using a sample of convenience, this quantitative quasi-treatment design utilized 262 students at two different school sites belonging to the same District Reference Group (DRG). This study assessed the impact of instructional scaffolding of HOT questions in four classes among heterogeneously grouped students in sixth grade. Two teachers were trained in the instruction and implementation of the program. One school was assigned to receive the treatment of instructional scaffolding of HOT questions while the remaining school served as the comparison group.
Several conclusions were drawn from the results. When teachers received explicit training in scaffolding HOT questions in the classroom, both students and teachers asked significantly more HOT questions than the comparison group. Results also point to a positive correlation between reader self-efficacy and critical thinking whereby students were more efficacious concerning their ability to read when they also demonstrate stronger critical thinking skills.

Based on this study, it is recommended that scaffolding be explicitly used in the classroom to support effective learning. When teachers consciously and consistently apply scaffolding techniques, learning strategies become systematic. Furthermore, a questioning framework such as Bloom’s revised taxonomy provides an important framework that enables the learner and teacher to use verbs to actively identify diverse forms of thinking. The organization of thinking into six levels (remembering, understanding, applying, analyzing, evaluating, and creating) represented a pragmatic way to design higher order thinking tasks, coinciding with scaffolding techniques, to improve student learning.
EFFECTS OF SCAFFOLDING HIGHER ORDER THINKING QUESTIONS ON READER SELF-EFFICACY AND CRITICAL THINKING OF SIXTH GRADE STUDENTS

Presented by

Jason L. McKinnon, EdD

Frank LaBanca, EdD
Primary Advisor
Signature 3/31/12

Marcia A. B. Delcourt, PhD
Secondary Advisor Committee Member
Signature 3/31/12

Jennifer F. Mitchell, EdD
Secondary Advisor Committee Member
Signature 3/31/12

2012
ACKNOWLEDGEMENTS

While many people have provided support and encouragement during the course of my doctoral studies, a few have been especially helpful and deserve recognition. I would like to thank Dr. Frank LaBanca for guiding this research and providing gems of wisdom when needed. Frank, I could not have accomplished this goal without you! Additionally, I would like to thank Dr. Marcia Delcourt—you inspire every student to think for themselves; your hand has guided this program from the beginning. Special thanks to Dr. Jennifer Mitchell and Dr. Michael Hibbard for sharing their valuable time and ideas, especially when I needed direction.

Thank you to the staff of Branchville Elementary School. A colleague could not ask for a more professional faculty; your kindness and friendship have been instrumental in support of my professional goals. I would also like to thank Ms. Low, Ms. Michael, Mr. Fiedler, Mr. Salem, Mrs. Hanies, Mrs. Bray, Mrs. Roth and Mrs. Meier for their direct contributions and enthusiasm for this project. Finally, thank you to Cohort Three (we did it!).
DEDICATION

This dissertation is dedicated to my family. Your love has seen me through challenging times and always pulled me through. Thank you for your encouragement, support, good humor, and love. To my wife, Hannah, I wish I had your talent for prose to express my sincere thanks for everything you have done for me. That one-way ticket from Australia to Sherman really paid off. It was your courage, not mine, to make that leap and look at us now. To our daughters, Grace and Finley, our greatest accomplishments, my love for you is beyond words. Girls, thanks for being patient as Dad worked on his homework. I’m done now. What should we do? Go exploring, biking, walking, fishing…just name it!
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>i</td>
</tr>
<tr>
<td>Copyright</td>
<td>iii</td>
</tr>
<tr>
<td>Approval Page</td>
<td>iv</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>v</td>
</tr>
<tr>
<td>Dedication</td>
<td>vi</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>vii</td>
</tr>
<tr>
<td>Appendices</td>
<td>xi</td>
</tr>
<tr>
<td>Table of Tables</td>
<td>xii</td>
</tr>
<tr>
<td>Table of Figures</td>
<td>xiv</td>
</tr>
<tr>
<td>CHAPTER ONE: INTRODUCTION AND IDENTIFICATION OF THE TOPIC</td>
<td>1</td>
</tr>
<tr>
<td>Overview</td>
<td>1</td>
</tr>
<tr>
<td>Rationale</td>
<td>1</td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td>2</td>
</tr>
<tr>
<td>Potential Benefits</td>
<td>4</td>
</tr>
<tr>
<td>Definition of Key Terms</td>
<td>4</td>
</tr>
<tr>
<td>Related Literature Overview</td>
<td>6</td>
</tr>
<tr>
<td>Methodology</td>
<td>7</td>
</tr>
<tr>
<td>Research Questions and Hypotheses</td>
<td>7</td>
</tr>
<tr>
<td>Description of the Setting and the Subjects</td>
<td>9</td>
</tr>
<tr>
<td>Table of Contents (continued)</td>
<td>Page</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>9</td>
</tr>
<tr>
<td>Description of the Research Design</td>
<td>12</td>
</tr>
<tr>
<td>Timeline</td>
<td>14</td>
</tr>
<tr>
<td>Limitations of the Study</td>
<td>14</td>
</tr>
<tr>
<td><strong>CHAPTER TWO: REVIEW OF THE LITERATURE</strong></td>
<td>16</td>
</tr>
<tr>
<td>Overview of Social Constructivist Theory</td>
<td>16</td>
</tr>
<tr>
<td>Sociocultural Theory</td>
<td>17</td>
</tr>
<tr>
<td>The Zone of Proximal Development</td>
<td>18</td>
</tr>
<tr>
<td>Scaffolding</td>
<td>20</td>
</tr>
<tr>
<td>Operationalization of Scaffolding</td>
<td>25</td>
</tr>
<tr>
<td>Social Cognition Theory</td>
<td>26</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>27</td>
</tr>
<tr>
<td>Higher Order Thinking</td>
<td>33</td>
</tr>
<tr>
<td>Blooms Taxonomy</td>
<td>39</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td>42</td>
</tr>
<tr>
<td>Chapter Summary</td>
<td>46</td>
</tr>
<tr>
<td><strong>CHAPTER THREE: METHODOLOGY</strong></td>
<td>48</td>
</tr>
<tr>
<td>Chapter Overview</td>
<td>48</td>
</tr>
<tr>
<td>Description of the Setting and the Sample</td>
<td>48</td>
</tr>
<tr>
<td>Research Questions and Hypotheses</td>
<td>50</td>
</tr>
<tr>
<td>Type of Data</td>
<td>52</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>52</td>
</tr>
<tr>
<td><strong>Table of Contents (continued)</strong></td>
<td>Page</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>California Measure of Mental Motivation</td>
<td>52</td>
</tr>
<tr>
<td>Reader Self Perception Survey</td>
<td>53</td>
</tr>
<tr>
<td>The Classroom Practice Record</td>
<td>56</td>
</tr>
<tr>
<td>Research Design and Analysis</td>
<td>58</td>
</tr>
<tr>
<td>Level of Significance</td>
<td>58</td>
</tr>
<tr>
<td>Research Question One</td>
<td>59</td>
</tr>
<tr>
<td>Research Question Two</td>
<td>59</td>
</tr>
<tr>
<td>Research Question Three</td>
<td>59</td>
</tr>
<tr>
<td>Research Question Four</td>
<td>61</td>
</tr>
<tr>
<td>Study Timeline and Data Collection</td>
<td>62</td>
</tr>
<tr>
<td>Treatment</td>
<td>63</td>
</tr>
<tr>
<td>Statement of Ethnics and Confidentiality</td>
<td>68</td>
</tr>
<tr>
<td><strong>CHAPTER FOUR: ANALYSIS OF DATA AND FINDINGS</strong></td>
<td>69</td>
</tr>
<tr>
<td>Chapter Overview</td>
<td>69</td>
</tr>
<tr>
<td>Methodology Summary</td>
<td>69</td>
</tr>
<tr>
<td>Research Questions</td>
<td>70</td>
</tr>
<tr>
<td>Research Question Analysis, Description, and Findings</td>
<td>70</td>
</tr>
<tr>
<td>Research Question One</td>
<td>70</td>
</tr>
<tr>
<td>Research Question Two</td>
<td>89</td>
</tr>
<tr>
<td>Research Question Three</td>
<td>104</td>
</tr>
<tr>
<td>Research Question Four</td>
<td>109</td>
</tr>
</tbody>
</table>
## Table of Contents (continued)

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHAPTER FIVE: SUMMARY AND CONCLUSIONS</td>
<td>114</td>
</tr>
<tr>
<td>Chapter Overview</td>
<td>114</td>
</tr>
<tr>
<td>Summary of Study</td>
<td>115</td>
</tr>
<tr>
<td>Comparison and Contrast of Findings Related to the Literature Review</td>
<td>118</td>
</tr>
<tr>
<td>and the Implications for Future Research</td>
<td></td>
</tr>
<tr>
<td>Research Question One</td>
<td>119</td>
</tr>
<tr>
<td>Research Question Two</td>
<td>121</td>
</tr>
<tr>
<td>Research Question Three</td>
<td>123</td>
</tr>
<tr>
<td>Research Question Four</td>
<td>126</td>
</tr>
<tr>
<td>Limitations of the Study</td>
<td>127</td>
</tr>
<tr>
<td>References</td>
<td>130</td>
</tr>
</tbody>
</table>
Appendices

Appendix A: IRB Approval
Appendix B: Consent Letters
Appendix C: Treatment Plan and Protocols
Appendix D: Permission to Adapt Critical Thinking Flowchart
Appendix E: Permission to Use Reader Self-Perception Scale (RSPS)
Appendix F: Connecticut State Department of Education: Grade 6 Language Arts Curriculum
Table of Tables

Table 1: The Revision of Bloom’s Taxonomy 41
Table 2: Numbers of Participants in the Study 51
Table 3: Cronbach’s Alpha of CM3 Scales and Subscales 53
Table 4: The Reader Self-Perception Scale Descriptions 54
Table 5: RSPS: Number of Items and Internal Consistency Reliabilities 55
Table 6: Research Design 58
Table 7: Model 2x4 Chi-Square Utilized to Interpret CPR Data 61
Table 8: Research Question One: Pretest Descriptive Statistics 74-75
Table 9: Box’s Test of Equality of Covariance Matrices 77
Table 10: Multivariate Tests Comparing Treatment and Comparison Groups for Critical Thinking Scores 79
Table 11: Research Question One: Posttest Descriptive Statistics 81-82
Table 12: Box’s Test of Equality of Covariance Matrices 86
Table 13: Multivariate Tests Comparing Treatment and Comparison Posttest Groups for Critical Thinking Scores 88
Table 14: Research Question Two: Pretest Descriptive Statistics 92-93
Table 15: Box’s Test of Equality of Covariance Matrices 94
Table 16: Multivariate Tests Comparing Treatment and Comparison Pretest Groups for Reader Self-Efficacy Scores 95
Table 17: Research Question Two: Posttest Descriptive Statistics 97-98
Table 18: Box’s Test of Equality of Covariance Matrices 102
Table 19: Multivariate Tests Comparing Treatment and Comparison 103
Posttest Groups for Reader Self-Efficacy Scores

Table 20: Differences in Question Use between Expected (pretreatment) and Observed (posttreatment) Frequencies-2x4 Chi-square

Table 21: Correlational Analysis of Participant’s Post Treatment Scores for the Subscales of the CM3 and RSPS
Table of Figures

<table>
<thead>
<tr>
<th>Figure 1: Map of Question Scaffolding</th>
<th>66</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 2: Decision Making Tree to Help Teachers in Determining Level of Thinking</td>
<td>67</td>
</tr>
<tr>
<td>Figure 3: CM3 Posttest Subscale Mental Focus for the Treatment and Comparison Groups</td>
<td>83</td>
</tr>
<tr>
<td>Figure 4: CM3 Posttest Subscale Creative Thinking for the Treatment and Comparison Groups</td>
<td>83</td>
</tr>
<tr>
<td>Figure 5: CM3 Posttest Subscale Learning Orientation for the Treatment and Comparison Group</td>
<td>84</td>
</tr>
<tr>
<td>Figure 6: CM3 Posttest Subscale Cognitive Integrity for the Treatment and Comparison Group</td>
<td>84</td>
</tr>
<tr>
<td>Figure 7: CM3 Posttest Subscale Scholarly Rigor for the Treatment and Comparison Group</td>
<td>85</td>
</tr>
<tr>
<td>Figure 8: RSPS Posttest Subscale Progress for Treatment and Comparison Groups</td>
<td>99</td>
</tr>
<tr>
<td>Figure 9: RSPS Posttest Subscale Observational Comparison for Treatment and Comparison Groups</td>
<td>98</td>
</tr>
<tr>
<td>Figure 10: RSPS Posttest Subscale Social Feedback for Treatment and Comparison Groups</td>
<td>100</td>
</tr>
<tr>
<td>Figure 11: RSPS Posttest Subscale Physiological States for Treatment and Comparison Groups</td>
<td>100</td>
</tr>
</tbody>
</table>
CHAPTER ONE: INTRODUCTION AND IDENTIFICATION OF THE TOPIC

Overview

During the last 10 years, since the implementation of No Child Left Behind (NCLB; 2001), schools in the United States have declined in international rankings. Surprisingly, international assessments have become more rigorous during the same period and require students to analyze, weigh and balance evidence, apply, and explain and defend their answers (Darling-Hammond, 2010). According to Darling-Hammond (2010), “these higher-order skills are emphasized in other nations’ curriculum and assessment systems but have been discouraged by the kind of lower-level multiple-choice testing favored by NCLB” (p. 14).

To counteract this disparity, teachers in the United States need consistent methods to scaffold the development of higher order thinking in our students. These scaffolds are not clearly defined for teachers. In fact, many teachers guide students effectively through a process that encourages critical thinking without being aware of the specific steps they have taken (Fisher & Frey, 2010). This study aims to clearly define a set of scaffolding steps necessary to develop higher order thinking skills and support teachers in the 21st century.

Rationale

Concern over the reading achievement of today’s students has reached the level of national attention and is considered a public health concern by the National Institute of Child Health and Human Development (Snow & Sweet, 2003). As a result, third through twelfth grade classroom teachers spend considerable time preparing students for standardized tests; this mechanistic form of teaching often accompanies traditional test preparation and can diminish a teacher’s focus on the curriculum (Assaf, 2006; Higgins, Miller, & Wegmann, 2006).

Fortunately, teachers are also mindful of the gradual release of responsibility paradigm; a framework where teachers scaffold student learning to facilitate student growth (Fisher & Frey,
A pragmatic way to scaffold instruction in this framework is through a unit of study. While state standards typically provide overarching goals, a unit of study can provide a teacher with a specific scope and sequence to deliver targeted lessons. As a result, a unit of study focusing on higher order thinking questions provided teachers with a specific scope and sequence for the eight-week treatment. Strategies embedded in the treatment unit of study enabled teachers to scaffold student learning through many avenues: questions, activities, cues, and think alouds. A teacher think aloud can direct students to a specific problem-solving strategy or mediate higher order thinking (Fisher & Frey, 2010).

According to Graves and Liang (2008), the promotion of higher order thinking to stimulate reading comprehension in middle school classrooms is less frequent and less deliberate than is needed. At a minimum, the promotion of higher order thinking and what constitutes higher order thinking questions is needed to improve student learning. Hence, the rationale to scaffold higher order thinking, specifically HOT questions, would provide teachers with explicit strategies to promote higher order thinking in the classroom.

Finally, there appears to be little to no evidence-based research demonstrating a clear link between self-efficacy and higher order thinking. An intended outcome of this study, in addition to identifying explicit scaffolding techniques, was to explore the relationship between reader self-efficacy and the explicit instruction that targets HOT questioning to assess the impact on student self-efficacy and critical thinking.

**Statement of the Problem**

According to the National Reading Panel (2008) reading scores in fourth and eighth grades have been stagnant during the past 10-years. While school teachers in the United States seem proficient at teaching basic reading skills, where there has been marginal growth, students
are increasingly challenged to broaden these reading skills to higher levels. Despite these challenges, teachers often have difficulty finding a reading program or an approach that meet the needs of all students.

During this same time period, educators have become increasingly comfortable with the concept of scaffolding as a way to explain their role in guiding children’s learning and development (Daniels, 2001; Hammond, 2002; Stone, 1988; Wells, 1999). However, the interpretation of scaffolding and its implementation varies significantly from study to study (Verenikina, 2008). While Vygotsky (1978) introduced us to the zone of proximal development (ZPD), which “awakens a variety of internal developmental processes that are able to operate only when the child is interacting with a more capable other” (p. 86), he did not operationalize the term scaffolding. Wood, Bruner and Ross (1976) described scaffolding as a “process that enables a child or novice to solve a problem or achieve a goal which would be beyond his unassisted efforts” (p. 90). Unfortunately, scaffolding does not provide educators with clear and definite steps for the ways it should be used to achieve effective teaching (Hammond, 2002). In fact, according to Wood and Wood (1996), the teacher is not provided with concrete direction on the “nature of the guidance and collaboration needed that promotes development” (p. 5).

A further dilemma exists over conceptual differences concerning higher level thinking. According to Geertsen (2003), the “indiscriminate use of terms such as critical thinking, reflective thinking, and high-level thinking has created unnecessary confusion” (p. 1). While experts agree that higher order thinking is more disciplined and systematic than every day thought, it still remains as an elusive concept to grasp (Geertsen, 2003).

In summary, current classroom approaches, particularly reading instruction, do not necessarily target higher order thinking; and, many teachers are missing explicit scaffolding
techniques from their instructional toolboxes to develop higher order thinking. Further, what constitutes higher order thinking is difficult to grasp in the classroom for both teachers and students. This study aims to find possible solutions to these problems. The need to identify a structure to counteract this disparity is therefore important. As a result, Bloom’s revised taxonomy (Anderson, et al., 2001) was an important tool in the treatment and is discussed below. Additionally, explicit scaffolding steps were explored and later discussed in Chapter 5. Finally, according to an EBSCO and ERIC search (using the terms “reader self-efficacy” and “critical thinking”) of more than 1.3 million records and 320,000 full-text articles, a link between higher order thinking and reader self-efficacy was not found. Therefore, results of this relationship are revealed in Chapter 4 and discussed in Chapter 5.

Potential Benefits

Geersten (2003) identifies critical thinking as a process that involves disciplined teacher questioning and active student participation. Students and teachers alike may benefit from specific identification and use of scaffolding steps, along with a clear definition of higher order thinking questions. Consequently, it is the hope of this researcher that the current study provides teachers with clear scaffolding steps and questioning strategies that will improve student learning while increasing our understanding of the relationship between reader self-efficacy and critical thinking.

Definition of Key Terms

In order to provide a common conceptual understanding, the following list provides an operational definition of terms:
1. **Critical Thinking** is defined as a process of purposeful, self-regulatory judgment. During this process, a learner gathers evidence to form a judgment about what to believe or what to do in a given context (Facione, 1990).

2. **Bloom’s Taxonomy** (1956) provides a way to organize thinking skills into six levels, from the most basic (Knowledge and Comprehension) to the higher order levels (Application, Analysis, Synthesis, and Evaluation). The taxonomy and the names of the six major categories were later revised from noun to verb forms. In the revised taxonomy, the noun and verb formed separate dimensions, the noun providing the basis for the Knowledge dimension and the verb forming the basis for the Cognitive Process dimension (Anderson, et al., 2001).

3. **Higher Order Thinking** (HOT) resists precise forms of definition (Resnick, 1987). According to Geertsen (2003), higher order thinking is a systematic way of using the mind to confirm existing information or to search for new information using various degrees of abstraction. Dewey (1933) considered attitude and disposition as important as knowledge and reasoning. For the purposes of this study, this author will frame HOT as it corresponds with Bloom’s revised taxonomy of overlapping levels above Understanding (Anderson, et al., 2001). This revision to Bloom’s Revised Taxonomy is illustrated in Chapter 3 and identifies Applying, Analyzing, Evaluating and Creating as higher order thinking strands.

4. **Reader Self-Efficacy** Reader self-efficacy in this study is defined as a measure of how students perceive their reading ability. Henk and Melnick (1995) developed this definition based on Bandura’s (1986) model of self-efficacy.
5. **Reader Self-Perception** A reader’s self-perception of themselves is a measure of how children feel about themselves as readers. (Henk & Melnick, 1995).

6. **Scaffolding** is defined as a “course of action that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts” (Wood, Bruner, & Ross, 1976, p. 90). In this study, scaffolding consisted of questions, prompts, cues, modeling, and dialogue.

7. **Self-Efficacy** is defined as a person’s belief in their ability to acquire new information or complete a task or activity to a prescribed level of performance (Bandura, 1986).

8. **Zone of Proximal Development** (ZPD) describes a relationship where a learner can acquire greater independence, skills and knowledge with skilled help (Vygotsky, 1978).

9. **Unit of Study** is defined as a framework tailored to meet developmental and curricular needs of students in reading and writing. A subsection of the yearlong curriculum calendar, a Unit of Study has a specific focus and a scope and sequence derived from State standards (Calkins, 2001).

**Related Literature Overview**

Teachers and researchers have become more aware of the role that scaffolding plays in effective instruction. The learning principles underpinning this research can be drawn from Lev Vygotsky (1978) and Jerome Bruner (1977). Together, their ideas combine aspects of cognitive development and the social world in which this development occurs. These social, cultural and cognitive factors present a view of learning that is best described by the Interactional Theory of
Cognitive Development with specific focus on the construct of scaffolding and the Zone of Proximal Development (Driscoll, 2005).

This study also explored the interaction between motivation and learning. According to Driscoll (2005), researchers are paying close attention to how students “enhance their self-perceptions of control in learning, and strategies to maintain personal beliefs in high ability” (p. 312). Since the construct of self-efficacy has its impetus in social learning theory (Bandura, 1986), the ties between self-efficacy, scaffolding and higher order thinking are also discussed in later chapters. Finally, while there is no universal agreement to the exact meaning of higher order thinking, Chapter 2 will expand on Bloom’s taxonomy (2008) as an intellectually disciplined process of active application, analysis, synthesis, and evaluation of information. The way in which a learner uses Bloom’s taxonomy (2008) through observation, experience, reflection, reasoning, or communication, as a guide to belief and action can be defined as critical thinking (Facione, 1990).

Methodology

Research Questions and Hypotheses

The following research questions were addressed in this study:

Research question 1. Is there a statistically significant difference in the critical thinking skills of students who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not?

Hypothesis. There is a statistically significant difference in the critical thinking skills of students who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not.
**Research question 2.** Is there a statistically significant difference in students’ self-perceptions of themselves as readers who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not?

*Hypothesis.* There is a statistically significant difference in students’ self-perceptions of themselves as readers who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not.

**Research question 3.** Is there a statistically significant difference in the frequency of higher-order thinking questions asked by teachers and students participating in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not?

*Hypothesis.* There is a statistically significant difference in the frequency of higher-order thinking questions asked by teachers and students participating in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not.

**Research question 4.** Is there a statistically significant correlation between critical thinking skills (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry and Scholarly Rigor) and reading self-efficacy (Progress, Observational Comparison, Social Feedback, and Physiological States)?

*Hypothesis.* There is a statistically significant correlation between critical thinking skills (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry and Scholarly Rigor) and reading self-efficacy (Progress, Observational Comparison, Social Feedback, and Physiological States).
Description of the setting and participants

The participants of this study were sixth grade students from two middle schools in the northeast. This suburban school District consists of approximately 5,575 students. The district is comprised of six elementary schools, two middle schools and one high school. The city population is approximately 24,300 people. Students were 93.4 percent white and the per capital income is $51,795. Participants in the study were a sample of convenience (n = 286).

Participating teachers received five hours of professional development and given support throughout the eight week treatment that included a unit of study that contained a questioning framework. Teachers were observed during the implementation of the treatment in order to minimize confounding effects on the dependent variable. Teachers in the comparison group were also observed during the treatment to ensure they followed the District’s grade six curriculum which was derived from the State Standards. It should be noted that the District’s grade six curriculum does not contain a specific focus on higher order thinking strategies or the steps to scaffold this level of learning. However, this researcher will provide comparison group teachers with the same training and questioning framework following the commencement of this study. The successful interventions (strategies and approaches) are detailed in Chapter 5.

Instrumentation

This study included the following instruments: the California Measure of Mental Motivation (CM3; Giancarlo, Blohm, & Urdan, 2004) to assess critical thinking, the Reader Self-Perception Survey (RSPS; Henk & Melnick, 1995) to assess student perception of reader self-efficacy, and Classroom Practice Record (CPR; Westberg, Archambault, Dobyns, & Salvin, 1993) to determine the effectiveness of HOT questions asked by teachers and students.
California Measure of Mental Motivation (CM3)

According to Giancarlo, Blohm, and Urdan (2004), “the CM3 is designed to measure the degree to which an individual is cognitively engaged and mentally motivated towards intellectual activities that involve reasoning” (p. 349). The CM3 has five scales that include: Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Integrity and Scholarly Rigor.

“Together, these scales assess the extent to which individuals perceive themselves as willing and inclined to approach challenging problems in a systematic, innovative, open-minded, and inquisitive way, thereby using their reasoning skills to increase their knowledge base” (Giancarlo, Blohm, & Urdan, 2004, p. 360). The survey measures dispositions towards critical thinking and mental motivation with a Likert-type (1-4) scale and a 50-point metric.

Reader Self-Perception Scale (RSPC)

This instrument was developed to measure student perceptions of reading self-efficacy (Henk & Melnick, 1995). “Because of research in the affective domain, we now know with greater certainly that children who have made positive associations with reading tend to read more often, for longer periods of time, and with greater intensity” (Henk & Melnick, 1995, p. 470). Additionally, Henk and Melnick (1995) note that “self-perceptions can impact upon an individual’s overall orientation toward the process itself” (p. 471). Essentially, students who believe they are good readers exhibit higher achievement and students who perceive themselves as poor readers experience less success.

The authors developed the RSPC to reflect the four basic factors students take into account when estimating their capabilities as readers. These four factors were based on the work of Bandura (1977, 1989) and Schunk (1985) related to their basic model of self-efficacy. The four factors include Progress (PR), Observational Comparison (OC), Social Feedback (SF)
and Physiological States (PS). Progress is defined as “how one’s perception of present reading performance compares with past performance” (Henk & Melnick, 1995, p. 472). Observational Comparison is defined as “how a child perceives his or her reading performance compared with the performance of classmates” (p. 472). Social Feedback includes, “direct or indirect input about reading from teachers, classmates, and people in the child’s family” (p. 472). Finally, Physiological States “refers to the internal feelings that the child experiences during the reading (p. 472). The RSPC was piloted on 625 students in grades four to six. After modifications, an additional 1, 479 fourth through sixth grade students responded which indicated reliability scale alphas ranging from .81 to .84 with “all items contributing to overall scale reliability” (Henk & Melnick, 1995, p. 482). The RSPS established content validity by using a Jury of experts, consisting of both university faculty and graduate students enrolled in reading and affective instrument development courses, to judge its adequacy. Gall, Gall, and Borg (2007) note that “content-related evidence is typically determined systematically by content experts…” (p. 196).

The Classroom Practice Record (CPR)

This observational tool is designed to collect descriptive information of participants by coding specific information and interactions. According to Westberg, Archambault, Dobyns and Salvin (1993), the observer records verbal interactions between the teacher and student, or vice versa, particularly when in the form of a knowledge/comprehension (KC) or higher order thinking (HOT) questions. Observers listened to a minimum of 5-minutes of verbal interactions between teachers and students. Inter-rater reliability between knowledge/comprehension and HOT questions was consistent where observers’ coding on question types resulted in observer agreement 80 percent of the time.
Description of the Research Design

This research study is a quasi-experimental design with a pretest-posttest comparison group. Intact classroom groups were utilized and, as a result, it was not possible to randomly select participants for either the comparison or treatment groups. Two teachers, at one middle school, were involved in the treatment group and received professional development in the scaffolding of higher order thinking questions. In addition, they received a unit of study which contained lessons with embedded higher order thinking (HOT) questions strategies. At the second middle school in the district, two additional teachers followed the District curriculum based on grade six State Standards.

Research question one consisted of one independent variable with two levels (treatment and comparison groups); the focus on grade six students was a constant. Research question one had five dependent variables as measured by the CM3 (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry and Scholarly Rigor) which was administered to participants pre and post treatment. Interval level posttest data was analyzed by a Multivariate Analysis of Variance (MANOVA) to determine if there was significant difference between the dependent variables based on the independent variable of treatment and comparison groups. Analysis was computed using SPSS statistic software (2009).

Research question two utilized the same independent variable structure as research question one and has four dependent variables (Progress, Observational Comparison, Social Feedback, and Physiological States) as measured by the RSPS. As in research question one, interval level data were analyzed by a Multivariate Analysis of Variance (MANOVA) to determine if there was significant difference between the dependent variables above and the
treatment and comparison groups. Analysis were computed using SPSS statistical software (2009).

Pretest analyses for research questions one and two were conducted prior to the treatment to establish a baseline and to determine if there were any differences between groups. A multiple analysis of variance (MANOVA) verified that significant differences between the groups were not present and therefore covariates were not needed.

For research question three, the CPR was utilized to measure the frequency of HOT questions asked by teachers and students. A chi-square determined if the scaffolding of HOT questions will be significantly different between expected and observed frequencies. Finally, any standardized residual values above the absolute value of two were identified as major contributors to the chi-square.

Finally, research question four explored the relationships between reader self-efficacy and critical thinking by conducting bivariate Pearson correlation to measure the strength of these relationships. The Pearson product-moment correlation coefficient $r$ was reported as a decimal between -1.00 and +1.00 and computed using SPSS statistic software (2009). Statistically significant correlations were identified.

**Type I Error Correction**

Research questions one, two and four all utilized the same individuals as sources of data. Because of this commonality, a Bonferroni adjustment technique was utilized to control for a Type I error. It was determined that the probability of making at least one Type I error in a set of tests “will be higher than indicated by the level of significance used in making the individual tests” (Huck, 2004, p. 250). Therefore, this correction technique changed the normal level of significance to a more rigorous level. In this study, the initial alpha value .05 was selected and
subsequently divided by the number of comparisons (RQ1 MANOVA, RQ2 MANOVA, RQ4 Pearson correlation = 3), thus establishing an alpha level of .017.

**Timeline**

Formal approval to conduct this study was obtained from the Western Connecticut State University Institutional Review Board (IRB protocol number 1011-71) (Appendix 1) in January, 2011. Upon receiving approval to conduct the study within the district, consent forms from all participating students in both the Treatment and Comparison groups were collected. Then, teachers from both the Treatment and Comparison groups received training in test administration in March 2011. Pretests at both sites were conducted in April 2011, and professional development training for teachers in the Treatment group occurred during this month. Two additional training sessions occurred during the eight-week Treatment between April and June of 2011.

Classroom observations, utilizing the Classroom Practice Record (CPR) were conducted at weeks one, three and six, and eight to document HOT questions for the treatment and comparison groups. Observations and teacher meetings ensured that Treatment protocols were followed during the eight-week treatment period. At the conclusion of the eight-week treatment in June 2011, posttests were administered. Data collection and analysis continued through August of 2011.

**Limitations of the Study**

This researcher acknowledges limitations to this study. First, the length of this study (eight-weeks) may produce a Hawthorne effect that possibly compromises external validity whereby participants become familiar with the instruments (Gall, Gall, & Borg, 2007). Second, the length of this study might not have provided the Treatment group with enough time to fully execute the scaffolding strategies designed to produce the intended effect. Third, a quasi-
experimental design does not allow for the random assignment of participants. As a result, participants were in intact classroom groups where the researcher could not control for class variability.

Forth, teachers’ adherence to the treatment protocols always posed an internal threat to validity. As noted above, this researcher observed classroom teachers to offer support as needed and ensure program fidelity. Finally, due to the sample of convenience \((n = 286)\), the target population from which the accessible population was obtained might have been underrepresented. Therefore, results could only be generalized to sixth grade students and schools with similar demographic characteristics.
CHAPTER TWO: REVIEW OF LITERATURE

This chapter describes the theory, constructs, and research supporting the scaffolding of Higher Order Thinking questions on reader self-efficacy and critical thinking. The chapter consists of the following sections: social constructivist theory, zone of proximal development, scaffolding, social cognitive theory, self-efficacy, higher order thinking, and critical thinking.

Overview of Social Constructivist Theory

In the latter part of the 20th century, Behaviorism was being eclipsed by Cognition Learning Theory. According to Peterson and Walberg (1979), Behaviorism theory regarded the student as an empty vessel whereby the teacher’s role was to transmit the curriculum through direct instruction. While this was a successful method to teach factual content, it was not as successful in the supporting of Higher Order Thinking (HOT) skills such as reasoning and problem solving (Geersten, 2003).

Bruner (1990) noted that the cognitive revolution was not just an improvement on Behaviorism; it also promoted a psychology that focused on meaning making. By doing so, it introduced us to cognitive structures such as schema, heuristics, problem solving and transfer ability (Bruner, 1990). According to Geersten (2003), these cognitive structures entail some form of constructivism. Initially, learners were regarded as individuals who were active in their environments and constructed their own knowledge. Prawat (1996) describes a postmodern constructivist perspective that rejects the view that the locus of control is the individual. It is at these crossroads where we see a distinction between Constructivist Theory (individual constructs knowledge for himself) and Social Constructivist Theory (learning and understanding are inherently social). It is important not to get mired in these differences and to point out that Social Constructivist Theory focuses on the social and individual interdependence in the co-construction of knowledge (Geersten, 2003; Palincsar, 1998).
As cognitive researchers clarified the role of reasoning, problem solving, social and cultural factors that influenced cognition also emerged as relevant phenomena in promoting learning (Bruner, 1994). The impetus for understanding the influence of social and cultural factors on cognition is drawn from the works of Piaget and Vygotsky (Geersteen, 2003). For the purposes of this study, the Sociocultural theory of Vygotsky (1978) will be explored in greater depth.

**Sociocultural Theory**

Cobb (1994) describes an account of learning and development through a constructivist lens as concerned with the ways in which an individual makes sense of his or her experience. The lens of Sociocultural theory widens this view where the learner attends to broader social systems. The framework for Sociocultural theory was conceived by Vygotsky (1978). Vygotsky, argued: “The social dimension of consciousness is primary in time and in fact, the individual dimension of consciousness is derivative and secondary” (Vygotsky, 1978, p. 30). This means that individuals learn, not just through social interactions, but because of them. The developmental theories of Vygotsky (1896-1934) have been incorporated into numerous studies as seen by an increased number of citations in recent decades (Wirtsch, 1991).

Eun (2010) presented three themes important to sociocultural theory. First, students bring knowledge from home to enhance formal instruction. According to Vygotsky (1978), scientific concepts develop as a result of formal instruction in school whereas everyday concepts are learned socially from home and constitute funds of knowledge. Second, sociocultural views of instruction maybe represented as interactive and collaborative, where students engage in shared activities that are negotiated through dialogue. Third, socioculturally orientated instruction is that of “recognizing teaching and learning as a process, rather than a product,
aimed towards the construction of knowledge” (Hedegaard, 1995, as cited in Eun, 2010, p. 404). Based on these themes, various principles are advanced to fully elucidate Vygotsky’s Zone of Proximal Development (ZPD) (1978, 1986) which describes a relationship where a learner can acquire greater independence, skills, and knowledge with skilled help. One principle, above others, describes the higher psychological functions of mediation as the foundation of ZPD (Eun, 2010; Geersteen, 2003; Palincsar, 1998). Wells (2002) discussed the importance of Vygotsky’s (1978) belief that mediation is the underlying premise in the concept of the ZPD. The importance of the mediating role of the teacher was not just to create an environment conducive to learning, but also for teachers to be more fully engaged in the learning process (Wells, 2002). “Teachers’ mediation in the learning process thus becomes a fundamental element in optimizing children’s potential to learn” (Eun, 2010, p. 406).

In summary, instructional principles based in sociocultural theory are firmly based on the work of Lev Vygotsky. While this theory broadly examines human development with diverse implications for instruction, most socioculturally oriented studies focus on one or two aspects of sociocultural theory emanating from the work of Vygotsky (1978). Therefore, the underlying implications in this research are based on Vygotsky’s mediation principal which explores the social nature of teaching and learning; specifically, interactions that occur in the Zone of Proximal Development. Of relevance to this study, scaffolding is inherently a social act that occurs when an expert assists a novice, thereby enhancing student learning.

The Zone of Proximal Development (ZPD)

Vygotsky (1978) emphasized that social interactions play a significant role very early in a child’s development. Therefore, subsequent discussion concerning the ZPD must be rooted in the understanding that a “child’s performance is mediated socially” (Verenikina, 2008, p. 5).
This construct is not seen as a one-way street between teacher and learner where the learner takes a back seat. In fact, “Vygotsky viewed children and adults as both being active agents in the process of a child’s development” (Verenikina, 2008, p. 164). According to Guerrero and Villamil (2000), the development of higher forms of thinking and the acquisition of complex skills can be attributed to this social interaction. Indeed, the ZPD supports an approach whereby students are actively engaged in their learning. This collaboration between teacher and student occurs at a point between what children can achieve independently and what they can do with assistance (Palincsar, 1998).

Vygotsky (1978) described the ZPD with two developmental levels: the actual developmental level, which is what the learner can achieve by himself or herself and, the potential level of development, which is established when a learner is assisted by a more expert other. According to Cole and Cole (2001), the term proximal indicates that the level of support is slightly above the learner’s current capability; additional support builds on a learner’s existing ability.

The Zone of Proximal Development is relevant in today’s classroom; teachers use benchmark assessments to determine a student’s instructional reading level; teachers group students in book clubs according to book level; or, group students in homogeneous math groups to deliver tiered instruction. In doing so, the teacher can structure the task’s difficulty level, implement instructional strategies and vary the level of support needed to ensure student success. Guerrero and Villamil (2000) support the connection between the ZPD and scaffolding, “which refers to those supportive behaviors by which an expert can help a novice learner achieve higher levels of regulation” (p. 51). Cazden (1979) related the ZPD to scaffolding and suggested that the metaphor be expanded from the domain of parent-child interactions to teacher-student
interactions. The utility of scaffolding will be expanded below and implications to this study will be discussed in Chapter 5.

**Scaffolding**

Scaffolding is characteristically associated with the socio-cultural theory of development (Vygotsky, 1978) and explained as the role that adults can play in joint problem-solving activities with children whereby a temporary structure assists learners with a task (Clark & Graves, 2004; Pearson & Fielding, 1991; Pol, Volman & Beishuizen, 2010; Wood, Bruner, & Ross, 1976). The term scaffolding was introduced by Wood, Bruner, and Ross (1976) in an attempt to operationalize the concept of teaching in the Zone of Proximal Development (Wells, 1999). Wood, Bruner and Ross (1976) described scaffolding as a “process that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts” (p. 90). Bruner (1977) describes scaffolding as a cognitive support given by teachers to learners to help them solve tasks that they could not complete on their own. It is widely accepted that although the support maybe cognitive in nature, the ZPD and scaffolding explores learning as a fundamentally social act because of the interactions that are needed between teacher and student for effective learning to take place (Guerrero & Villamil, 2003).

Essentially, the teacher, having found the instructional level of a student, can identify the area that is just beyond, but not too far beyond, a student’s abilities. At this point, the teacher and student can have a dialogue in which a teacher can monitor progress and provide support as necessary. This support can be in the form of questions, cues and prompts and is illustrated later in Chapter 3.

It is also possible to vary the level of scaffolding support depending on a student’s ability or where they enter a specific task. Clark and Graves (2004) linked scaffolding to the Gradual
Release of Responsibility model (Pearson & Fielding, 1991) which explains how a teacher facilitates and supports a learner along a continuum leading up to independent practice and application. Pressley (2002) describes the scaffolding metaphor this way:

The scaffolding of a building under construction provides support when the new building cannot stand on its own. As the new structure is completed and becomes freestanding, the scaffolding is removed. So it is with scaffolding adult-child academic interactions. The adult carefully monitors when enough instructional input has been provided to permit the child to make progress towards an academic goal, and thus the adult provides support only when the child needs it. (p. 97)

In the context of this study, teachers scaffold the development of higher order thinking questions. This moment-to-moment method, as defined by Clark and Graves (2004), requires teachers to prompt students, ask probing questions, and elaborate upon student responses during the course of instruction. Gaskins et al., (1997) suggested that teachers consider two things: how their instructional talks support students to achieve the goal and how students can be more reflective or aware of the meta-cognition involved in this process.

The ZPD and scaffolding cannot be narrowly defined as deriving from the teacher’s or student’s perspective. Both have to be actively engaged in the learning process to bring together the cognitive development of a student and the social classroom in which this development occurs. This reciprocity between student and teacher will enable the learner to achieve internalization (Vygotsky, 1978) and therefore become more autonomous. Described through a critical thinking lens, the intent of a scaffold is to build a student’s knowledge so they can apply, analyze, evaluate, and create (Fisher & Frey, 2010). This link between scaffolding and critical thinking was an expected outcome of this study and will be discussed further in Chapter 5.
Scaffolding is fine-tuned according to the learner and their progress. Therefore, the level of support and the type of scaffolding provided by a teacher is seen as a fluid, interpersonal process which largely depends on the nature of the task and the responses of the student to the scaffolding (Pol, Volman, & Beishuizen, 2010). Hence, scaffolding seldom looks the same in different situations and is not a technique that can be applied the same way in every situation. According to Pea (2004), the concept of scaffolding has become so broad that its meaning for teachers and in educational research is unclear. One criticism by Stone (1998) is that teachers initiate and direct various instructional strategies whereby the student is a less active participant. These cautions prompted a guiding framework for the current study that focused scaffolding in the area of HOT questions. In addition, it related scaffolding to the techniques demonstrated later in Chapter 3 where the teacher and student have active roles in scaffolding from a sociocultural perspective.

**Scaffolding techniques.** In the field of scaffolding, there are four techniques that are commonly selected because of their cognitive approach to learning. According to Hacker and Tenent (2002), Reciprocal Teaching (Palincsar & Brown, 1984) is a powerful technique for teaching four comprehension strategies (questioning, summarizing, clarifying, and predicting). Clark (2004) identified Moment-to-Moment scaffolding where the teacher’s role is to prompt students, ask probing questions, and elaborate upon student responses during the course of instruction. Questioning the Author enabled the teacher to guide and facilitate students during reading comprehension as they progress through sections of text. The Scaffolding Reading Experience (Clark & Graves, 2003) assists students in understanding and learning from both narrative and expository texts. This support occurs through various pre-reading, during-reading and post-reading activities designed to scaffold cognitive thought.
These models differ in the level of support offered and how support is provided to students. This study considered the best possible scaffolding techniques to support the development of higher order thinking (HOT) questions. Certain components of the above techniques that included summarizing, predicting, or learning from narrative and expository writing did not fully support a clear pathway to HOT questions use in the classroom. The below studies do not point to one singular delivery system. However, they do indicate that scaffolding techniques are successful when they are explicit and systematic. As a result, the operationalization of scaffolding is discussed in this below.

**Scaffolding studies.** Mercer, Dawes, Wegerif, and Sams (2004) demonstrated the effectiveness of the Thinking Together program whereby teachers scaffolded students (aged 9-10) by asking constructive questions and modeling problem solving skills. Using pre-post video-recorded data, qualitative methods of discourse analysis were used to investigate changes in quality of student talk. After students in the Treatment group \( n = 109 \) utilized reasoning skills and talk more effectively (teachers received training in this program) than students in the Comparison group \( n = 121 \). In addition, a content mapping exercise was utilized to assess the extent to which children could understand scientific concepts. Overall, results demonstrated that students in the Treatment group had significant gains in science scores as compared to those in the Comparison group \( F(1,124) = 17.471, p = 0.014 \). The evidence of the positive effects of scaffolding student talk and the benefits of these strategies formed the basis for this study.

Liang (2011) studied the effects of scaffolding middle school students’ \( n = 85 \) comprehension and responses to short stories using a reader-response approach and a Scaffolded Reading Experience (Clark & Graves, 2003). This study was a pretest-posttest, quasi-experimental design with the student as a unit of study. During the first week of this two-week
study, students were taught short stories using a traditional basal approach and assessed at the end of week one. During week two, students were taught short stories using both the reader-response approach and the SRE approach. Significant main effects were noted for the SRE approach \( [F(1,158) = 490.00, p < .001] \) with an effect size of .76, and for the reader-response approach posttests, \( [F(1, 158) = 711.36, p < .001] \), with an effect size of .82. Results indicated that students engaged in a program using a cognitive-orientated response (reader-response) and a scaffolded approach (SRE) scored significantly higher than those using a traditional basal reading program.

Finally, Oliveira (2009) explored the questioning practices of 15 elementary and middle school teachers after receiving one day of explicit training in scaffolding student questions. Descriptive data were systematically collected through open-ended research methods such as classroom observations, video-recordings and professional development activities, and then, analyzed inductively to build a naturalistic account of questioning practices (Oliveira, 2009). Teacher questions and student responses were videotaped and responses were coded by a jury of experts. As a result of being introduced to scholarly descriptions of questions, teachers became increasingly aware of the social aspects involved in formulating questions. When teachers scaffolded this inquiry-based discourse, the degree to which teachers asked student-centered and confirmation/clarification questions produced higher-order responses by students as measured by Bloom’s taxonomy.

**Summary of research studies.** Most studies in the field of instructional scaffolding are descriptive in nature. Metacognitive and cognitive scaffolding is studied to the greatest extend compared with scaffolding of students’ affect (Pol, Volman, & Beishuizen, 2010). The results of these studies (Clark & Graves, 2003; Liang, 2011; Mercer et al, 2004; Oliveira, 2009) largely
indicate that scaffolding is effective. Despite extensive study, scaffolding research does not possess a valid measurement instrument or point to a singular process of scaffolding (Pol, Volman & Beishuizen, 2010). This is likely due to the varying degree that scaffolding can be operationalized in learning environments. The present study, being quantitative in nature, aims to add to the body of research while specifically focusing on scaffolding the use of higher order thinking (HOT) question in the classroom. While the measurement of this task can add value to how teachers formulate questions in the classroom, further measurement of student critical thinking and reader self-efficacy will measure the potential benefits of this approach.

**Operationalization of scaffolding**

There is no consensus in regard to scaffolding models (Fisher & Frey, 2010; Liang, 2011; Pol; Volman, & Beishuizen, 2010). Due to the many different characterizations of scaffolding, each study offers its own intervention and unit of analysis. Some studies focus on the behavior of a teacher whereas other studies focus on the role of the student. Furthermore, the unit of analysis can differ depending on the characteristics of scaffolding being utilized and therefore influence the outcome of the study. Consequently, the present study operationalized scaffolding by making it more explicit in the classroom. By building on a teacher’s intentionality while consciously applying scaffolding for students to learn, treatment strategies became systematic rather than scripted. Adapted from the work of Fisher and Frey (2010), a scaffolding map identified scaffolding moves to explicitly scaffold and prompt student understanding through inquiry, such as asking clarifying questions followed by prompts and cues whenever students when misconceptions arose. When prompts and cues did not lead to deeper understanding, then teachers moved to more direct explanations and modeling. The scaffolding map can be viewed in Chapter 3.
Social Cognitive Theory

Bandura introduced the construct of self-efficacy in 1977, which laid the foundation for his social cognitive theory (1986). Bandura changed the label of his theory to differentiate his theory from others by adding “cognitive” in its title (Parjares, 2002). The purpose was to highlight the “central role of cognitive, vicarious, self-regulatory, and other self-reflective processes in human adaptation and change” (Parjares, 2002, p. 1). The essential premise of social cognition theory frames behavior, which includes academic achievement, within an interactive context of behavior, personal thoughts and beliefs, and influences present behavior within the environment (Schunk, 2003). How students perceive their performance alters their self-beliefs through self-reflection, which in turn, informs and alters subsequent behavior (Pajares, 1996). This forms Bandura’s (1986) concept of reciprocal determinism which represents the feedback cycle created between a person’s unique thoughts, feelings and genetic predispositions, behavior and environmental events (Pajares, 2002).

Social cognitive theory (Bandura, 1986) conceives the ability for abstract thought as a uniquely human characteristic. The underlying purpose in the development of this theory (Bandura, 1986, 1989) is to heighten our understanding of group and individual behavior, while also identifying the methods in which this behavior can be altered through application of social cognitive theory. For example, if social cognitive theory is applied to examine the effects of the use of higher order thinking questions on students’ self-efficacy in reading, subsequent interventions can be designed to improve student learning which would result in positive impacts on student achievement. Bandura also viewed individuals as agents involved in their own development. “Unless people believe that they can produce desired effects by their actions, they have little incentive to act or to persevere in the face of difficulty” (Bandura, 1995, p. 28).
Bandura (2001) expanded upon this conclusion by noting that human learning and functioning can be proactive rather than reactive. This doesn’t mean that individuals can function beyond their abilities. Rather, how people behave is both mediated by their beliefs about their abilities and by the results of their previous performances. According to Pajares (1996), competent functioning requires harmony between self-beliefs on one hand and possessed skills and knowledge on the other.

In summary, through direct personal experiences and social interactions, individuals learn behaviors and consequences of behaviors that influence future action. Pajares (2002) expands on the environmental interaction in reciprocal determinism that resulted in what he termed Triadic Reciprocity whereby the interactions between one’s behavior, environmental factors, and an individual’s system of self-beliefs is at the heart of Bandura’s social cognitive theory. Further, if Triadic Reciprocity explains the means by which human beings affect their environment and direct their behavior, then student achievement emanates from a student’s perception in their beliefs of cognitive development and functioning (Bandura, 1993).

Self-Efficacy

Self-Efficacy is the personal belief regarding one’s ability or performance and represents the building blocks in Bandura’s social cognitive theory. According to Bandura (1986), self-efficacy refers to “people’s judgments of their capabilities to organize and execute courses of action required to attain designated performances” (p. 391). There are two important features of this definition. First, self-efficacy is considered a belief concerning one’s perceived ability and therefore does not necessarily match one’s actual ability. This is detailed in research findings which indicate that most students actually overestimate their academic capabilities (Bandura, 1997; Pajares, 1996). According to Bandura (1986), the most useful efficacy judgments are
those that slightly exceed one’s actual abilities, as this assessment can increase effort and persistence during challenging times. Second, Bandura’s (1986) definition includes the idea that individuals make use of their efficacy judgments in reference to goal attainment, academic motivation, learning and motivation (Pajares, 1996; Schunk, 1991). In addition, perceived self-efficacy affects performance accomplishments both “directly and indirectly” through its influence on self-set goals (Zimmerman, Bandura, & Martinez-Pons, 1992, p. 665).

Self-efficacy also influences several aspects of behavior that are important to learning. It is shown to affect choice of activities, effort expenditure, persistence, and achievement (Bandura, 1993). It is the core belief that one has the power to produce changes by one’s actions (Bandura, 1977, 1986, 1997). People who have low self-efficacy for a particular task, may avoid that task. Conversely, individuals who feel efficacious expend more effort and persist longer, even when the task seems difficult for them (Bandura, 1997).

**Sources of self-efficacy.** Self-efficacy theory and beliefs derive from four primary sources (Bandura, 1997): (a) enactive or mastery experiences (performance accomplishments); (b) vicarious experiences (observations of others); (c) verbal persuasion (judgment and feedback from others); and (d) physiological states (positive and negative thoughts about one’s performance). The individual’s interpretation of information from these sources is impacted by personal, situational and cultural factors (Bandura, 1997) and each source differs in magnitude (Pajares, 1996).

Enactive or mastery experiences are the most influential source of self-efficacy information because they provide the most direct and authentic way to assess one’s own success at a task (Bandura, 1997). Experiences interpreted as successful generally raise confidence in one’s own ability. Thus, if one interprets his or her performance with an activity or task as
unsuccessful, self-efficacy is likely to be reduced. Furthermore, people who believe they may not succeed, perhaps because of previous failures, are also eroding their self-efficacy further by making fewer attempts at a task (Bandura, 1993, 1997; Pajares, 1996).

The second source of self-efficacy information occurs when individuals observe the success or failure produced by the actions of others. Vicarious experience (Bandura, 1986, 1997) occurs when individuals evaluate the likelihood of success at the same or similar tasks based on observations. Schunk (1991, 2003) noted that although vicarious information is a weaker source of self-efficacy information, when people are tentative of their abilities they are more uncertain of their own performance in a given task. Part of one’s vicarious experiences involves social comparisons made with other individuals (Pajares, 1996). These comparisons or experiences can be a positive source on developing self-perceptions of competence (Schunk, 1985).

The third source of efficacy information comes from verbal persuasion, or the verbal and nonverbal judgments that others provide. In Bandura’s (1997) own words, “verbal persuasion alone may be limited in its power to create enduring increases in self-efficacy, but it can bolster self-change” (p. 101). Typically, positive feedback can scaffold the development of self-efficacy, and negative messages can hinder its development. Parents, as well as peers, can positively impact overall self-efficacy beliefs through verbal persuasion (Frome & Eccles, 1998). However, if the individual ultimately fails at a task, optimistic comments can discredit the verbal persuasion and undermine the recipient’s self-efficacy beliefs (Bandura, 1977, 1997).

Finally, the fourth source of self-efficacy information originates from one’s own physiological and emotional state during their performance. An individual’s fears, anxiety, stress, fatigue and mood can lower perception of one’s ability and self-efficacy. Essentially,
information carried by physiological reactions is assessed by an individual and can positively or negatively influence efficacy beliefs, depending on one’s appraisal of their emotional arousal (Bandura, 1997).

**Self-efficacy and academic achievement.** There is an abundance of research findings which specify that self-efficacy correlates with academic outcomes (Bandura, 1997; Barkley, 2006; Pajares, 1996; Schunk, 1991; Schunk and Zimmerman, 2007.) Self-efficacy is also positively related to self-regulation and cognitive strategy use, and useful in predicting academic achievement (Pintrich & Schunk, 1996). According to Schunk (2003), increased self-efficacy relates positively to the maintenance of strategy use and academic skills. Self-efficacy exerts its influence through “four major processes: cognitive, motivational, affective, and selective processes” (Bandura, 1993, p. 117) whereby students’ beliefs in their efficacy to regulate their own learning determines their aspirations, level of motivation and academic accomplishments (Bandura, 1993).

According to Graham and Weiner (1996), self-efficacy in comparison to other motivational constructs, is a more consistent predictor of behaviors. This is particularly relevant to academic performance. At the outset, students differ in their self-efficacy beliefs. As they engage in activities however, students are affected by personal and situational influences that provide student feedback concerning their own learning. Self-efficacy is reinforced when students perceive they are performing well. Interestingly, a lack of success or poor performance in a particular task will not necessarily lower self-efficacy if learners still believe they can perform at a higher level by expending more energy or by using different strategies (Schunk, 1991).
These trends continue across academic subjects. In writing, self-efficacy relates positively with students’ goals for course achievement, satisfaction with potential grades, and actual achievement (Bandura, 1995). In problem solving, students with high self-efficacy demonstrate greater performance and persist longer than those students with lower self-efficacy (Bouffard-Bouchard, Parent, & Parivee, 1991). Mathematics self-efficacy has been found to be a better predictor of mathematics performance than prior experience, perceived usefulness of mathematics and math anxiety (Pajares & Miller, 1994).

Research on reading achievement and reader self-efficacy demonstrates a sound relationship. Shell, Murphy, and Bruning (1989) confirmed the relationship between self-efficacy, outcome expectations, and achievement in reading. Henk and Melnick (1995) based their Reader Self Perception Survey (RSPS) on Bandura’s theory of self-efficacy, noting that student “self-perceptions can impact upon the individual’s overall orientation towards the process itself” (p. 471).

In sum, Jinks and Morgan (1996) note that if theories of self-efficacy are applied to children’s belief’s about learning, it would be logical to predict that children with higher self-efficacy are likely to demonstrate greater success in school. Of importance to this study, Jinks and Morgan (1996) determined that efficacy beliefs can be influenced by planned instruction. Bandura (1993) presented evidence that teachers who also “believe strongly in their instructional efficacy create mastery experiences for their students” (p. 140). This study explored how improved questioning ability by students and teachers can improve a student’s self-perception of themselves as readers. Prior research is predominantly content-specific and focused on reading, mathematics, science, and the like. By focusing on questioning ability and the use of higher order thinking questions the classroom, this study aims to measure the impact of questioning as it
relates to reader self-efficacy which can be more easily generalized in an inter-disciplinary fashion.

**Self-perception and self-efficacy.** Zimmerman, Bandura, and Martinez-Pons (1992) noted that improved self-perception is synonymous to improved self-efficacy when influencing performance accomplishments in specific areas. From a conceptual perspective, self-concept incorporates cognitive and affective responses toward the self and is heavily influenced by social comparison. Whereas, self-efficacy incorporates cognitive judgments of one’s capabilities based on mastery criteria. Despite these slight differences, the two constructs demonstrate similar internal structures (cognitive, social, motivational and affective) that are multifaceted and hierarchical (Bong & Clark, 1999). According to Pajares and Miller (1994), studies show that when a student’s self-perception, or belief about ability, is presented on a self-efficacy scale, efficacy measures tend to predict outcomes. These findings have led to various inquiries into self-concept and self-efficacy beliefs and how these beliefs affect classroom behavior, performance and achievement (Henk & Melnick, 1995; Linnenbrink & Pintrich, 2003; Schunk, & Zimmerman, 2007).

**Research in efficacy beliefs.** Students generally rely on some type of motivation to facilitate the successful completion of tasks. Barkley (2006), in his non-experimental study of middle school students (n = 400), found that students with high self-efficacy scores predicted reading comprehension achievement on the Stanford Achievement Test (SAT 10). This quantitative approach, stemming from action research efforts explored student efficacy beliefs and student achievement scores. Correlational analysis was conducted to determine statistical significance between scales of the Teacher and Student Efficacy Beliefs Survey (Barkey, 2006) and standardized test data reported by the SAT 10. Results indicated that when grades six, seven
and eight grade students demonstrated high efficacy beliefs, there was a positive correlation to reading achievement. Positive correlations were found in two subscales: Prior Knowledge \( (r = .157, p < .01) \) and Self-Monitoring \( (r = .124, p < .01) \). This study supported the link between reading self-efficacy and reading achievement.

This connection was further reinforced by Schunk and Zimmerman’s (2007) study of reading and writing research on effective modeling techniques and these effects on improving a student’s self-efficacy and self-regulation. In this study, modeling refers to the process in which observers pattern their thoughts, beliefs, and behaviors, after those displayed by one or more models (Schunk, 1985). “Consistent with the results for reading comprehension, research on writing achievement also shows that modeling is an effective means of raising self-efficacy” (Schunk & Zimmerman, 2007, p. 18).

The lack of experimental studies in the area self-efficacy research was surprising and supported a need for this present study. More prevalent when conducting a literature review, were the presence of self-efficacy instruments. Whereas scaffolding lacked clear instrumentation, there were many research studies available to consider the effects of scaffolding. This was just the opposite when exploring the literature concerning self-efficacy; few relevant experimental studies that considered self-efficacy as the dependent variable were available.

Higher Order Thinking (HOT)

There is no universal agreement to the exact meaning of higher order thinking (HOT) and critical thinking. For the purposes of this study, higher order thinking is depicted as the “umbrella” under which critical thinking resides. Therefore, critical thinking will be reviewed as a subsection under higher order thinking.
Taking into consideration all forms of higher order thinking is outside the scope of this research. Herein, higher order thinking will be framed in more traditional terms as the thinking associated with Bloom’s Taxonomy (2008). Reference to Bloom’s taxonomy hereafter implies the use of Bloom’s revised taxonomy. Furthermore, one aim of this study was to determine if purposely scaffolding teacher and student HOT questions in the classroom would promote students’ critical thinking. Therefore, this review of literature has been narrowed in an attempt to focus on higher order thinking and critical thinking as it relates to scaffolding HOT questions use in the classroom.

Dewey (1933) was one of the first researchers to distinguish between levels of thinking. At the higher-level, he distinguished between reflective and critical thought where reflective thought was espoused as a mental process and critical thought as the judgments an individual made while solving a problem (Geertsen, 2003). Higher order thinking has its early roots in the cognitive and theoretical approaches promulgated in the 1950s, 1960s and 1970s (Bloom, 1956; Flavell, 1976; Gagné, 1965; Perry, 1970; Piaget, 1971). Later developments in cognitive psychology suggested the importance of executive functioning in the brain which regulates learning and problem solving (Moseley, Elliot, Gregson, & Higgins, 2005). Flavell (1976) conceived of metacognition as the activity one has control of one’s thinking processes. Gradually, as was the case with Behavioral learning theory, an emphasis on cognitive and metacognitive strategies assimilated into mainstream practice in schools. Moseley et al (2004) notes that the proliferation of thinking skills frameworks, constructs and definitions tend to confuse educators about what is of the most potential value.

Gagné (1965) first proposed a learning hierarchy that incorporated a taxonomy of learning objectives, specific learning conditions and nine events of instruction. According to
Driscol (2005), Gagné’s intellectual skills incorporated “reasonably well” with the levels of Bloom’s taxonomy (p. 362); verbal information incorporated knowledge and comprehension levels, while application, analysis, synthesis, and evaluation represent higher-order problem solving skills. Gagné’s conception of learning is more consistent with information-processing theorists, where learners organize their knowledge in terms of themes and schemata (Driscoll, 2005). Whereas higher order thinking, depending on the task, may be defined from a cognitive and information-processing perspective; considering the present study, higher order thinking draws more from social constructivist theories (Dewey, 1933; Vygotsky, 1978) where thinking and learning are themselves presented as social constructs (Moseley et al, 2004).

Tharp and Gallimore (1988) noted that the learner can best succeed and develop higher order thinking skills when learning takes place in the Zone of Proximal Development (ZPD). Furthermore, expert scaffolding is viewed not only as a way to assist learners with task completion, but to also assist them in self-regulatory skills needed to exhibit higher order thinking. As discussed below, whereas critical thinking cannot be defined without a dispositional component, higher order thinking occurs when learners acquire social skills and share knowledge, values, and dispositions with other learners (Moseley et al, 2004).

Finally, fostering higher ordering thinking skills in schools has always been an important aim of education. This concept, however, is difficult to define from both a content-oriented instructional approach and a process-oriented approach because of differences in teacher’s beliefs and pedagogical understanding of higher order thinking. According to Barak and Shakhman (2007), to foster students’ higher order thinking, teachers must possess not only in-depth subject matter knowledge, but also sound pedagogical knowledge or explicit steps to
develop students’ higher order thinking. Three research studies touch on these themes in the following section.

**Research in the area of Higher Order Thinking**

Miri, David, and Uri (2007) conducted a longitudinal case study (3-years) of grade 10 and grade 12 Israeli students \( n = 177 \). They found that purposeful teaching for the promotion of higher order thinking skills enhanced critical thinking in science education. This mixed method pre-, post-, and post-post experimental design divided student participants into three groups. The experimental group \( n = 57 \) consisted of science students who were exposed to teaching strategies designed to enhance higher order thinking skills. There were two other groups, used as controls, whereby science \( n = 41 \) and non-science majors \( n = 79 \) were taught using traditional techniques. Semi-structured interviews were carried out by the research team to distinguish teaching strategies that might promote higher order thinking skills. The teachers found to possess these qualities taught the experimental students. In addition, classroom observations were conducted to examine the actual teaching strategies of the science and non-science control groups.

According to the results, students who received instruction that fostered the development of higher order thinking skills scored significantly higher \( (F = 8.62, p < 0.01) \) on the California Critical Thinking Skills test (Facione, 1990) than students receiving a traditional approach. Additionally, these students also received significantly higher scores \( (F = 10.11, p < 0.01) \) on the California Critical Thinking Disposition Inventory (Facione, 1990) than students in the control groups. These results strongly suggested that persistence in teaching for higher order thinking skills improved students’ critical thinking in a science framework (Miri, David, & Uri, 2007). Although this study focused on teaching within a science context there was evidence that these
higher order thinking skills could be applied across other domains since the critical thinking instruments include generic non-disciplinary questions and statements.

In a study conducted by Oliveira (2009), 15 teachers were offered professional development on a typology of questions framework exploring the degree of student-centeredness of teacher’s oral questions. While Bloom’s taxonomy utilizes a hierarchal framework according to level, Oliveira employed a typology as a way of organizing question stems as either student-centered or teacher-centered. The study adopted a mixed-method research approach aligned with a social constructivist perspective that emphasized meanings are created in human social interaction (Oliveira, 2009). Descriptive data were recorded and collected through open-ended classroom observations and video recordings and then analyzed to build a naturalistic account (Lincoln & Guba, 1985). Classroom observations and video recordings were transcribed and coded; upon completion, emerging themes were summarized and compared. Of importance, it was observed that teacher questions may center on the student (student-centered) or the teacher (teacher-centered). While both have a clear role in the classroom, student-centered questions were found to establish longer student responses and promote higher levels of thinking as measured by Bloom’s taxonomy (1956). Oliveira (2009) also found that when teachers were introduced to a scholarly description of questions, not only did it improve higher order thinking, participants became increasingly aware of the social aspects of asking questions.

Questions included open-ended or divergent questions; descriptive questions that motivated students to describe their own work; challenging questions that encouraged students to think more deeply concerning their work; and connecting questions that helped students connect to previous learning (Oliveira, 2009). Of relevance to the current study, teacher questions were explored from a sociolinguistic perspective whereby teacher questioning behavior is
multifunctional in nature, serving both cognitive and social needs (Oliveira, 2009). The “questions that teachers ask during classroom inquiries elicit students’ understanding and promote higher order thinking while constructing social identifies (e.g. expert, novice, partner, guide, peer, etc.) and establish social relationships” (Oliveira, 2009, p. 425). This supports the idea that higher order thinking can be viewed as deriving from a sociocultural and constructivist perspective. In sum, a framework of questions and related teacher training promoted longer and more articulated student responses to questions and promoted higher-level student thinking according to Bloom’s Taxonomy (Oliveira, 2009).

Another study that focused on fostering higher order thinking in the classroom was conducted by Barak and Shakhman (2007). This study examined what teachers knew and did about fostering higher order thinking skills in science. Participants in the study were 11 physics teachers, most having over 10-years of experience. Data were collected in semi-structured interviews with teachers and was aimed at collecting information to assess how teachers accounted for their understanding of higher order thinking and the instructional strategies they employ to use higher order thinking strategies when teaching (Barak & Shakhman, 2007). Once data were collected, an analysis of the patterns, themes, and categories were extracted and sorted into four categories: meta-strategic knowledge, utilization of higher-level instructional strategies, beliefs about students and teacher’s self-perceptions of the issues discussed. Study findings were summarized in four main outcomes. First, some teachers were barely able to discuss concepts of higher-order thinking, whereas others had a general sense of the notion. Second, only a minority of teachers used techniques that could foster the use of higher order thinking in the classroom. Third, teachers were divided into two extremes: those who had confidence in their students to use higher order thinking skills and those who were less confident of student abilities. Fourth,
only a few teachers exhibited the conference in this area to enhance their pedagogical knowledge to scaffold higher order thinking skills in their students (Barak & Shakhman, 2007). The study concluded that only specific, systematic and structured constructivist pedagogy with explicit steps aimed at fostering higher order thinking skills could realistically improve teacher development in this area (Barak & Shakhman, 2007).

The above three studies (Barak & Shakhman, 2007; Miri, David, & Uri, 2007; Oliveira, 2009) are representative of the research in the area of higher order thinking. Essentially, prevailing research is qualitative in nature with less emphasis placed on quantitative exploration. The present study builds on the work and themes presented in these studies, while highlighting the effects of scaffolding the use of HOT question and their impact on the critical thinking ability of sixth grade students.

**Bloom’s Taxonomy**

Higher order thinking in the present study was operationalized using Bloom’s revised taxonomy (Anderson, et al. 2001). In Moseley, et al. (2005) descriptive review of 35 theoretical frameworks and taxonomies, Bloom’s revised taxonomy was identified as one of three frameworks to be of greater value due to its flexibility of use according to age range and instructional value in promoting higher level thinking. Specifically, Bloom’s concepts of *analyze, evaluate* and *create* represent a deeper understanding of an issue and promote strategic, reflective and critical thinking (Moseley, Elliot, Gregson, & Higgins, 2005).

The original taxonomy (Bloom, 1956) presented six major categories: *Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation*. Categories were arranged from simple to complex whereby objectives could describe intended learning outcomes. In the revised taxonomy, three categories were renamed, the order of two categories were interchanged,
and those category names retained were changed to verb form to fit the way they are used in learning objectives (Anderson, et al. 2001). The original Knowledge category was kept as the first of six categories, but renamed to Remember. Comprehension was renamed to Understand because it was more user friendly for teachers. “Application, Analysis, and Evaluation were retained, but in verb forms as Apply, Analyze, and Evaluate” (Anderson, et al. 2001, p. 214). These changes in categories and sub categories can be seen in Table 1.
### Table 1

**The Revision of Bloom’s Taxonomy**

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Knowledge</strong> - Knowledge of ways, means, universals, and abstractions in a field</td>
<td><strong>1. Remember</strong> - Retrieving relevant knowledge from long-term memory</td>
</tr>
<tr>
<td><strong>2. Comprehension</strong> - Translation, interpretation and extrapolation</td>
<td><strong>2. Understand</strong> - Determining the meaning of instructional messages, including oral, written, and graphic communication</td>
</tr>
<tr>
<td><strong>3. Application</strong></td>
<td><strong>3. Apply</strong> - Carrying out or using a procedure in a given situation</td>
</tr>
<tr>
<td><strong>4. Analysis</strong> - Analysis of elements, relationships and organizational practices</td>
<td><strong>4. Analyze</strong> - Breaking material into its component parts and detecting how the parts relate to one another</td>
</tr>
<tr>
<td><strong>5. Synthesis</strong> - Production of a unique communication, plan, or proposed set of operations</td>
<td><strong>5. Evaluate</strong> - Making judgments based on criteria and standards</td>
</tr>
<tr>
<td><strong>6. Evaluation</strong> - Evaluation in terms of internal evidence; and judgment in terms of external criteria</td>
<td><strong>6. Create</strong> - Putting elements together to form a novel, coherent whole or make an original product</td>
</tr>
</tbody>
</table>

Particularly useful to a classroom teacher is the important role that questioning plays within the framework. This, combined with different levels representing lower to higher levels of thinking, enables the learner and teacher to use verbs to actively identify diverse forms of thinking. The organization of thinking into six levels (remembering, understanding, applying, analyzing, evaluating, and creating) represents a pragmatic way to design effective instructional tasks. As illustrated in Chapter 3, the revision to Bloom’s Revised Taxonomy identifies applying, analyzing, evaluating and creating as higher order thinking strands. In Bloom’s earlier taxonomy, knowledge and comprehension were considered lower levels on the taxonomy; according (Anderson, et al. 2001), understanding and remembering (U/R) correspond to this hierarchy. While understanding and remembering represent lower levels in the hierarchy; mastery of these foundational levels were prerequisite to mastery of the next levels (Anderson, et al., 2001). The decision to utilize Bloom’s revised taxonomy in this study is linked to the active engagement required in order for teachers to scaffold student questions using actionable verbs. Teachers received training in determining question type which is also explained in Chapter 3.

**Critical Thinking**

Conceptual disagreements about critical thinking are prevalent in education literature (Geertsen, 2003). Watson and Glaser (1980) state that critical thinking consists of three related areas: first, that evidence is needed and can be asserted as true; second, valid inferences, abstractions and generalizations about that evidence are logically assessed; and third, specific skills are employed to apply the above attitudes and knowledge. According to Paul (1992), Director of the Center for Critical Thinking, “Critical thinking is thinking about your thinking while you’re thinking, in order to make your thinking better” (p. 7). Certainly, this definition is broad, and perhaps awkward to some; he later clarified in 1996 that critical thinking is defined as a skill of taking responsibility and control of our own mind. Salmon (1989) narrows this view by
offering inductive and deductive reasoning methods to define critical thinking. Teays (1996) describes critical thinking as the conscious reflection to elevate thoughts above those found in everyday thinking. According to Linn (2000), critical thinking involves a variety of skills where the individual identifies sources of information, analyses credibility, reflects according to prior knowledge, and draws conclusions based in their critical thinking skills. Yeh (2001) defines critical thinking as argumentation. Borg and Borg (2001) equate critical thinking with the ability to make contextually appropriate choices based on one’s own personal values.

In the 1990s, the American Philosophical Association (APA) sponsored a two-year Delphi project to conceptualize and define critical thinking. Early works by Sternberg (1985), Norris and Ennis (1989), and Ennis (1989) prominently influenced the Delphi Project research where critical thinking was defined as purposeful, self-regulatory, and cognitive judgments. An important outcome signaled any conceptualization of critical thinking that focused exclusively on cognitive skills alone is incomplete (Giancarlo & Facione, 2001). Therefore the APA (1990) defined critical thinking to be “purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological or contextual considerations upon which judgment is based” (Facione, 2009, p. 22). As noted in the above section, critical thinking in this study is conceptualized as an operative example of higher order thinking; it needs to be explicit if critical thinking acquisition is to be achieved (Halpern, 2007). Therefore, an aim of this study is to determine if the explicit scaffolding of HOT questions enhances student’s critical thinking capabilities?

**Research in the area of Critical Thinking.** Gunn and Pomahac (2008) studied critical thinking skills in middle school classrooms. This mixed method study consisted of two grade
seven classrooms (n = 50) in a small Canadian mid-sized city. The classes were randomly assigned to an experimental group (i.e., structured generic questions stems; n = 22) or to a control group (i.e., unstructured questions; n = 28). Students in both groups were administered the Cornell Critical Thinking test (2004) prior to the study which provided baseline data by which changes could be detected and established (Gunn & Pomahac, 2008). Following the test, students in the experimental group were trained to differentiate between memory and critical thinking questions. Additionally, the experimental group was required to create questions utilizing structured generic questions stems. The stems were designed to elicit higher level critical thinking processes according to Bloom’s Taxonomy. To complete the study, students were re-administered the Cornell Critical Thinking test approximately five months later. A one-way ANOVA was conducted to measure changes from pretest to posttest. While no significant differences were detected, the treatment group scored higher than the control group and demonstrated some growth. Of relevance to this study, students in the experimental group were observed to be more mindful of critical thinking questions according to teacher interviews and coded responses. In addition, students created significantly more evaluation questions as compared to their control counterparts who created more knowledge questions (Gunn & Pomahac, 2008). According to Anderson and Krathwohl (2001), an evaluation question requires validation, prediction, assessment and appraisal and is therefore considered a higher level. Conversely, a knowledge questions requires listing and describing, which stands as a lower level activity.

McLean and Miller (2010) studied critical thinking skills following a course on science and pseudoscience. Participants were 53 undergraduate students enrolled in two psychology courses (experimental group; n = 23) and an advanced research methods course (comparison
This quasi-experimental pretest, posttest method utilized the Watson-Glaser Critical Thinking Appraisal (WGCTA; 1994) test to measure critical thinking ability. The experimental course contained a teaching approach emphasizing explicit critical thinking skills instruction within the discipline of science and pseudoscience. The comparison group focused on course material containing statistical concepts and research methods. Overall, after the 14-week treatment, students in both courses showed significant improvements on all three critical thinking measures (McLean & Miller, 2010). However, “students in the experimental course showed slightly greater improvements in critical thinking as compared to students in the comparison course, but this difference was not statistically different” (McLean & Miller, 2010).

As noted by Halpern (1998), an improvement across groups may not have been noted because content-specific instruction is not optimal for teaching students to transfer more abstract critical thinking skills.

Both the Gunn and Pomahac (2008) and McLean and Miller (2010) studies failed to find significance when student progress was measured by critical thinking tests (Cornell Critical Thinking, 2004 and the Watson-Glaser Critical Thinking Appraisal, 1994). The Gunn and Pomahac (2008) study added an additional qualitative component that examined question use by students. The experimental group received instruction in question stems designed to elicit higher level critical thinking processes according to Bloom’s Taxonomy. According to qualitative data described above, this part of the study was successful. The current study conducted by this researcher builds on previous success but aims to find an impact from scaffolding HOT question use and measuring its effect on student critical thinking skills.
Chapter Summary

Learning in today’s classroom is certainly influenced by cognitive factors. While cognitive phenomena undoubtedly promote learning, the impetuses for understanding these factors of cognition and the underlying implications of this research are drawn from the work of Vygotsky who explored the social nature of teaching and learning; specifically, interactions that occur in the Zone of Proximal Development (ZPD).

Essentially, instructional scaffolding was the key mechanism in this current study to develop higher order thinking questions. Bruner (1978) describes scaffolding as a cognitive support given by teachers to learners to help them solve tasks that they could not complete on their own. It is widely accepted that although the support maybe cognitive in nature, the ZPD and scaffolding explores learning as a fundamentally social act (Guerrero & Villamil, 2003).

It was hypothesized that the use of higher order thinking questions (utilizing Bloom’s revised taxonomy: remember, understand, apply, analyze, evaluate, and create) would improve student critical thinking and reader self-efficacy. Critical thinking in this study was conceptualized as an operative example of higher order thinking; it needed to be explicit if the acquisition of critical thinking was to be achieved (Halpern, 2007).

Social Cognitive Theory frames behavior, which includes academic achievement, within an interactive context of behavior, personal thoughts and beliefs, and influences present within the environment (Schunk & Pajares, 2002). The underlying purpose in the development of this theory (Bandura, 1986, 1989) is to heighten our understanding of group and individual behavior, while also identifying the methods in which this behavior can be altered through application of social cognitive theory.
Of importance to this study, Jinks and Morgan (1996) determined that efficacy beliefs can be influenced by planned instruction. Bandura (1993) presented evidence that teachers who also “believe strongly in their instructional efficacy create mastery experiences for their students” (p. 140). This study explored how improved questioning ability by students and teachers can improve a reader’s self-efficacy.
CHAPTER THREE: METHODOLOGY

Chapter Overview

The goal of this study was to investigate whether or not scaffolding the development of higher order thinking (HOT) questions would significantly improve reader self-efficacy and critical thinking. Other questions explored the relationship between reader self-efficacy and critical thinking, and if a clear definition of HOT questions would help students become more efficient learners. This chapter describes the research setting and sample, questions and hypotheses, data type, instrumentation, research design and analysis, study timeline, treatment and statement of ethics and confidentiality.

Description of Setting and Sample

The participants in this study were sixth grade students, from two middle schools, within the same Connecticut Public School District. Students from one middle school received the treatment (scaffolding the development of HOT questions) while students in the second middle school (followed the District’s 6th grade curriculum) represented the comparison group. This suburban District consisted of approximately 5,575 students. The district was comprised of six elementary schools, two middle schools and one high school. The city population was approximately 24,300 people. Student ethnicity was homogeneous: 93.4% white, 2% Asian, 2% Hispanic and .2% Black. The median income in this community was $105,000 which is above the county average ($85,000) and the United States average ($55,000). The District had 336 teachers whereby 85% have a Master’s Degree or above; the student to teacher ratio was 17:1 (Connecticut State Department of Education, 2010).

The middle school that received the treatment served 610 students in grades six, seven and eight. Average class size in both schools was 22 students and the required hours of instruction in content area subjects is identical. The treatment school had 37 general education
teachers and six special education teachers. Approximately 83% of teachers had a Master’s Degree or higher and teachers have an average of 15-years of experience. School ethnicity was commensurate to the District level. Students eligible for free and reduce lunch comprised 3% of the student population. The two teachers who received the instructional strategies in the treatment group both had the same level of training, having received Master’s Degrees while teaching for 11-years and 20-years, respectfully. Both teachers served on grade level teams and were responsible for teaching language arts. According to the District’s job description for language arts teacher, this included reading, writing, grammar and spelling.

The second middle school, served as the comparison site, and had a student population of 741 students. As mentioned above, student ethnicity was proportionate with 2% of the student population eligible for free and reduced lunch status. The comparison school had 52 classroom teachers and seven special education teachers. Approximately 88% of teachers earned Master’s Degrees or higher and teachers had an average 14-years of experience. The two language arts teachers at the comparison site had commensurate levels of classroom experience, both teaching for 16-years.

According to the CSDE (2010), 89.6% of students met goal in reading on the Connecticut Mastery Test at the comparison site and 90.2% of students met goal in reading at the treatment site. Similarities in reading scores between middle school sites were also evident for grades seven and eight.

Participants in this study consist of 286 students ($n = 286$) with 157 students in the comparison group and 129 students in the treatment group. Four teachers participated in this study; two teachers each with six classes of students were responsible for students at the treatment group school; the other two teachers, each with six classes of students, were
responsible for students at the comparison group school. As discussed later in the chapter, this sample of convenience \( n = 286 \) varied marginally depending on the code and value cleaning required for each research questions. Refer to Table 2 for sample size information.

**Research Questions and Hypotheses**

The following research questions guided this study:

**Research question 1**

Is there a statistically significant difference in the critical thinking skills of students who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not?

**Non-directional hypothesis.** There is a statistically significant difference in the critical thinking skills of students who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not.

**Research question 2**

Is there a statistically significant difference in students’ self-perceptions of themselves as readers who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not?

**Non-directional hypothesis.** There is a statistically significant difference in students’ self-perceptions of themselves as readers who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not.

**Research question 3**

Is there a statistically significant difference in the frequency of higher-order thinking questions asked by teachers and students participating in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not?
Non-directional hypothesis. There is a statistically significant difference in the frequency of higher-order thinking questions asked by teachers and students participating in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not.

Research question 4

Is there a statistically significant correlation between critical thinking skills (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry and Scholarly Rigor) and reading self-efficacy (Progress, Observational Comparison, Social Feedback, and Physiological States)?

Non-directional hypothesis. There is a statistically significant correlation between critical thinking skills (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry and Scholarly Rigor) and reading self-efficacy (Progress, Observational Comparison, Social Feedback, and Physiological States).

Table 2

Numbers of Participants in the Study

<table>
<thead>
<tr>
<th>Group</th>
<th>Sample Size</th>
<th>Research Question 1</th>
<th>Research Question 2</th>
<th>Research Question 3</th>
<th>Research Question 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>129</td>
<td>121</td>
<td>124</td>
<td>129</td>
<td>116</td>
</tr>
<tr>
<td>Comparison</td>
<td>157</td>
<td>154</td>
<td>157</td>
<td>157</td>
<td>135</td>
</tr>
<tr>
<td>Total</td>
<td>286</td>
<td>275</td>
<td>281</td>
<td>286</td>
<td>251</td>
</tr>
</tbody>
</table>
Types of data

Data collected were quantitative in nature and interval-level in the form of subscale group means using the California Measure of Mental Motivation (CM3; Giancarlo, Blohm & Urdan, 2004) and the Reader Self-Perception Survey (RSPS; Henk & Melnick, 1995). The Classroom Practice Record (CPR; Westberg, Archambault, Dobyns, & Salvin, 1993) was utilized to collect descriptive information of participants by coding specific types of questions. These verbal interactions between the teacher and student, or vice versa, are characterized as nominal (categorical) level data.

Instrumentation

California Measure of Mental Motivation

The instrument utilized to measure research question one was the California Measure of Mental Motivation (CM3; Giancarlo, Blohm, & Urdan, 2004). The CM3 is a 72-item, self-report instrument designed to measure the degree to which students are cognitively engaged and mentally motivated towards intellectual activities that involve reasoning. The CM3 is divided into five broad domains: Mental Focus, Learning Orientation, Creative Problem Solving, and Cognitive Integrity. A fifth domain was added in 2006, Scholarly Rigor. Altogether, the CM3 has five domains and nine subscales. Students rate themselves on a 4-point Likert scale from 1 (disagree strongly) to 5 (agree strongly). Scores in each subscale are averaged to find the mean for each domain.

Validity and reliability of the CM3. Three studies support the reliability and validity of the CM3. According to Giancarlo, Blohm, and Urdan (2004), to establish external validity, the CM3 was hypothesized to correlate in a positive direction with established measures of mental motivation and classroom-related behavior. “All five scales of the CM3 result in statistically
significant, albeit modest, positive correlations with mastery goals, self-efficacy, and self-regulation at the $p < .01$ level” (Giancarlo, Blohm, & Urdan, 2004, p. 358). Internal consistency determined by Cronbach’s alpha coefficients range from .7 to .83 (see Table 3).

Table 3

*Cronbach’s Alpha for CM3 Scales and Subscales*

<table>
<thead>
<tr>
<th>Scale Name</th>
<th>Cronbach Alpha range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Orientation</td>
<td>.79-.83</td>
</tr>
<tr>
<td>Creative Problem-Solving</td>
<td>.70-.77</td>
</tr>
<tr>
<td>Mental Focus</td>
<td>.79-.83</td>
</tr>
<tr>
<td>Cognitive Integrity</td>
<td>.53-.63</td>
</tr>
</tbody>
</table>

The authors calculated the CM3’s predictive validity by calculating correlations of the subscales with standardized test scores from the Stanford Achievement Test (SAT9: Stanford Achievement Test Series, 9th Edition, 1996) and the Preliminary Scholastic Aptitude Test (PSAT/NMSQT; National Merit Scholarship Corporation, 1997). Giancarlo, Blohm, and Urdan (2004) noted significant relationships between the SAT9 (reading) and the CM3 ($r = .53, p < .001$) and the PSAT/NMSQT and the CM3 ($r = .43, p < .001$) whereby increased scores in the SAT9 and PSAT/NMSQT related to a student’s inclination towards critical thinking.

**Reader Self Perception Survey**

The Reader Self-Perception Scale (RSPC; Henk & Melnick, 1995) was developed to measure student perceptions of reading self-efficacy. In this study, the RSPS was selected to measure student perceptions of reading self-efficacy. The RSPC consists of 32 items that represent 4 scales (Progress, Observational Comparison, Social Feedback, and Physiological...
States). These four factors were based on the work of Bandura (1977, 1986) and Schunk (1985) related to their basic model of self-efficacy. Items intend to provide an assessment of how children feel about themselves as readers. Children are asked to indicate how strongly they agree or disagree with specific statements on a 5-point Likert scale (1=Strongly Disagree, 2=Disagree, 3=Undecided, 4=Agree, 5=Strongly Agree). Table 4 provides a description of the RSPS’ four factors.

Table 4

The Reader Self-Perception Scale Descriptions

<table>
<thead>
<tr>
<th>Scale Name</th>
<th>Scale Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progress</td>
<td>“…how one’s perception of present reading performance compares with past performance.”</td>
</tr>
<tr>
<td>Observational Comparison</td>
<td>“…deals with how a child perceives his or her reading performance to compare with the performance of classmates.”</td>
</tr>
<tr>
<td>Social Feedback</td>
<td>“…includes direct or indirect input about reading from teachers, classmates, and people in the child’s family.”</td>
</tr>
<tr>
<td>Physiological States</td>
<td>“…refers to internal feelings that the child experiences during reading.”</td>
</tr>
</tbody>
</table>

Note: (Henk & Melnick, 1995, p. 472)

The RSPC was piloted with 625 students in grades four, five and six. Preliminary alpha reliabilities for each scale measured in the .70’s range. Revisions were made based on exploratory factor analysis and a panel of eight experts examined the data and made recommendations. After the revisions from the first pilot study were implemented, an additional 1,479 fourth (n = 506), fifth (n = 571) and sixth (n = 402) grade students “in several urban, suburban, and rural school districts were asked to respond” (Henk & Melnick, 1995, p. 482).
New reliability analysis indicated scale alphas ranging from .81 to .84 with “all items contributing to overall scale reliability” (Henk & Melnick, 1995, p. 482). This information can be found in Table 5. For each of the four scales, the mean scores and standard deviations were analogous, with corresponding standard errors desirably low. The RSPS utilized internal consistency reliability by grouping questions in four different scales to compare results in each scale for consistency.

Table 5

<table>
<thead>
<tr>
<th>Number of Items and Internal Consistency Reliabilities for Each Item</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scale</strong></td>
</tr>
<tr>
<td>Progress</td>
</tr>
<tr>
<td>Observational comparison</td>
</tr>
<tr>
<td>Social feedback</td>
</tr>
<tr>
<td>Physiological stress</td>
</tr>
</tbody>
</table>

*Note. From Henk & Melnick (1995)*

To establish content validity, graduate students were provided with conceptual definitions for Bandura’s (1977) four factors of self-efficacy. These students categorized a pool of reading items into these four broad categories. By arranging these items into categories, the authors were defining a particular construct and attempting to establish content validity. In addition, “a panel of eight experts (consisting of both university faculty and graduate students enrolled in reading and affective instrument development courses) examined the data more closely and made recommendations” (Henk & Melnick, 1995, p. 482). The RSPS established content validity by using a Jury of experts to judge its adequacy. Gall, Gall, and Borg (2007) note that “content-related evidence is typically determined systematically by content experts…” (p. 196).
The Classroom Practice Record (CPR)

The Classroom Practice Record (CPR: Westberg, Archambault, Dobyns, & Salvin, 1993) is an observational tool designed to collect descriptive information of participants by coding specific information and interactions. According to Westberg, Archambault, Dobyns, and Salvin (1993), the observer records verbal interactions between the teacher and student, or vice versa, particularly when in the form of knowledge/comprehension (KC) or higher order thinking (HOT) questions. In studies conducted by Westberg, Archambault, Dobyns, and Salvin (1993), inter-rater agreement between knowledge/comprehension and HOT questions, when observers listened to a minimum of 5-minutes of verbal questions between teachers and students, was consistent where observers’ coding on question types resulted in observer agreement 80 percent of the time.

At the beginning of this study, this researcher and his advisor observed four 41-minute lessons whereby we coded questions individually. Both the researcher and advisor are certified by the state of Connecticut for Intermediate Supervision and Evaluation and both regularly observe classroom teachers as part of their professional responsibilities. To establish inter-rater agreement, we compared results of coding teacher and student questions as either HOT questions or understanding/remembering questions. To establish criteria for what constituted a HOT verse understanding/remembering question, we reviewed Bloom’s revised taxonomy (Anderson, et al., 2001). After our first observation, we discussed differences in our data and adjusted observation techniques in an effort to record similar discourse. The first round of observation resulted in 55% agreement, mainly due to inconsistent application of the instrument. Discussion of instrument protocol, strategies for proper implementation, and discussion of differences in question types were discussed. After three more observations, consistency was observed at a rate of 100%
agreement. Total agreement over four observations was 82%. Calculation of Cohen’s Kappa yielded a result of .8 which is interpreted as very good agreement (Curdy, 2009). Inter-rater agreement provides evidence that scores were consistent among scorers when using the CPR, indicating agreement in the definition of HOT and understanding/remembering questions during classroom observations.

Since observations for this study were all conducted by the researcher, intra-rater reliability was calculated for a subset of observations using a code-recode procedure. There was 98% agreement on the code-recode protocol resulting in a Cohen’s Kappa value of .97 which is interpreted as very good agreement (Curdy, 2009). Therefore, post data should be deemed reliable.

**Observations.** Throughout the treatment, this researcher conducted 22 classroom observations at treatment and comparison group sites. These observations were significant to the study in four key areas: (a) inter-rater agreement was established by comparing results for HOT and understanding/remembering questions; (b) treatment fidelity could be established whereby classroom teachers were observed following the treatment protocols and the unit of study; (c) comparison site observations determined that key treatment strategies were not being implemented at the comparison site; and finally, (d) question data were collected from treatment and comparison classrooms on the frequencies of higher order thinking and lower order thinking questions for both teachers and students. Together, classroom observations confirmed inter-rater agreement, served as a source of data collection for research questions three and ensured that treatment protocols were being implemented with fidelity.

**Research Design and Analysis**
This study is a quasi-experimental research design with a pretest-posttest comparison group (Table 6). Intact classroom groups were utilized and as a result there was no random selection of participants to comparison and treatment groups. This design was selected to investigate the impact that scaffolding the development of HOT questions in the classroom had on students’ critical thinking, readers’ self-efficacy and the frequency of HOT questions within intact literacy classrooms where the random assignment of students to a treatment was not practicable.

Table 6

*Research Design*

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest</th>
<th>Treatment</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment group</td>
<td>O</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>Comparison group</td>
<td>O</td>
<td></td>
<td>O</td>
</tr>
</tbody>
</table>

*Level of Significance*

As previously noted, there are four research questions in this study. However, three tests were conducted in the study using the same participants’ pretest and posttest scores as sources of data. To protect against the increased likelihood of making a Type I error, a more stringent alpha level was appropriate. For most tests of significance in the field of social sciences (Huck, 2008), the alpha level is set at $p = .05$. Given that there are three statistical tests being conducted (research questions one, two and four), the adjusted alpha level used to reject the null hypothesis is calculated using a Bonferroni technique whereby the alpha value $p = .05$ was selected and subsequently divided by the number of comparisons ($.05 \div 3$), thus establishing an alpha level of
The alpha level for research question three is established at \( p = .05 \) on the basis of the data being collected to assess the relationship between expected and observed frequencies.

**Research Question One**

Research question one consisted of one independent variable with two levels (treatment and comparison groups); the focus on grade six students was a constant. There were five dependent variables (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) as measured by the California Measure of Mental Motivation (CM3) used to examine critical thinking. A Multivariate Analysis of Variance (MANOVA) was applied to determine if there was a significant difference between the dependent variables based on the independent variable of treatment and comparison groups.

**Research Question Two**

Research question two consisted of four dependent variables for reader self-efficacy (Progress, Observational Comparison, Social Feedback, and Physiological States) as measured by the Reader Self Perception Scale (RSPS). A Multivariate Analysis of Variance (MANOVA) was also applied to determine if there was a significant difference between the dependent variables based on the independent variable of treatment and comparison groups.
Research Question Three

Using the Classroom Practice Record (CPR; Westberg, Archambault, Dobyns, & Salvin, 1993) found in Appendix C, data were collected from 22 observations in treatment and comparison classrooms on the frequencies of higher order thinking and lower order thinking questions for both teachers and students. A 2-group (treatment/comparison) independent Chi-square test was utilized with a four category response (HOT/UR) variable (Huck, 2008). A Chi-square test is an appropriate nonparametric statistic test to determine if significant differences exist beyond the .05 level between expected and observed frequencies (Hinkle, Wiersma, & Jurs, 2003). This 2x4 Chi-square model can be found in Table 7.
Table 7

Model 2x4 Chi-square Utilized to Interpret CPR Data

<table>
<thead>
<tr>
<th>Group</th>
<th>Participants</th>
<th>Observed (post treatment)</th>
<th>Expected (pretreatment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>Teacher HOTs</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Teacher URs</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Student HOTs</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Student URs</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Comparison</td>
<td>Teacher HOTs</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Teacher URs</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Student HOTs</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Student URs</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Research Question Four

Research question four \( (n = 251) \) explored the relationship between critical thinking (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) and reader self-efficacy (Progress, Observational Comparison, Social Feedback, and Physiological States). A bivariate Pearson correlation was utilized to measure the strength of this relationship. While it is possible to examine descriptive statistics to discuss variability or central tendency, the key concept of a correlation examines whether there is a relationship between sets of scores and the strength of that relationship. This researcher decided to utilize a Pearson product-moment correlation coefficient \( r \) reported as a decimal between -1.00 and +1.00.
rather than interpreting the nature of a scatter diagram (Huck, 2008). Correlations were computed using SPSS statistical software (2009).

**Study Timeline and Data Collection**

**Study Time Line**

Formal approval to conduct this study was obtained from Western Connecticut State University Institutional Review Board (IRB) prior to initiation of the research in January 2011 (IRB protocol number 1011-71; reference Appendix A). As per standards set forth by Western Connecticut State University IRB, permission to conduct this study was obtained by the District’s Superintendent, Assistant Superintendent, middle school principals, teachers and parents in February 2011 (reference Appendix B). Once permission was obtained, parents received consent forms to obtain permission for students to participate in this study. Students were informed that their participation was voluntary and that consenting participants’ testing results would be coded and confidential (Gall, Gall, & Borg, 2007). Consent forms were collected by the end of February 2011 which produced a sample size of $n = 286$ students who agreed to participate in the study whereby $n = 157$ students were in the comparison group and $n = 129$ were in the treatment group.

At the end of March 2011, four teachers who consented to be in the study received test administration instructions for the California Measure of Mental Motivation (CM3) and the Reader Self Perception Scale (RSPS) from this researcher to ensure test administration fidelity. In April 2011, students were administered pretests from both treatment and comparison groups. This researcher monitored pretest administration and also explained the purpose of this study to students. Classroom observations using the CPR occurred at both sites prior to professional development training. Shortly after pretest administration, two teachers from the treatment
group received 2.5 hours of professional development training in scaffolding the development of HOT question use in the classroom. Following this session, another 2.5 hours of professional development training occurred in late April 2011 to consolidate earlier concepts and review unit of study implementation. Throughout the eight-week treatment and between April 2011 and June 2011, classroom observations at both comparison and treatment sites occurred to assess fidelity of study implementation. Finally, posttest administration and classroom observations using the CPR were conducted in June 2011. Data collection and coding occurred between June 2011 and August 2011.

**Data Collection**

All participating students completed pretest and posttest survey instruments (CM3 and RSPS) during scheduled language arts classes in computer labs. Teachers were provided with a test administration script which they followed faithfully. This researcher developed a website (www.ridgefieldreading.com) where students recorded demographic information and answers to Likert-scale surveys. Data were recorded electronically and exported to Excel (2010) for coding and cleaning.

Using the aforementioned SPSS (2009) software, data were placed into columns which facilitated the consequent statistical operations. CM3 data or RSPS subscale data occupied five columns and four columns, respectfully, and these dependent variables were named according to subscales. In both tests, participants were coded as either a 0 (comparison group) or 1 (treatment group) to represent the independent variable with two levels and MANOVA tests were applied.

**Treatment**

The eight-week treatment focused on four related areas: (a) teachers scaffolding the use of higher order thinking questions through a scaffolding map (reference Figure 1); (b) the use of
Bloom’s (2001) revised taxonomy so teachers and students can pose questions that correspond to higher level thinking (reference Table 1); (c) the use of a higher order thinking decision making tree that assisted teachers in determining question level (reference Figure 2); and (d) the use of a unit of study that provided teachers with embedded higher order thinking strategies along with supplementary lesson activities (reference Appendix D).

Chin (2007) noted that teacher questioning can serve to scaffold and advance student thinking. Therefore, teachers received training in scaffolding the development of questions as seen in Figure 1 which was adapted by this researcher with permission from Fisher and Frey (2010). According to Fisher and Frey (2010), these “types of questions, prompts and cues are considered critical for student success” (p. 94).

Consequently, teachers in the treatment group received professional development training by this researcher for 2.5 hours on the topic of teacher questioning and scaffolding. This researcher of this present study was a literacy specialist and professional trainer of teachers in his District for four years. Following that, he was an elementary school Assistant Principal for two years and a Principal for seven years. Further training consisted of a Master’s Degree in the area of Special Education and Reading from Flinders University of South Australia and certification from the Connecticut State Department of Education in the areas of Elementary Education, Special Education and Remedial Reading. Training sessions also covered the implementation of the unit of study and accompanying activities that scaffolded HOT questions use by teachers and students. These materials are located in Appendix D. The unit of study introduced a lesson focus each day that emphasized HOT question use. In addition, each lesson contained embedded HOT questions and scaffolding techniques to ensure that the teacher utilized the treatment protocol with fidelity. Oliveira (2009) noted that the use of a framework of questions, such as
Bloom’s taxonomy, promotes longer and more articulated student responses to questions and promotes higher-level student thinking. One of the goals of this study was to make scaffolding more explicit in the classroom. Therefore, in addition to HOT questions, each lesson provided opportunities for teachers to model key concepts, guide student learning, provide students with independent practice and provide students with direct feedback.

As noted above, teachers in the treatment group received training in scaffolding HOT questions through the implementation of a unit of study. Teachers in the comparison group followed the grade six District curriculum which derives from the Connecticut State Department of Education state standards. The Connecticut PreK-8 English Language Arts Curriculum Standards are intended to be a structure by which a school district may develop its own literacy curriculum (Connecticut State Department of Education, 2010). According to the grade six curriculum, teachers do not focus on higher order thinking questions (reference Appendix G). However, both the treatment site and comparison site followed the same structure during the eight week treatment. Each focused on short stories for four weeks followed by a focus on literature circles (Daniels, 2002) for four weeks whereby students discuss books in small groups. While both sites followed a similar structure, the teachers at the treatment site received explicit training in scaffolding HOT question use. In addition, teachers at the treatment site received a unit of study which embedded HOT question use during the four week focus on short stories and literature circles. Teachers at the comparison site did not receive this support or training; instead they followed the grade six curriculum which did not refer to HOT question use or implementation.
Figure 1. Map of Question Scaffolding.

Question tree that illustrates teacher steps to scaffold student understanding. Adapted from “Identifying Instructional Moves During Guided Learning,” by N. Frey and D. Fisher, 2010 The Reading Teacher, 64(2), p. 87.
Figure 2. Decision making tree to assist teachers in determine level of thinking. Adapted with permission from Critical thinking and formative assessments, by N. Moore and T. Stanley (2010). Larchmount, NY: Eye of Education
As indicated above, treatment teachers received a unit of study which served as a scope and sequence for the implementation of HOT question use in the classroom. In order to further scaffold students, each learner received a flip book with sample questions identifiable according to Bloom’s taxonomy. Students were encouraged to select HOT questions due to a higher point value than UR questions. Most activities supported student selection of HOT questions in this way and were embedded into each lesson. Other examples of lesson content included homework assignments, short answer responses to open ended questions, debates and longer written responses. The full treatment protocol, unit of study and teacher materials can be found in Appendix G.

Finally, LaBanca (2009) states that a professional developer should be aware of his or her audience’s expertise and adjust instruction appropriately. As a result, approximately 2.0 hours of additional professional development followed the initial session in 41-minute intervals during weeks 2, 4, and 6 of the treatment. These sessions provided an opportunity for the researcher and teachers to discuss progress while also managing the focus of instruction during the following week.

**Statement of Ethics and Confidentiality**

Permission to participate in this research was sought from each district’s superintendent, each school principal and all parents/guardians of students and students (reference Appendix C). To ensure confidentiality, participant names were not used in the study. Rather, students from the Comparison group and Treatment group were coded as 0 and 1 respectfully. All collected data were kept secure until the findings were published. Upon completion of this research, these data will be made available to participating principals, teachers, and parents if they request this information.
CHAPTER FOUR: ANALYSIS OF THE DATA AND AN EXPLANATION OF THE
FINDINGS

Chapter Overview

The goal of this study was to investigate the impact of scaffolding the development of higher order thinking (HOT) questions regarding critical thinking and reader self-efficacy. Other questions explored the relationship between reader self-efficacy and critical thinking, and if a clear definition of HOT questions will stimulate question use in the classroom. To accomplish this research, four research questions were addressed. This chapter will discuss results according to the following four sections: (a) methodology summary, (b) research questions, (c) research question analysis, and (d) summary of results.

Methodology Summary

This study utilized a quasi-experimental design with a pretest-posttest comparison group. Intact classroom groups were utilized in a school setting and as a result a nonrandomized selection of participants was assigned to comparison and treatment groups. Two sixth-grade language arts teachers were involved in the treatment group at one middle school and received professional development in the scaffolding of higher order thinking questions for the purpose of improving reader’s self-efficacy and critical thinking skills. Teachers at the treatment site also received a unit of study that served as an explicit scope and sequence curriculum to implement the target strategies. At the second middle school, another two language arts teachers followed the traditional grade six District curriculum which did not emphasize or scaffold higher order thinking questions.
Research Questions

The following research questions were addressed in this study:

1. Is there a statistically significant difference in the critical thinking skills of students who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not?

2. Is there a statistically significant difference in students’ self-perceptions of themselves as readers who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not?

3. Is there a statistically significant difference in the frequency of higher-order thinking questions asked by teachers and students participating in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not?

4. Is there a statistically significant correlation between critical thinking skills (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry and Scholarly Rigor) and reading self-efficacy (Progress, Observational Comparison, Social Feedback, and Physiological States)?

Research Question Analysis, Description, and Findings

Research Question One

Research question one consisted of one independent variable with two levels (treatment and comparison groups); the focus on grade six students was a constant. There were five dependent variables (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) as measured by the California Measure of Mental Motivation (CM3; Giancarlo, Blohm, & Urdan, 2004) used to examine critical thinking. Interval level
posttest data were analyzed by a Multivariate Analysis of Variance (MANOVA) to determine if there was a significant difference between the dependent variables based on the independent variable of treatment and comparison groups.

The hypothesis is that if teachers received training in scaffolding the development of HOT questions, along with implementing a unit of study which embedded HOT questions use throughout the eight week study; then students in the treatment group would have significant different levels of critical thinking, as measured by the CM3 (Giancarlo, Blohm, & Urdan, 2004) than those students in the comparison group which followed the traditional grade six curriculum.

**Code and Value Cleaning.** Data collection was preplanned and teachers received training on test directions and procedures. Students in preexisting classes, from treatment and comparison groups, were administered each test on a computer in separate computer labs. Students were directed to a researcher-made website (http://ridgefieldreading.org). From this website, students could access a link for each test. Data were automatically recorded as students completed each test. Participating teachers complied with all test procedures, according to written test directions provided by this researcher, and administered the CM3 with fidelity.

When students completed each test, data were automatically stored and later exported to Excel. Once collected, the first step was to visually screen the data for missing values and determine if these values were legitimate and reasonable (Meyers, Gamst, & Guarino, 2006).

Pretest data were collected to ensure that there were no statistically significant differences between groups (treatment, comparison) prior to implementation of the intervention. Pretest sample size included \( n = 286 \) students, whereby \( n = 129 \) students were in the treatment group and \( n = 157 \) students were in the comparison group. A total sample size of \( n = 275 \) students was available for analysis. The variation between the intended sample size and the resulting size can
be explained by 9 students being excluded due to missing values. Due to the size of the data set, SPSS statistic software (2009) was used to investigate the data further. This analysis revealed an additional \( n = 2 \) students missing from each group, thereby bringing the total sample size down to the above stated \( n = 275 \). Missing data can be attributed to missing subscale scores where students did not complete all sections of the instrument.

The available posttest sample size originally totaled 282 students whereby 4 students were absent from the treatment group on the day of the posttest. Similarly, once the data set had been collected, code and value cleaning procedures were conducted to determine if the posttest data set contained valid numerical codes. A total sample size after visual inspection was 262 students. Once again, this variation is explained by 9 students from the treatment group and 11 students from the comparison group being excluded due to incomplete subscales from the total instrument. Variations or missing values are attributed to students missing questions on the CM3. Students were administered this test through a web based survey. The program did not prompt students for missing answers before they were asked to submit responses. Despite the loss of these values, \( n = 262 \) represented a large enough sample size to conduct all multivariate analyses for this research question.

**Pretest descriptive statistics.** Table 8 displays the pretest descriptive statistics for the subscales of the CM3 (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) for the treatment and comparison groups. Subscales reflect standard deviations ranging from 6.42 to 8.49 with means ranging from 27.83 to 35.36. The multivariate statistical assumption of normality was investigated. According to Meyers, Gamst, and Guarino (2006), normality refers to the shape of the continuous variables in the analysis that should correspond to a normal distribution. Normally distributed variables generate a measure of
symmetry (skewness) and a measure of peakedness (kurtosis) with a range between 0 and absolute 1, without exceeding absolute 1 (Hinkle, Wiersma, & Jurs, 2003). When investigating each subscale, values fell within acceptable ranges from -1.0 to 1.0 demonstrating data which were neither too peaked nor asymmetric with the exception of Scholarly Rigor with a Kurtosis value of 1.85 in the Treatment Group and 1.97 in the Comparison Group.

As a result, this researcher proceeded with a Shapiro-Wilk’s analysis whereby the mean of the skewness and kurtosis values is tested for discrepancies in normality (Meyers, Gamst, & Guarino, 2006). Significant values ($p < .01$) indicate a violation of the assumption of normality (Stevens, 2002). The analysis revealed a $p = .015$ for Scholarly Rigor in the Treatment Group and $p = .367$ for the Comparison Group indicating the assumption of normality had not been violated. As a result, an investigation of the assumption of homoscedasticity was conducted.
### Table 8

**Research Question One: Pretest Descriptive Statistics**

<table>
<thead>
<tr>
<th></th>
<th>Mental Focus</th>
<th>Creative Problem Solving</th>
<th>Learning Orientation</th>
<th>Cognitive Inquiry</th>
<th>Scholarly Rigor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>121.00</td>
<td>121.00</td>
<td>121.00</td>
<td>121.00</td>
<td>121.00</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>28.47</td>
<td>30.14</td>
<td>32.85</td>
<td>32.70</td>
<td>27.83</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>28.70</td>
<td>29.76</td>
<td>33.33</td>
<td>32.62</td>
<td>27.79</td>
</tr>
<tr>
<td><strong>Std. Deviation</strong></td>
<td>7.65</td>
<td>8.49</td>
<td>7.92</td>
<td>7.28</td>
<td>6.42</td>
</tr>
<tr>
<td><strong>Skewness</strong></td>
<td>-.17</td>
<td>-.38</td>
<td>-.33</td>
<td>-.18</td>
<td>-.678</td>
</tr>
<tr>
<td><strong>Kurtosis</strong></td>
<td>-.15</td>
<td>.94</td>
<td>-.21</td>
<td>-.11</td>
<td>1.85</td>
</tr>
<tr>
<td><strong>Percentiles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>23.61</td>
<td>25.00</td>
<td>27.08</td>
<td>27.86</td>
<td>23.61</td>
</tr>
<tr>
<td>50</td>
<td>28.70</td>
<td>29.76</td>
<td>33.33</td>
<td>32.62</td>
<td>27.78</td>
</tr>
<tr>
<td>75</td>
<td>33.89</td>
<td>34.52</td>
<td>39.06</td>
<td>38.10</td>
<td>31.94</td>
</tr>
</tbody>
</table>
Table 8 (continued)

Research Question One: Pretest Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mental Focus</th>
<th>Creative Problem Solving</th>
<th>Learning Orientation</th>
<th>Cognitive Inquiry</th>
<th>Scholarly Rigor</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>154.00</td>
<td>154.00</td>
<td>154.00</td>
<td>154.00</td>
<td>154.00</td>
</tr>
<tr>
<td>Mean</td>
<td>29.95</td>
<td>32.18</td>
<td>35.36</td>
<td>32.00</td>
<td>28.92</td>
</tr>
<tr>
<td>Median</td>
<td>30.37</td>
<td>32.14</td>
<td>35.41</td>
<td>31.43</td>
<td>27.78</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>7.77</td>
<td>8.49</td>
<td>7.28</td>
<td>7.40</td>
<td>6.56</td>
</tr>
<tr>
<td>Skewness</td>
<td>-.19</td>
<td>.01</td>
<td>-.032</td>
<td>-.04</td>
<td>.11</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>.30</td>
<td>-.71</td>
<td>-.23</td>
<td>.01</td>
<td>1.97</td>
</tr>
<tr>
<td>Percentiles 50</td>
<td>30.37</td>
<td>32.14</td>
<td>35.42</td>
<td>31.43</td>
<td>27.78</td>
</tr>
<tr>
<td>Percentiles 75</td>
<td>35.00</td>
<td>38.39</td>
<td>40.63</td>
<td>37.26</td>
<td>32.29</td>
</tr>
</tbody>
</table>
Pretest effects of treatment and comparison groups on the dependent variable. To determine if the two samples can be used for comparison purposes, pretest scores were examined to determine if a covariate is necessary. In order to measure the effect of the dependent variables (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) on the independent variable (treatment and comparison groups), the data were analyzed by a Multivariate Analysis of Variance (MANOVA). “When more than one quantitative dependent variable is being assessed, then Box’s $M$ test for equality of variance-covariance matrices is used to test for homoscedasticity” (Meyers, Gamst, & Guarino, 2006, p. 71). A statistically significant ($p < .05$) Box’s $M$ Test indicates a homoscedasticity assumption violation, which would suggest that quantitative dependent variables do not have equal levels of variability across a range of independent variables (Meyers, Gamst, & Guarino, 2006). The significance value of $p = .27$ demonstrated in Table 9 indicates equal covariance between the dependent variables for the groups comprising the independent variables and therefore no violation of homoscedasticity is observed. The above statistical approaches to examine normality of the pretest data together with the MANOVA indicate that treatment and control groups did not differ statistically. As a result, groups could be used for comparison purposes.
To test for differences in the critical thinking skills between the treatment and comparison groups prior to the treatment a MANOVA of pretest data were calculated. The MANOVA is used to test the effect of one independent variable on two or more quantitative dependent variables (Meyers, Gamst, & Guarino, 2006). Wilks’s Lambda allowed for the evaluation of differences on the independent variable with two levels being (a) treatment group and (b) comparison group on the five dependent variables of Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor. A statistically significant value would indicate reliable differences between the treatment and comparison groups on the dependent variables measuring critical thinking. This MANOVA test revealed no significance differences between the pretest means with Wilks’ $\lambda = .97$ $F(5,269) = 1.814, p = .11$ (see Table 10) displaying no statistical difference in the participants’ critical thinking skills on the subscales of Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor prior to the treatment. This suggests the two groups, students in the
treatment group and comparison group, had statistically similar critical thinking skills at the beginning of the study.
Table 10

*Multivariate Tests Comparing Treatment and Comparison Pretest Groups for Critical Thinking Scores*

<table>
<thead>
<tr>
<th>Effect</th>
<th>Value</th>
<th>$F$</th>
<th>Hypothesis $df$</th>
<th>Error $df$</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Wilks’ Lambda</td>
<td>.97</td>
<td>1.814$^a$</td>
<td>5.00</td>
<td>269.00</td>
<td>.11</td>
</tr>
</tbody>
</table>

$^a$ Exact statistic
Posttest descriptive statistics. Table 11 displays posttest descriptive statistics for the subscales of the CM3 (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) for the treatment and comparison groups. The CM3 posttest was administered to both groups upon the completion of the 8-week treatment (scaffolding of HOT questions). Table 11 shows that 262 students were administered the posttest CM3. There were 116 students participating from the treatment group and 146 students from the comparison group. Subscales reflected standard deviations ranging from 6.62 to 8.93 with means ranging from 27.92 to 34.39. The descriptive data are described in Table 11 and Figures 7-11. When investigating each subscale, values fell within acceptable ranges from -1.0 to 1.0 demonstrating data which were neither too peaked nor asymmetric with the exception of Scholarly Rigor in the treatment group with a value of 1.08. As a result, this researcher proceeded with a Shapiro-Wilk’s analysis indicating the assumption of normality had not been violated. Box plots displayed both the Treatment and Comparison groups with minimum differences. Spacing between quartiles revealed even dispersion with no outliers.
Table 11

Research Question One: Protest Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Treatment Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mental</td>
</tr>
<tr>
<td></td>
<td>Focus</td>
</tr>
<tr>
<td>N</td>
<td>116.00</td>
</tr>
<tr>
<td>Mean</td>
<td>27.92</td>
</tr>
<tr>
<td>Median</td>
<td>28.24</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>8.72</td>
</tr>
<tr>
<td>Skewness</td>
<td>-.21</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>.387</td>
</tr>
<tr>
<td>Percentiles 25</td>
<td>22.54</td>
</tr>
<tr>
<td>Percentiles 50</td>
<td>28.24</td>
</tr>
<tr>
<td>Percentiles 75</td>
<td>32.73</td>
</tr>
</tbody>
</table>
Table 11 (continued)

Research Question One: Posttest Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mental Focus</th>
<th>Creative Problem Solving</th>
<th>Learning Orientation</th>
<th>Cognitive Inquiry</th>
<th>Scholarly Rigor</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>146.00</td>
<td>146.00</td>
<td>146.00</td>
<td>146.00</td>
<td>146.00</td>
</tr>
<tr>
<td>Mean</td>
<td>29.94</td>
<td>32.28</td>
<td>34.38</td>
<td>33.31</td>
<td>29.56</td>
</tr>
<tr>
<td>Median</td>
<td>31.29</td>
<td>31.54</td>
<td>33.33</td>
<td>33.21</td>
<td>29.16</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>8.67</td>
<td>8.70</td>
<td>8.62</td>
<td>8.20</td>
<td>6.62</td>
</tr>
<tr>
<td>Skewness</td>
<td>-.33</td>
<td>-.19</td>
<td>-.37</td>
<td>-.46</td>
<td>.01</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>.32</td>
<td>.45</td>
<td>.16</td>
<td>.53</td>
<td>.30</td>
</tr>
<tr>
<td>Percentiles</td>
<td>25</td>
<td>23.84</td>
<td>27.38</td>
<td>29.16</td>
<td>28.09</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>31.29</td>
<td>31.54</td>
<td>33.33</td>
<td>33.21</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>35.74</td>
<td>38.09</td>
<td>41.92</td>
<td>39.64</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

82
Figure 3  CM3 Posttest Subscale Mental Focus for Treatment and Comparison Groups

Figure 4  CM3 Posttest Subscale Creative Problem Solving for Treatment and Comparison Groups
Figure 5  CM3 Posttest Subscale Learning Orientation for Treatment and Comparison Groups

Figure 6  CM3 Posttest Subscale Cognitive Integrity for Treatment and Comparison Groups
Verification of normality. The multivariate statistical assumption of normality was investigated. When investigating each subscale, values fell within acceptable ranges from -1.0 to 1.0 demonstrating data which were neither too peaked nor asymmetric with the exception of Scholarly Rigor in the treatment group with a value of 1.08. As a result, this researcher proceeded with a Shapiro-Wilk’s analysis whereby the mean of the skewness and kurtosis values is tested for discrepancies in normality (Meyers, Gamst, & Guarine, 2006). Significant values ($p < .01$) indicate a violation of the assumption of normality (Stevens, 2002). The analysis revealed a $p = .02$ for Scholarly Rigor in the treatment subscale indicating the assumption of normality had not been violated. As a result, an investigation of the assumption of homoscedasticity was conducted.
Posttest effects of treatment and comparison groups on the dependent variable. In order to measure the effect of the dependent variables (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) on the independent variable (treatment and comparison groups), the data were analyzed by a Multivariate Analysis of Variance (MANOVA). A statistically significant ($p < .05$) Box’s $M$ Test indicates a homoscedasticity assumption violation, which would suggest that quantitative dependent variables do not have equal levels of variability across a range of independent variables (Meyers, Gamst, & Guarine, 2006). The significance value of $p = .48$ demonstrated in Table 12 tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups and no violation of homoscedasticity was observed. (Box’s $M = 14.86$, $F(15,243766) = .97$, $p = .484$). The above statistical approaches to examine normality of the pretest data together with the MANOVA indicated that treatment and control groups did not differ statistically. As a result, groups could be used for comparison purposes.

Table 12

Box’s Test of Equality of Covariance Matrices

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box’s $M$</td>
<td>14.87</td>
</tr>
<tr>
<td>$F$</td>
<td>.97</td>
</tr>
<tr>
<td>$df1$</td>
<td>15.00</td>
</tr>
<tr>
<td>$df2$</td>
<td>243765.55</td>
</tr>
<tr>
<td>$Sig.$</td>
<td>.48</td>
</tr>
</tbody>
</table>
To test for differences in the critical thinking skills between the treatment and comparison groups after the treatment, a MANOVA of posttest data were calculated. Wilks’s Lambda allowed for the evaluation of differences on the independent variable, with two levels being (a) treatment group and (b) comparison group, on the five dependent variables (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor). A statistically significant value would indicate reliable differences between the treatment and comparison groups on the dependent variables measuring critical thinking. This MANOVA test revealed no significance differences between the posttest means with Wilks’ $\lambda = .97$ $F(5,269) = 1.43, p = .21$ (see Table 13) displaying no statistical difference in the participants’ critical thinking skills on the subscales of Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor following the treatment. This result suggests that students’ scores in the treatment group and comparison group were not statistically different after the study.
Table 13

*Multivariate Tests Comparing Treatment and Comparison Posttest Groups for Critical Thinking Scores*

<table>
<thead>
<tr>
<th>Effect</th>
<th>Value</th>
<th>$F$</th>
<th>Hypothesis df</th>
<th>Error df</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Wilks’ Lambda</td>
<td>.97</td>
<td>1.430&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.00</td>
<td>256.00</td>
<td>.21</td>
</tr>
</tbody>
</table>

<sup>a</sup> Exact statistic
**Research question one findings and summary.** Research question one: Is there a statistically significant difference in the critical thinking skills of students who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not? The sample size of the treatment group \((n = 116)\) and the comparison group \((n = 146)\) represented 262 participants in the study. In order to measure the effect of the dependent variables (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) on the independent variable (treatment and comparison groups), the data were analyzed by a Multivariate Analysis of Variance (MANOVA). All assumptions of the statistic were tested and verified. An evaluation of Wilks’s Lambda was utilized to assess the differences in the independent variable on the dependent variables. This MANOVA test revealed no significance difference \([F(5,256) = 1.43, p = .21]\) in participants’ critical thinking skills on the subscales of Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor. This result suggests that students’ scores in the treatment group and comparison group, were not statistically different after the 8-week study.

**Research Question Two**

Research question two utilized the same independent variable structure as in research question one and had four dependent variables for reader self-efficacy (Progress, Observational Comparison, Social Feedback, and Physiological States) as measured by the Read Self-Perception Survey (RSPS; Henk & Melnick, 1995). As in research question one, interval level data were analyzed by a Multivariate Analysis of Variance (MANOVA) to determine if there was a significant difference between the dependent variables and the treatment and comparison groups.

The non-directional hypothesis is that if teachers received training in scaffolding the development of HOT questions, along with implementing a unit of study which embedded HOT
questions use throughout the eight week study; then students in the treatment group would display significantly different levels in reader self-efficacy, as measured by the RSPS (Henk & Melnick, 1995) than those students in the comparison group which followed the traditional grade six curriculum.

**Code and value cleaning.** Once collected, the data set for research question two was visually screened in the same manner as for research question one. The pretest data set from the RSPS contained a sample size of 286 students. The treatment group had 124 subjects. The comparison group was comprised of 162 students. Unlike the CM3 instrument used for research question one, the RSPS did not allow students to skip questions. As a result, all students completed each question, with zero missing results. Therefore, no data were excluded due to missing values and the total sample size remained 286 students.

The posttest sample was 281 students; four students were absent on the day of the posttest administration from the treatment group. Therefore, the treatment group had 124 students and the comparison group had 157 students. As with research question one, SPSS software (2009) was used for further data investigation.

**Pretest descriptive statistics.** In order to determine if the groups (treatment/comparison) were similar prior to treatment, baseline data were collected and analyzed. Table 14 displays the pretest descriptive statistics for subscales of the RSPS (Progress, Observational Comparison, Social Feedback, and Physiological States) for the treatment and comparison groups. Subscales for the RSPS reflect standard deviations ranging from .87 to 7.5 with means ranging from 4.04 to 39.89. The multivariate statistical assumption of normality was investigated. According to Meyers, Gamst, and Guarino (2006), normality refers to the shape of the continuous variables in the analysis that should correspond to a normal distribution. For the Treatment group, Progress
(-1.83) and Physiological States (-1.08) resulted in Skewness values above 1.0. Atypical Kurtosis values were also noted with Progress (5.75) and Physiological States (1.1), above 1.0. For the Comparison group, Progress (-1.1) resulted in Skewness values, above 1.0. Atypical Kurtosis values were also noted for the values of Progress (1.65) and Social Feedback (1.63), above 1.0.

Therefore, a Shapiro-Wilk’s analysis was calculated whereby the mean of the skewness and kurtosis values were tested for discrepancies in normality (Meyers, Gamst, & Guarino, 2006). Significant values ($p < .01$) indicate a violation of the assumption of normality (Stevens, 2002). The analysis revealed that values in both the Treatment and Comparison Group for Progress and Physiological States were found to be significant at the $p < .01$ level indicating the assumption of normality had been violated. As a result, this researcher proceeded with posttest analysis with caution. The subscale of Social Feedback was not found to be significant at the $p < .01$ level, indicating that normality was within acceptable limits.
Table 14

*Research Question Two: Pretest Descriptive Statistics*

<table>
<thead>
<tr>
<th></th>
<th>Treatment Group</th>
<th>General</th>
<th>Observation</th>
<th>Social</th>
<th>Physiological</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Perception</td>
<td>Comparison</td>
<td>Progress</td>
<td>Feedback</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td>124.00</td>
<td>124.00</td>
<td>124.00</td>
<td>124.00</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>4.04</td>
<td>20.49</td>
<td>39.88</td>
<td>32.29</td>
</tr>
<tr>
<td>Median</td>
<td></td>
<td>4.00</td>
<td>20.50</td>
<td>41.00</td>
<td>32.50</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td></td>
<td>.86</td>
<td>5.15</td>
<td>4.88</td>
<td>5.52</td>
</tr>
<tr>
<td>Skewness</td>
<td></td>
<td>-.98</td>
<td>-.31</td>
<td>-1.83</td>
<td>-.30</td>
</tr>
<tr>
<td>Kurtosis</td>
<td></td>
<td>1.00</td>
<td>-.38</td>
<td>5.75</td>
<td>.90</td>
</tr>
<tr>
<td>Percentiles</td>
<td></td>
<td>25</td>
<td>4.00</td>
<td>17.00</td>
<td>37.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50</td>
<td>4.00</td>
<td>20.50</td>
<td>41.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75</td>
<td>5.00</td>
<td>25.00</td>
<td>44.00</td>
</tr>
</tbody>
</table>
Table 14 (continued)

*Research Question Two: Pretest Descriptive Statistics*

<table>
<thead>
<tr>
<th></th>
<th>Comparison Group</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>General Perception</td>
<td>Observation Comparison</td>
<td>Progress</td>
<td>Social Feedback</td>
<td>Physiological States</td>
</tr>
<tr>
<td>N</td>
<td>162.00</td>
<td>162.00</td>
<td>162.00</td>
<td>162.00</td>
<td>162.00</td>
</tr>
<tr>
<td>Mean</td>
<td>4.11</td>
<td>21.53</td>
<td>39.31</td>
<td>33.23</td>
<td>30.20</td>
</tr>
<tr>
<td>Median</td>
<td>4.00</td>
<td>22.00</td>
<td>40.00</td>
<td>33.50</td>
<td>31.00</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>.88</td>
<td>5.43</td>
<td>4.89</td>
<td>5.80</td>
<td>7.49</td>
</tr>
<tr>
<td>Skewness</td>
<td>-1.17</td>
<td>-.40</td>
<td>-1.09</td>
<td>-.66</td>
<td>-.78</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>1.54</td>
<td>-.58</td>
<td>1.64</td>
<td>1.64</td>
<td>.10</td>
</tr>
<tr>
<td>Percentiles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>4.00</td>
<td>18.00</td>
<td>36.00</td>
<td>29.75</td>
<td>25.00</td>
</tr>
<tr>
<td>50</td>
<td>4.00</td>
<td>22.00</td>
<td>40.00</td>
<td>33.50</td>
<td>31.00</td>
</tr>
<tr>
<td>75</td>
<td>5.00</td>
<td>26.00</td>
<td>43.25</td>
<td>37.25</td>
<td>36.25</td>
</tr>
</tbody>
</table>
Pretest effects of treatment and comparison groups on the dependent variable. In order to measure the effect of the dependent variables (Progress, Observational Comparison, Social Feedback, and Physiological States) on the independent variable (treatment and comparison groups), the data were analyzed by a Multivariate Analysis of Variance (MANOVA). Box’s $M$ test for homoscedacity (see Table 15) indicated that there were no violations of normality ($Box’s \ M = 16.66, F(15, 280,445) = 1.09, p = .36$) and a MANOVA (see Table 16) indicated there was no statistically significant difference between groups for dependent variables ($Wilk's \ \lambda = .97, F(5, 280) = 1.79, p = .11$). This suggests the two groups, students in the treatment group and comparison group, had equal reading self-efficacy skills at the beginning of the study, and groups could be used for comparison purposes.

Table 15

*Box’s Test of Equality of Covariance Matrices*

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Box’s \ M$</td>
<td>16.66</td>
</tr>
<tr>
<td>$F$</td>
<td>1.09</td>
</tr>
<tr>
<td>$df1$</td>
<td>15</td>
</tr>
<tr>
<td>$df2$</td>
<td>280445.32</td>
</tr>
<tr>
<td>$Sig.$</td>
<td>.36</td>
</tr>
</tbody>
</table>
Table 16

Multivariate Tests Comparing Treatment and Comparison Pretest Groups for Reader Self Efficacy Scores

<table>
<thead>
<tr>
<th>Effect</th>
<th>Value</th>
<th>$F$</th>
<th>Hypothesis $df$</th>
<th>Error $df$</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Wilks’ Lambda</td>
<td>.97</td>
<td>1.794$^a$</td>
<td>5.00</td>
<td>280.00</td>
<td>.11</td>
</tr>
</tbody>
</table>

$^a$ Exact statistic
**Posttest descriptive statistics.** Table 17 displays posttest descriptive statistics for the subscales of the RSPS (Progress, Observational Comparison, Social Feedback, and Physiological States) for the treatment and comparison groups. The RSPS posttest was administered to both groups upon the completion of the 8-week treatment (unit with embedded scaffolding of HOT questions). Table 17 shows that \( n = 281 \) students were administered the posttest RSPS. There were \( n = 124 \) students participating from the treatment group and \( n = 157 \) students from the comparison group. Subscales reflect standard deviations ranging from .51 to .96 with means ranging from 3.47 to 4.46. The descriptive data are described in Table 17 and Figures 12-15. When investigating each subscale, values fell within acceptable ranges from -1.0 to 1.0 demonstrating data which were neither too peaked nor asymmetric with the exception of Progress and General Perception in the comparison group. As a result, this researcher proceeded with a Shapiro-Wilk’s analysis indicating the assumption of normality had not been violated. Box plots displayed both the Treatment and Comparison groups with minimum differences. Spacing between quartiles revealed even dispersion with no outliers.
Table 17

*Research Question Two: Posttest Descriptive Statistics*

<table>
<thead>
<tr>
<th>Treatment</th>
<th>General</th>
<th>Progress</th>
<th>Observation</th>
<th>Social</th>
<th>Physiological</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Perception</td>
<td></td>
<td>Comparison</td>
<td>Feedback</td>
<td>States</td>
</tr>
<tr>
<td>N</td>
<td>124.00</td>
<td>124.00</td>
<td>124.00</td>
<td>124.00</td>
<td>124.00</td>
</tr>
<tr>
<td>Mean</td>
<td>4.02</td>
<td>4.46</td>
<td>3.47</td>
<td>3.65</td>
<td>3.67</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>.95</td>
<td>.50</td>
<td>.95</td>
<td>.64</td>
<td>.96</td>
</tr>
<tr>
<td>Skewness</td>
<td>-1.00</td>
<td>-1.00</td>
<td>-.30</td>
<td>-.220</td>
<td>-.90</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>.50</td>
<td>1.10</td>
<td>-.40</td>
<td>.60</td>
<td>.20</td>
</tr>
<tr>
<td>Percentiles</td>
<td>25</td>
<td>4.00</td>
<td>4.15</td>
<td>2.83</td>
<td>3.33</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>4.00</td>
<td>4.50</td>
<td>3.50</td>
<td>3.66</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>5.00</td>
<td>4.96</td>
<td>4.16</td>
<td>4.00</td>
</tr>
</tbody>
</table>
### Table 17 (continued)

**Research Question Two: Posttest Descriptive Statistics**

<table>
<thead>
<tr>
<th></th>
<th>General</th>
<th>Observation</th>
<th>Physiological</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Perception</td>
<td>Progress</td>
<td>Comparison</td>
</tr>
<tr>
<td>N</td>
<td>157.00</td>
<td>157.00</td>
<td>157.00</td>
</tr>
<tr>
<td>Mean</td>
<td>4.15</td>
<td>4.44</td>
<td>3.66</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>.88</td>
<td>.54</td>
<td>.91</td>
</tr>
<tr>
<td>Skewness</td>
<td>-1.10</td>
<td>-1.00</td>
<td>-.50</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>1.40</td>
<td>1.00</td>
<td>-.40</td>
</tr>
<tr>
<td>Percentiles 25</td>
<td>4.00</td>
<td>4.06</td>
<td>3.00</td>
</tr>
<tr>
<td>50</td>
<td>4.00</td>
<td>4.62</td>
<td>3.66</td>
</tr>
<tr>
<td>75</td>
<td>5.00</td>
<td>5.00</td>
<td>4.50</td>
</tr>
</tbody>
</table>
Figure 8. RSPS Posttest Subscale Progress for Treatment/Comparison groups

Figure 9. RSPS Posttest Subscale Observational Comparison for Treatment/Comparison groups
Figure 10. RSPS Posttest Subscale Social Feedback for Treatment and Comparison groups

Figure 11. RSPS Posttest Subscale Physiological States for Treatment/Comparison groups
**Verification of normality.** The multivariate statistical assumption of normality was investigated. When investigating each subscale, values fell within acceptable ranges from -1.0 to 1.0 demonstrating data which were neither too peaked nor asymmetric with the exception of Progress in the treatment group with a Kurtosis value of 1.1 and General Perception in the comparison group with a skewness value of -1.1 and Kurtosis value of 1.4. However, as implemented previously, a Shapiro-Wilk’s analysis tested for discrepancies in normality (Meyers, Gamst, & Guarino, 2006) whereby results did not indicate a violation of the assumption of normality (Stevens, 2002) as scores were above $p = .01$.

**Posttest effects of treatment and comparison groups on the dependent variable.** In order to measure the effect of the dependent variables (Progress, Observational Comparison, Social Feedback, and Physiological States) on the independent variable (treatment and comparison groups), the data were analyzed by a Multivariate Analysis of Variance (MANOVA). The significance value of $p = .03$ demonstrated in Table 18 tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups. The Box’s Test of Equality of Covariance Matrices (Box’s $M = 27.617, F(279495.21) = 1.81, p = .03$) does not represent a violation of homoscedasticity as a Box value can be considered homogeneous until $p = .01$ (Huberty & Olejnik, 2006). The above statistical approaches to examine normality of the pretest data together with the MANOVA indicates that treatment and control groups did not differ statistically. As a result, groups could be used for comparison purposes.
Table 18

*Box’s Test of Equality of Covariance Matrices*

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Box’s M</em></td>
<td>27.62</td>
</tr>
<tr>
<td><em>F</em></td>
<td>1.81</td>
</tr>
<tr>
<td><em>df1</em></td>
<td>15.00</td>
</tr>
<tr>
<td><em>df2</em></td>
<td>2.00</td>
</tr>
<tr>
<td><em>Sig.</em></td>
<td>.03</td>
</tr>
</tbody>
</table>

To test for differences in the reader self-efficacy skills between the treatment and comparison groups after the treatment, a MANOVA of posttest data were calculated. Wilks’s Lambda allowed for the evaluation of differences on the independent variable; the two levels being (a) treatment group and (b) comparison group on the five dependent variables Progress, Observational Comparison, Social Feedback, and Physiological States. A statistically significant value would indicate reliable differences between the treatment and comparison groups on the dependent variables measuring critical thinking. This MANOVA test revealed no significance differences between the posttest means with Wilks’ $\lambda = .98 F(5,269) = 1.16, p = .37$ (see Table 19). This result suggests that students in the treatment group and comparison group were not statistically different after the study.
Table 19

*Multivariate Tests Comparing Treatment and Comparison Posttest Groups for Reader Self Efficacy Scores*

<table>
<thead>
<tr>
<th>Effect</th>
<th>Value</th>
<th>$F$</th>
<th>Hypothesis $df$</th>
<th>Error $df$</th>
<th>Sig.</th>
<th>Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td></td>
<td>1.166</td>
<td>5.00</td>
<td>276.00</td>
<td>.37</td>
<td>.02</td>
</tr>
</tbody>
</table>

*a Exact statistic*
Research question two findings and summary. Research question two: Is there a statistically significant difference in students’ self-perceptions of themselves as readers who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not? The sample size of the treatment group (n = 124) and the comparison group (n = 157) represented 281 participants in the study. In order to measure the effect of the dependent variables (Progress, Observational Comparison, Social Feedback, and Physiological States) on the independent variable (treatment and comparison groups), the data were analyzed by a Multivariate Analysis of Variance (MANOVA). An evaluation of Wilks’s Lambda was utilized to assess the differences in the independent variables on the dependent variables. This MANOVA test revealed no significant difference ($F(5,276) = 1.17 \ p = .37$) in participants’ reader self-efficacy skills on the subscales of Progress, Observational Comparison, Social Feedback, and Physiological States. This result suggests that students in the treatment group and comparison group were not statistically different after the 8-week study.

Research Question Three

Research question three utilized the CPR (Westberg, Archambault, Dobyns, & Salvin, 1993) to measure the frequency of higher order thinking (HOT) and lower order thinking (U/R) questions asked by teachers and students. A Chi-square was applied to measure if the scaffolding of HOT questions was significantly different between expected (pretreatment) and observed (post treatment) frequencies.

Code and Value Cleaning. According to Huck (2008), when chi-squares tests are performed, certain criteria need to be met. First, sample size and “expected frequencies need to be sufficiently large for the chi-square to function as intended” (p. 463). Second, expected values of less than five cannot be evident in more than 20% of the cells and values need to be
greater than zero. Third, the data must be reported in raw frequencies and be independent. Fortunately, the above criteria were met as all values achieved frequencies greater than five.

**Results.** The Chi-square test assesses the relationship between expected and observed frequencies. If the expected and observed frequencies are close, then no statistical significance would be detected (Meyers, Gamst, & Guarino, 2006). The hypothesis is that if teachers received training in scaffolding the development of HOT questions, along with implementing a unit of study which embedded HOT questions use throughout the eight week study, than both teachers and students will ask significantly more HOT questions than understanding/remembering questions than those students in the comparison group.

Based on research question three, a two-group (treatment/comparison) independent Chi-square test was utilized with a four category response (HOTs/UR) variable (Huck, 2008). This 2x4 chi-square can be found in Table 20. The Chi-square value exceeded the critical value of 7.815 ($x^2 = 940.16$, $df = 3$, $p < .05$) demonstrating that there was a significant difference between the observed (posttest) and expected (pretest) data. Finally, any standardized residual values above the absolute value of two were identified as major contributors to the Chi-square.
Table 20

*Differences in Question Use between Expected (pretreatment) and Observed (posttreatment) Frequencies – 2x4 Chi-square*<sup>a</sup>

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Observed (Post)</th>
<th>Expected&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Standard Residual&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Observed (Post)</th>
<th>Expected&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Standard Residual&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher HOT</td>
<td>102</td>
<td>45</td>
<td>8.50&lt;sup&gt;b&lt;/sup&gt;</td>
<td>30</td>
<td>49</td>
<td>-2.71&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Teacher U/R</td>
<td>26</td>
<td>116</td>
<td>-8.36&lt;sup&gt;b&lt;/sup&gt;</td>
<td>131</td>
<td>158</td>
<td>-2.15&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Student HOT</td>
<td>81</td>
<td>7</td>
<td>27.97&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10</td>
<td>7</td>
<td>1.13</td>
</tr>
<tr>
<td>Student U/R</td>
<td>12</td>
<td>19</td>
<td>-1.61</td>
<td>17</td>
<td>17</td>
<td>0.00</td>
</tr>
</tbody>
</table>

*Note:*  
<sup>a</sup>These data produced a chi-square value of ($X^2 = 940.16, df = 3, p < .05$)

<sup>b</sup>Expected values were calculated based on classroom observations that occurred before the treatment was implemented.

<sup>c</sup>Standard residuals greater than the absolute value of 2 are major contributors to the Chi-square value.
Comparison group data. In order to measure the effect of the treatment (unit of study with embedded scaffolding of HOT questions) on the frequency of higher-order thinking questions asked by teachers and students, data were collected from both groups. Expected values were calculated based on classroom observations that occurred before the treatment was implemented. Observed values were calculated post treatment (please see Table 20). The comparison group did not receive the treatment, but data were still collected at these two points. Teachers in the comparison group asked more HOT questions ($n = 49$) at the beginning of the study and fewer HOT questions ($n = 30$) at the conclusion of the study. The Chi-square analysis revealed this is a major contributor ($R = -2.71$) to this significant Chi-square. Teachers also asked fewer lower level (U/R) questions ($n = 158$) at the beginning of the study than eight weeks later ($n = 131$). The Chi-square analysis revealed this was also a major contributor ($R = -2.15$) to this significant Chi-square.

Students from the comparison group asked ($n = 7$) HOT questions at the beginning of the study and ($n = 10$) questions at the end of the study. Students asked the same number of U/R questions ($n = 17$) in both expected (week 1) and observed (week 8) frequencies. These slight differences were not found to be major Chi-square contributors with residuals less than the absolute value of 2.

Treatment group data. The treatment group received embedded instructional strategies to scaffolding HOT questions during the implementation of an eight-week unit of study. Matching the comparison group, questions were recorded as either HOT or U/R prior to the study (expected) and post treatment (observed). Prior to the treatment, teachers asked 45 HOT questions as compared to 102 HOT questions post treatment. The Chi-square analysis revealed this was a major contributor ($R = 8.50$) to this significant Chi-square. This is juxtaposed to the
number of U/R questions asked pretreatment \((n = 116)\) and post treatment \((n = 26)\). The Chi-square analysis revealed this was also a major contributor \((R = -8.36)\) to this significant Chi-square.

Students only asked 7 HOT questions prior to the treatment compared to a marked 81 HOT questions post treatment. A Chi-square analysis revealed this was a major contributor \((R = 27.97)\) to this significant Chi-square. Students asked 19 U/R questions pretreatment and 12 U/R questions post treatment. This last discrepancy did not contribute significantly to the Chi-square.

**Research question three findings and summary.** Research question three: Is there a statistically significant difference in the frequency of higher-order thinking questions asked by teachers and students participating in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not? When comparing pretest data to posttest data, there was a statistically significant difference in the frequencies of types of questions asked by teachers and students \((\text{Chi-square} = 940.16, \text{df} = 3, p < .05)\). After receiving the eight-week treatment focusing on a unit of study with embedded scaffolding of HOT questions, teachers and students in the treatment group asked significantly more higher order thinking questions than teachers and students from the comparison group. Conversely, teachers from the treatment group asked significantly fewer U/R level questions post treatment. Students in the treatment asked fewer U/R level questions post treatment, but this difference was not a major contributor to the Chi-square \((R = -1.61)\).

These data suggests that professional training of teachers in the scaffolding of higher order thinking questions will significantly increase the number of HOT questions asked in the classroom by teachers and students. Data also indicate that teachers asked significantly fewer
lower level questions in the classroom following a training focused on HOT questions. The implications of these findings will be discussed in-depth in Chapter 5.

**Research Question Four**

Research question four examined the relationship between critical thinking (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) and reader self-efficacy (Progress, Observational Comparison, Social Feedback, and Physiological States). A bivariate Pearson correlations were utilized to measure the strength of these relationships. This researcher decided to utilize the Pearson product-moment correlation coefficient $r$ reported as a decimal between -1.00 and +1.00 (Huck, 2008).

**Code and Value Cleaning.** The correlation was conducted post treatment only. Only matched students’ scores were compared. This meant that a student’s RSPS score was compared to his or her corresponding CM3 score. Some students were eliminated from the sample as they were absent on the day of test administration or did not take either the RSPS or the CM3 test. Therefore, the available posttest sample size totaled 251 students. Scatterplots were created for the CM3 and RSPS scales to visually inspect the data and review for outliers. The visual inspection of the scatter diagrams did not reveal outliers and therefore analysis could proceed with confidence (Huck, 2008).

**Correlational Analyses of Data.** For research question four, a correlational analysis was completed for the data collected from the two instruments. Data obtained were analyzed for 251 students and can be found in Table21. Significant correlations were observed at the $p < .001$ level in all sub-scales with the exception of the Progress subscale for the RSPS instrument. When interpreting direction of the correlation, all significant values were also found to be positive (see Table 21).
Table 21

*Correlational Analyses of Participant’s Post Treatment Scores for the Subscales of the CM3 and RSPS*

<table>
<thead>
<tr>
<th>Subscale</th>
<th>M</th>
<th>SD</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
<th>7.</th>
<th>8.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental Focus</td>
<td>28.98</td>
<td>8.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creative Problem Solving</td>
<td>31.32</td>
<td>8.86</td>
<td>.608***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning Orientation</td>
<td>33.26</td>
<td>8.66</td>
<td>.582***</td>
<td>.784***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive Integrity</td>
<td>33.19</td>
<td>8.54</td>
<td>.578***</td>
<td>.515***</td>
<td>.494***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scholarly Rigor</td>
<td>28.72</td>
<td>6.92</td>
<td>.588***</td>
<td>.809***</td>
<td>.819***</td>
<td>.577***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress</td>
<td>4.10</td>
<td>.92</td>
<td>-.078</td>
<td>.035</td>
<td>.039</td>
<td>.047</td>
<td>-.009</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observation Comparison</td>
<td>3.60</td>
<td>.92</td>
<td>.320***</td>
<td>.569***</td>
<td>.524***</td>
<td>.349***</td>
<td>.545***</td>
<td>.063</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social feedback</td>
<td>3.70</td>
<td>.65</td>
<td>.374***</td>
<td>.687***</td>
<td>.546***</td>
<td>.372***</td>
<td>.559***</td>
<td>-.008</td>
<td>.689***</td>
<td></td>
</tr>
<tr>
<td>Physiological States</td>
<td>3.73</td>
<td>.94</td>
<td>.744***</td>
<td>.616***</td>
<td>.618***</td>
<td>.475***</td>
<td>.616***</td>
<td>.044</td>
<td>.663***</td>
<td>.659***</td>
</tr>
</tbody>
</table>

Note: Correlation is significant at the $p < .05^{*}$, $p < .01^{**}$, $p < 0.001^{***}$ level (2-tailed)
As expected, critical thinking subscales (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) significantly correlated with other critical thinking subscales in a positive fashion at moderate ($r = .50$ to $.70$) to high ($r = .70$ to $.90$) levels (Henkle, Wiersma, & Jurs, 2003). These values support reliability analysis by Giancarlo, Blohm and Urdan (2004) where internal consistency, determined by Cronbach’s alpha coefficients, ranged from $.70$ to $.83$ at the $p < .01$ level.

The relationship between critical thinking and reader self-perception is also supported with significant positive correlations. The Mental Focus sub-scale measures the critical thinking ability for students to stay focused on the task of problem solving while also being task-oriented and organized. Mental Focus correlated with Observational Comparison, which is how a student perceives his or her reading performance “compared with the performance of classmates” (Henk & Melnick, 1995, p. 472) ($r = .32$, $p < .01$). This correlation indicated that students with higher Mental Focus tended to perceive that they could read at a high level compared to their peers. Another sub-scale of the CM3 which correlated with Observational Comparison was Cognitive Integrity. This concept defines how a student is disposed to think in an open and fair-minded fashion while also regarding varying viewpoints. This correlation ($r = .35$, $p < .01$) indicated that students with high Cognitive Integrity tend to value other’s viewpoints while also regarding their own performance to peers favorably.

The Creative Problem Solving subscale examines critical thinking in how students approach problem solving with innovative or original ideas and solutions. Students with a high degree of Creative Problem Solving tend to enjoy challenging activities and derive personal satisfaction in understanding complexity. Creative Problem Solving correlated with Observational Comparison ($r = .57$, $p < .01$) to a moderate degree (Henkle, Wiersma, & Jurs,
2003) indicating that students with high Creative Problem Solving also perceive their performance as high when compared to their classmates. Two other subscales correlated at the moderate level to Observational Comparison; those students scoring high in Learning Orientation (students enjoy learning for the sake of learning) and Scholarly Rigor (students enjoy working with complex ideas and concepts) correlated with Observational Comparison ($r = .52$, $p < .01$), ($r = .56$, $p < .01$), respectfully.

Mental Focus ($r = .37$, $p < .01$) and Cognitive Integrity ($r = .37$, $p < .01$), correlated with Social Feedback, which is how students perceive direct input concerning their reading ability from teachers, parents and peers, at a low positive level (Henkle, Wiersma, & Jurs, 2003). This indicated that students with a high degree of Mental Focus and Cognitive Integrity tend to perceive input concerning their reading ability at a significant level. Critical thinking subscales of Creative Problem Solving ($r = .69$, $p < .01$), Learning Orientation ($r = .55$, $p < .01$) and Scholarly Rigor ($r = .56$, $p < .01$) correlated with Social Feedback moderately. This relationship reveals that students judging their reading ability from feedback from others also tend to have high critical thinking skills at a moderate positive level.

Finally, critical thinking subscales of Creative Problem Solving ($r = .61$, $p < .01$), Learning Orientation ($r = .61$, $p < .01$) and Scholarly Rigor ($r = .61$, $p < .01$) correlated with Physiological States moderately. Physiological States refers to internal feelings that a student may have during the experience of reading; these feelings correlate with high critical thinking skills at a moderate positive level. Also relevant, albeit at a low positive level, Cognitive Integrity ($r = .48$, $p < .01$) correlated with how students feel about the experience of reading. The strongest relationship linking reading self-efficacy and critical thinking is found when examining Mental Focus ($r = .74$, $p < .01$) and Physiological States. Students with the ability to
stay focused on the task of problem solving while also being task-oriented and organized
demonstrate a high positive (Henkle, Wiersma, & Jurs, 2003) correlation to a student’s
Physiological State, or how they feel during the process of reading.

Follow-up correlational analyses were also completed for the treatment group and
comparison group to determine if any notable trends were evident. Data obtained from the
treatment group were analyzed for 116 students. Significant correlations were observed at the $p < .001$ level in all sub-scales with the exception of the Progress subscale for the RSPS instrument. Similarly, data obtained from the comparison group were analyzed for 135 students. Significant correlations were observed at the $p < .001$ level in all sub-scales with the exception of the Progress subscale for the RSPS instrument. There were no notable differences when comparing correlation matrices for all students post treatment, or when running the correlation for students from either the treatment or comparison groups.

The subscale Progress, representing a subscale from the RSPS, did not meet significance
criteria in all three tests. According to Henk and Melnick (1995), Progress is defined as a
student’s present level of performance compared to a past level of performance. Certainly, a
small standard deviation of .54 indicates little variability from the mean possibly because of the
homogeneous group of high achieving students. Students might have already reached a test
ceiling whereby a follow-up test eight weeks later had little impact.

**Research question four findings and summary.** Research question four: Is there a
statistically significant correlation between critical thinking skills (Mental Focus, Learning
Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) and reading self-
efficacy (Progress, Observational Comparison, Social Feedback, and Physiological States)? The
technique of using a correlation is not to find causality; rather to assess the extent to which
relationships are significant (Henkle, Wiersma, & Jurs, 2003). When five subscales of an instrument correlate positively to three-out-of-four subscales of another instrument, at the alpha level of .001, then certain elements of these instruments are also related. Hence, certain dimensions of critical thinking are significantly correlated with certain dimensions of reader self-efficacy at the $p < .001$ level. Students with high critical thinking skills tend to demonstrate high levels of reader self-efficacy, with the exception of the Progress sub-scale in the RSPS instrument. Further implications are discussed in Chapter 5.
CHAPTER FIVE: SUMMARY AND CONCLUSIONS

Chapter Overview

The need for this study was predicated on the necessity for further clarification in the areas of instructional scaffolding, higher order thinking, and the exploration of a link between reader self-efficacy and critical thinking. First, scaffolding does not provide educators with clear and definite steps on the ways it should be used to achieve effective teaching (Hammond, 2002). According to Wood and Wood (1996), the teacher is not provided with concrete direction on the “nature of the guidance and collaboration needed that promotes development” (p. 5). Furthermore, there is no consensus in regard to scaffolding models (Fisher & Frey, 2010; Pol, Volman, & Beishuizen, 2010; Liang, 2011); therefore, this study aimed to present an explicit scaffolding framework that systematized scaffolding techniques in the classroom.

Second, a further dilemma exists over conceptual differences concerning higher level thinking (HOT). According to Geertsen (2003), the “indiscriminate use of terms such as critical thinking, reflective thinking, and high-level thinking has created unnecessary confusion” (p. 1). While experts agree that higher order thinking is more disciplined and systematic than everyday thought (Geertsen, 2003), it still remains an elusive concept to grasp. Teachers are missing explicit scaffolding techniques from their instructional toolboxes to develop higher order thinking. To counteract this disparity, Bloom’s revised taxonomy (Anderson, et al. 2001) was identified as a tool whereby explicit scaffolding steps could shape HOT question use by teachers and students in the classroom.

Third, a link between components of critical thinking and reader self-perceptions, which was not evident in previous literature, was explored in this study. This association was viewed through Bivariate Pearson correlations (two-tailed) to measure the strength of these relationships.
Ultimately, a positive relationship existed in multiple areas noting that, in most cases, if a student’s critical thinking improves, his or her self-perceptions as a reader also increases. This chapter will present a summary of the study, a review of the findings related to the research questions, a comparison of findings related to literature, limitations, implications, and suggestions for future research.

**Summary of Study**

This study obtained a sample of convenience which consisted of 286 grade six students. Intact classroom groups were examined with 157 students in the comparison group and 129 students in the treatment group. Four teachers participated in this study; two teachers each with six classes of students were responsible for students at the treatment group school; the other two teachers, each with six classes of students, were responsible for students at the comparison group school.

The aim of this study was to present an explicit scaffolding model whereby teachers could scaffold student development of HOT questions. Hence, this study operationalized scaffolding by making it more explicit. The eight week treatment focused on four related areas: (a) teachers scaffolding the use of higher order thinking questions through a scaffolding map; (b) the use of Bloom’s (2001) revised taxonomy so teachers and students can pose questions that correspond to higher level thinking; (c) the use of a higher order thinking decision making tree that assisted teachers in determining question level; and (d) the use of a unit of study that provided teachers with embedded higher order thinking strategies along with supplementary lesson activities. By building on a teacher’s intentionality while consciously applying scaffolding for students to learn, treatment strategies became systematic rather than scripted. Adapted from the work of Fisher and Frey (2010), a scaffolding map identified explicit
scaffolding techniques by asking clarifying questions followed by prompts and cues when student misconceptions arose. When prompts and cues did not lead to deeper understanding, then teachers moved to more direct explanations and modeling. Additionally, Bloom’s revised taxonomy provided a framework of HOT questions that not only served as a measurement tool, but also provided teachers and students with unambiguous exemplars of HOT questions.

During the eight week treatment, teachers in the Treatment group received training in scaffolding the development of HOT questions. The first 2.5 hour professional development session took place shortly after pretests were conducted. This session focused on the need for explicit scaffolding techniques through the utilization of the scaffolding map. A rationale was presented that scaffolding techniques needed to be responsive to the individual student and systematic in implementation. This session also covered the implementation of the unit of study and accompanying activities (reference Appendix D) that scaffolded HOT questions use by teachers and students.

The unit of study introduced a lesson focus each day that emphasized the integration of HOT questions. In addition, each lesson contained embedded HOT questions and scaffolding techniques to ensure that the teacher utilized the treatment protocol with fidelity. Oliveira (2009) noted that the use of a framework of questions (such as Bloom’s taxonomy) promoted longer and more articulated student responses to questions and promotes higher-level student thinking. One of the goals of this study was to make scaffolding more explicit in the classroom. Therefore, in addition to HOT questions, each lesson provided opportunities for teachers to model key concepts, guide student learning, provide students with independent practice and provide students with direct feedback. This gradual release of responsibility model (Pearson & Fielding,
1991) explains how a teacher facilitates and supports a learner along a continuum leading up to independent practice and application.

In order to scaffold students until they reached this level of autonomy, each student received a flip book with sample questions identifiable according to Bloom’s taxonomy. Students were encouraged to select HOT questions due to a higher point value than understanding and remembering questions. Most activities supported student selection of HOT questions in this way and were embedded into each lesson. Other examples of lesson content included homework assignments, short answer responses to open ended questions, debates and longer written responses. An additional 2-hours of professional development followed the initial session in 41 minute intervals during weeks 2, 4, and 6 of the treatment. These sessions provided an opportunity for the researcher and teachers to discuss progress while also managing the focus of instruction during the following week.

As noted above, teachers in the treatment group received training in scaffolding HOT questions through the implementation of a unit of study. Teachers in the comparison group followed the grade six District curriculum which derives from the Connecticut State Department of Education (2010) state standards. According to the grade six curriculum, teachers do not focus on higher order thinking questions (reference Appendix H). However, both the treatment site and comparison site followed the same structure during the eight week treatment. Each focused on short stories for four weeks followed by a focus on literature circles (Daniels, 2002) for four weeks whereby students discuss books in small groups. While both sites followed a similar structure, the teachers at the treatment site received explicit training in scaffolding HOT question use. In addition, teachers at the treatment site received a unit of study which embedded HOT question use during the treatment period. Teachers at the comparison site did not receive
this support or training; instead they followed the grade six curriculum which did not refer to HOT question use or implementation. To the measure the effectiveness of the treatment, four research questions were developed. The full process, along with research design and instrumentation is outlined in Chapter 3. The effectiveness of each research question is discussed below along with implications of the study.

**Comparison and Contrast of Findings Related to the Literature Review and the Implications for Future Research**

The review of literature in Chapter 2 suggested that learning is mediated as a social act between expert and novice within the Zone of Proximal Development (Vygotsky, 1978). Students need to be active participants in their learning and teachers need to engage students by scaffolding metacognitive and motivational learning objectives (Pajares, 1996; Schunk, 1991). Students also need to be aware of personal self-efficacy information to assess their own success at a task (Bandura, 1997). Experiences interpreted as successful generally raise confidence in one’s own ability. Thus, if a student interprets his or her performance with an activity or task as unsuccessful, self-efficacy is likely to be reduced (Bandura, 1997).

Research also demonstrated that fostering higher ordering thinking skills in schools is difficult to achieve. According to Barak & Shakhman (2007), to foster students’ higher order thinking, teachers must possess not only in-depth subject matter knowledge, but also sound pedagogical knowledge or explicit steps to develop students’ higher order thinking. The use of Bloom’s revised taxonomy provides the explicit steps necessary for fostering critical thinking skills along with structured constructivist pedagogy in the form of scaffolding.

Despite the benefits of this research, few teachers effectively provide explicit scaffolding techniques in the classroom or select clear and concrete mechanisms to systematically improve
critical thinking (Fisher & Frey, 2010; Halpern, 2007; Liang, 2011; McLean & Miller, 2010; Pol, Volman, & Beishuizen, 2010). Moreover, students often do not have the opportunity to self-reflect on their learning or receive feedback concerning their achievement (Bandura, 1997; Zimmerman, 2002). This disconnect between theory and practice supported the need for this study on the instructional scaffolding of higher order thinking questions on critical thinking and reader self-efficacy. Each research question is summarized below and discussed in relationship to the review of the literature.

**Research Question One**

Research question one consisted of one independent variable with two levels (treatment and comparison groups); the focus on grade six students was a constant. There were five dependent variables (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) as measured by the California Measure of Mental Motivation (CM3) used to examine critical thinking. The CM3 is a 72-item, self-report instrument designed to measure the degree to which students are cognitively engaged and mentally motivated towards intellectual activities that involve reasoning (Giancarlo, Blohm, & Urdan, 2004). The research question which guided this study was: Is there a statistically significant difference in the critical thinking skills of students who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not?

Interval level posttest data was analyzed by a Multivariate Analysis of Variance (MANOVA) to determine if there was a significant difference between the dependent variables based on the independent variable of treatment and comparison groups. An evaluation of Wilks’s Lambda was utilized to assess the differences in the independent variable on the dependent variables. This MANOVA test revealed no significance difference ($F(5,256) = 1.43,$
in participants’ critical thinking skills on the subscales of Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor. This result suggests that students in the treatment group and comparison group were not statistically different after the eight-week study.

**Relation of research question one to literature review.** The California Measure of Mental Motivation (CM3) was used to examine critical thinking skills after the eight-week treatment focusing on instructional scaffolding techniques associated with HOT questions. However, as noted above, students in the treatment group and comparison group were not statistically different after the eight-week study. There are two potential explanations why the Treatment group did not significantly improve their critical thinking skills as measured by the CM3. First, an improvement across groups may not have been noted because content-specific instruction, (the Treatment was presented in a Language Arts classroom) may not be optimal for teaching students to transfer more abstract critical thinking skills (Halpern, 1998). Second, the Treatment period (eight weeks) might not have been long enough to make sustained changes in critical thinking (McLean & Miller, 2010).

**Implications for future research.** Using the CM3 subscales of Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry and Scholarly Rigor to measure critical thinking of students in the Treatment group was inconclusive in determining if receiving scaffolding in the development of HOT questions was effective. Certainly, the eight-week Treatment did not provide statistically significant results. A similar quasi-experimental study of McLean and Miller (2010), during a 14-week period yielded similar results. Expanding the study beyond 20-weeks is recommended for teachers to fully enhance their pedagogical knowledge in scaffolding higher order thinking questions in the classroom. Furthermore,
broadening the study across disciplines would enhance students’ abilities to generalize critical thinking skills across content-specific subjects and transfer more abstract critical thinking skills (Halpern, 1998).

**Research Question Two**

Research question two utilized the same independent variable structure as in research question one and had four dependent variables to measure the construct of reader self-efficacy (Progress, Observational Comparison, Social Feedback, and Physiological States) as measured by the Reader Self-Perception Survey (RSPS; Henk & Melnick, 1995). The RSPS was selected to measure student perceptions of reading self-efficacy. The RSPS consists of 32 items that represent 4 scales (Progress, Observational Comparison, Social Feedback, and Physiological States). Children are asked to indicate how strongly that agree or disagree with specific statements on a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, 5 = Strongly Agree). The research question which guided this study was: Is there a statistically significant difference in students’ self-perceptions of themselves as readers for those who have participated in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not?

As in research question one, interval level data was analyzed by a Multivariate Analysis of Variance (MANOVA) to determine if there was a significant difference between the dependent variables above and the treatment and comparison groups. An evaluation of Wilks’s Lambda was utilized to assess the differences in the independent variables on the dependent variables. This MANOVA test revealed no significant difference ($F(5, 276) = 1.166, p = .37$) in participants’ reader self-perception on the subscales of Progress, Observational Comparison,
Social Feedback, and Physiological States. This result suggests the two groups, students in the treatment group and comparison group were not statistically different after the eight-week study.

**Relation of research question two to literature review.** The Reader Self-Perception Survey (RSPS) was used to examine reader self-efficacy after the eight week treatment focused on a unit of study with embedded instructional scaffolding techniques associated with HOT questions. As noted above, students in the treatment group and comparison group were not statistically different after the 8-week study. Self-efficacy is reinforced when students perceive they are performing well (Schunk & Pajares, 2002). Interestingly, a lack of success or poor performance in a particular task will not necessarily lower self-efficacy if learners still believe they can perform at a higher level by expending more energy or by using different strategies (Schunk, 1991). However, students also require positive feedback concerning their success if they are to make judgments concerning self-efficacy beliefs (Bandura, 1997). While outside of the original scope of this study, student feedback is seemingly necessary to improve student self-efficacy. As a result, further implications for student feedback are discussed in the next section.

**Implications for future research.** Using the RSPS subscales of Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor to measure reader self-efficacy of students in the Treatment group was inconclusive in determining if receiving scaffolding in the development of HOT questions was effective. Certainly, the 8-week Treatment did not provide statistically significant results. There are three potential explanations why the Treatment group did not significantly improve their reader self-perception skills as measured by the RSPS. First, self-efficacy is reinforced when students perceive they are performing well in an area of study (Schunk & Pajares, 2002). While students demonstrated their ability in asking more HOT questions at the completion of the Treatment, they did not
necessarily connect this success to increased reading achievement; traditionally, reading prowess is measured through achievement driven activities such as tests, quiz’s and multiple choice questions (Calkins, 2001). Therefore, both formal and informal feedback concerning student achievement in relation to HOT question use is needed for students to fully appreciate their growth in this area. Perceived growth and success is likely to increase student self-efficacy (Shell, Murphy, & Bruning, 1989). Second, at the outset, students differ in their self-efficacy beliefs. As they engage in activities over time, students are affected by personal and situational influences that provide student feedback concerning their own learning which essentially improves student self-efficacy (Graham & Weiner, 1996). Third, expanding the study beyond 20-weeks is recommended for students to fully grasp their increased skills; herein, their ability to formulate enhanced HOT questions to ultimately improve skills and reader self-efficacy.

**Research Question Three**

Research question three utilized the CPR (Westberg, Archambault, Dobyns, & Salvin, 1993) to measure the frequency of higher order thinking (HOT) questions and Understanding/Remembering (U/R) questions asked by teachers and students. Data were collected from 22 observations in treatment and comparison classrooms on the frequencies of HOT and U/R questions for both teachers and students. A two-group (treatment/comparison) independent Chi-square test was utilized with a four-category response (HOT/UR) variable (Huck, 2008). The research question which guided this study was: Is there a statistically significant difference in the frequency of higher-order thinking questions asked by teachers and students participating in an instructional scaffolding intervention focused on higher-order thinking questions and those who have not?
When comparing pretest data to posttest data, there was a statistically significant difference in the frequencies of types of questions asked by teachers and students (Chi-square=940.16, df = 3, p < .05). After receiving the eight-week treatment focusing on the implementation of a unit with embedded scaffolding to develop HOT questions, teachers and students in the treatment group asked significantly more higher order thinking questions and few U/R questions. These findings will be discussed further in the implications section of this Chapter.

**Relation of research question three to literature review.** The Classroom Practice Record (CPR) was used to examine critical thinking skills after the eight-week treatment focusing on instructional scaffolding techniques associated with HOT questions. As noted above, students and teachers asked significantly more HOT questions post Treatment. According to research, the success of the Treatment can be attributed to four important criteria being met.

First, students worked within the Zone of Proximal Development (Vygotsky, 1978). The ZPD represents two developmental levels: the actual developmental level, which is what the learner can achieve by himself or herself and, the potential level of development, which is established when a learner is assisted by a more expert other. According to Cole and Cole (2001), the term proximal indicates that the level of support is slightly above the learner’s current capability; additional support builds on a learner’s existing ability and has been shown to accelerate student growth.

Second, teachers effectively scaffolded students in the formulation of higher level questions; previous tasks that they could not complete on their own (Bruner, 1978). While this support was cognitive in nature, it also scaffolding student learning as a fundamentally social act.
Teachers varied their level of scaffolding support depending on a student’s ability or where he or she entered a specific task; in this case, use of higher order thinking questions. Clark and Graves (2004) linked scaffolding to the Gradual Release of Responsibility model (Pearson & Fielding, 1991) which explains how a teacher facilitates and supports a learner along a continuum leading up to independent practice and application.

Third, this study operationalized scaffolding by making it more explicit in the classroom. By building on a teacher’s intentionality while consciously applying scaffolding for students to learn, Treatment strategies became systematic rather than scripted. The use of a scaffolding map identified specific scaffolding moves to explicitly scaffold and prompt, cue, and guide students’ use of higher order thinking questions.

Finally, the use of Bloom revised taxonomy (Anderson & Krathwohl, 2001) operationalized higher order thinking in a concrete and explicit way making it more user friendly in the classroom. The ambiguity of terms such as higher order thinking and critical thinking (Geertsen, 2003) make it difficult for teachers to process these concepts into achievable learning objectives. The organization of thinking into six levels (remembering, understanding, applying, analyzing, evaluating, and creating) represents a pragmatic way to design effective instructional tasks. Particularly useful to a classroom teacher is the ease at which questioning plays an important role within the framework. This combined with different levels representing lower to higher levels of thinking enables the learner and teacher to use verbs to actively identify diverse forms of thinking.

Implications for future research. The Treatment strategies were implemented during an English class where the primary focus for the unit of study was reading and writing. The study should be expanded across disciplines to include all subjects. According to Delcourt and
McKinnon (2011), although reports of using inquiry in schools occur predominantly in science classrooms, there are clear benefits in using inquiry, in this case, an emphasis on asking HOT questions, across all academic subjects.

**Research Question Four**

Research question four examined the relationship between critical thinking (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) and reader self-efficacy (Progress, Observational Comparison, Social Feedback, and Physiological States). A bivariate Pearson correlation procedure was utilized to measure the strength of this relationship. This researcher decided to utilize a Pearson product-moment correlation coefficient \( r \) reported as a decimal between -1.00 and +1.00 (Huck, 2008). The research question which guided this study was: Is there a statistically significant correlation between critical thinking skills (Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry, and Scholarly Rigor) and reading self-efficacy (Progress, Observational Comparison, Social Feedback, and Physiological States)?

**Relation of research question four to the literature review.** Research question four was used to examine the relationship between critical thinking and construct of reader self-efficacy. An EBSCO and ERIC (Education Resource Information Center) search, utilizing the terms “critical thinking” and “reader self-efficacy,” of more than 1.3 million records and 320,000 full-text articles revealed “no results were found.” According to Paul (1992), Director of the Center for Critical Thinking, critical thinking is defined as a skill of taking responsibility and control of one’s own mind. Self-efficacy also involves conscious thought and reflection on one’s own performance (Bandura, 1997). It certainly fits that as one’s critical thinking skills improve, a learner feels better about themselves. According to Bandura (1997) enactive or mastery
experiences are the most influential source of self-efficacy information because they provide the most direct and authentic way to assess one’s own success at a task. Experiences interpreted as successful generally raise confidence in one’s own ability. In this regard, this study established a link between reader self-efficacy and critical thinking abilities as demonstrated in Chapter 4.

**Implications for future research.** Using the RSPS subscales of Progress, Observational Comparison, Social Feedback, and Physiological States to measure reader self-perception and the CM3 scales of Mental Focus, Learning Orientation, Creative Problem-solving, Cognitive Inquiry and Scholarly Rigor to measure critical thinking established a link between reader self-efficacy and critical thinking. Future research should be aimed at widening this relationship to include academic achievement in other core content subjects.

**Limitations of the Study**

This researcher acknowledges limitations to this study. First, an internal threat exists when a pretest is followed by a Treatment, and then a posttest is administered (Gall, Borg, & Gall, 2003). The pretest administration of the RSPS and CM3 may have influenced how students responded to the posttest administration of the RSPS and CM3 since there were no alternative forms of these instruments available. Furthermore, the length of this study (eight-weeks) possibly compromises external validity whereby participants become familiar with the instruments (Gall, Gall, & Borg, 2007). This effect is minimized to some extend as students do not receive specific feedback concerning reader self-efficacy or critical thinking during the Treatment window.

Second, the length of this study might not have provided the Treatment group with enough time to fully execute the scaffolding strategies designed to produce the intended effect. A similar quasi-experimental study (McLean & Miller, 2010) with a 14-week period yielded
similar results. Expanding the study beyond 20 weeks is recommended for teachers to fully enhance their pedagogical knowledge in scaffolding higher order thinking questions in the classroom.

Third, a quasi-experimental design does not allow for the random assignment of participants to groups. As a result, participants were in intact classroom groups where there was not a control for class variability. Specifically, threats exist due to the fact that the groups were composed of nonrandomized volunteers with different experiential backgrounds regarding critical thinking and reader self-efficacy skills. According to Schunk (1991) a lack of success or poor performance in a particular task will not necessarily lower self-efficacy if learners still believe they can perform at a higher level by expending more energy or by using different strategies. However, students may not significantly improve self-efficacy skills if their ability is already strong.

Fourth, teachers’ adherence to the treatment protocols posed an internal threat to validity. As noted in chapter 3, this researcher conducted 22 classroom observations. These observations were significant to the study in four key areas: (a) inter-rater agreement was established by comparing results for HOT and understanding/remembering questions; (b) treatment fidelity could be established whereby classroom teachers were observed following the treatment protocols and the unit of study; (c) comparison site observations determined that key treatment strategies were not being implemented at the comparison site; and finally, (d) question data were collected from treatment and comparison classrooms on the frequencies of higher order thinking and lower order thinking questions for both teachers and students. Finally, the interaction between teachers and this researcher to ensure program fidelity may have threatened the explicit description of the treatment by the researcher to the participants and influenced results (Gall,
Borg, & Gall, 2003). This possibility was reduced by focusing on specific scaffolding techniques and not revealing self-efficacy or critical thinking objectives.

Fourth, due to the sample of convenience \((n = 286)\), the target population from which the accessible population was obtained might be underrepresented. The ability to generalize results to the larger population poses an external threat to validity because this sample comprised students of an ethnically homogenous and affluent public school. Therefore, results could only be generalized with caution to sixth grade students and schools with similar demographic characteristics.

**Summary**

When teachers receive explicit training in scaffolding HOT questions in the classroom, both students and teachers asked significantly more HOT questions than the comparison group. Results also point to a positive correlation between reader self-efficacy and critical thinking whereby students are more efficacious concerning their ability to read when they also demonstrate stronger critical thinking skills. This study recommends that scaffolding be explicitly used in the classroom to increase the use of HOT questions. When teachers consciously and consistently apply scaffolding techniques, questions strategies become systematic. Furthermore, a questioning framework such as Bloom’s revised taxonomy provides an important framework that enables the learner and teacher to use verbs to actively identify diverse forms of thinking. The organization of thinking into six levels (remembering, understanding, applying, analyzing, evaluating, and creating) represents a pragmatic way to design higher order thinking tasks, coinciding with scaffolding techniques, to improve student responses in the classroom.
References


Pajares, F. (2002). Gender and perceived Self-Efficacy in self-regulated learning:
Theory into practice. Retrieved July 22, 2005 from http://www.findarticles.com/p/articles/mi_m0NQM/is_2_41/ai_90190499/pg. 1


Appendix A: IRB Approval
Dear Mr. McKinnon,

I am pleased to inform you that your I.R.B. protocol number 1011-71 has been approved by full committee review. Your approval copies will be sent to Dr. LaBanca by next week. The WCSU I.R.B. wishes all of the best with your research.

Thank you,
Martha Palanzo
I.R.B. Secretary
Appendix B: Consent letters
January 24, 2011

Dear Superintendent:

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. The purpose of the study is to determine the potential benefits of scaffolding the development of Higher Order Thinking (HOT) questions on reader self-efficacy and critical thinking.

Three instruments will be used in this study: The California Measure of Mental Motivation (CM3) will assess critical thinking; The Reader Self-Perception Survey will assess reader self-efficacy, and the Classroom Practices Record (CPR) will be used to investigate higher order thinking questions through researcher observations. Students in both treatment and control groups will take each of these assessments. The first two surveys will be completed on-line. The third is an observational tool, which will be used by the researcher. Student names will be numerically coded and as a result privacy will be protected. All subjects’ identities will be maintained in a secure location. These efforts will maintain confidentiality.

This research study has been reviewed and approved by Western Connecticut State University’s Institutional Review Board (I.R.B. Protocol Number 1011-71). Results of this study will enable educators to better understand the benefits of instructional scaffolding, particularly its relationship with higher order thinking questions. Participation in this study is completely voluntary and participants may withdraw from the study at any time. The questionnaires are coded to ensure that all responses will be held strictly confidential.

I wish to thank the for participating in this study and for contributing to the body of research on scaffolding questions. If you have any questions, please feel free to contact me or my primary advisor.

Sincerely,

Jason McKinnon
jmckinnon@ridgefield.org
203-947-1704

Frank LaBanca, Ed.D
franklabanca@sbcglobal.net

I agree that the study described above can be conducted in the

Please Print Name
Signature
Date
January 24, 2011

Dear Assistant Superintendent,

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. The purpose of the study is to determine the potential benefits of scaffolding the development of Higher Order Thinking (HOT) questions on reader self-efficacy and critical thinking.

Three instruments will be used in this study: The California Measure of Mental Motivation (CM3) will assess critical thinking; The Reader Self-Perception Survey will assess reader self-efficacy, and the Classroom Practices Record (CPR) will be used to investigate higher order thinking questions through researcher observations. Students in both treatment and control groups will take each of these assessments. The first two surveys will be completed on-line. The third is an observational tool, which will be used by the researcher. Student names will be numerically coded and as a result privacy will be protected. All subjects’ identities will be maintained in a secure location. These efforts will maintain confidentiality.

This research study has been reviewed and approved by Western Connecticut State University’s Institutional Review Board (I.R.B. Protocol Number 1011-71). Results of this study will enable educators to better understand the benefits of instructional scaffolding, particularly its relationship with higher order thinking questions. Participation in this study is completely voluntary and participants may withdraw from the study at any time. The questionnaires are coded to ensure that all responses will be held strictly confidential.

I wish to thank the participants for participating in this study and for contributing to the body of research that supports the effects of scaffolding questions. If you have any questions, please feel free to contact me or my primary advisory.

Sincerely,

Jason McKinnon
jmckinnon@ridgefield.org
203-947-1704

Frank LaBanca, Ed.D
franklabanca@sbcglobal.net

I agree that the study described above can be conducted in the

Please Print Name

Signature

Date
January 24, 2011

Dear Principal,

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. The purpose of the study is to determine the potential benefits of scaffolding the development of Higher Order Thinking (HOT) questions on reader self-efficacy and critical thinking.

Three instruments will be used in this study. The California Measure of Mental Motivation (CM3) will assess critical thinking; The Reader Self-Perception Survey will assess reader self-efficacy, and the Classroom Practices Record (CPR) will be used to investigate higher order thinking questions through researcher observations. Students in both treatment and control group will take each of these assessments. Students who agree to participate will complete assessments on-line. Student names will be numerically coded and as a result privacy will be protected. All subjects’ identity will be maintained in a secure location. These efforts will maintain confidentiality.

This research study has been reviewed and approved by Western Connecticut State University’s Institutional Review Board (I.R.B. Protocol Number 1011-71). Results of this study will enable educators to better understand the benefits of instructional scaffolding, particularly its relationship with higher order thinking questions. Participation in this study is completely voluntary and participants may withdraw from the study at any time. The questionnaires are coded to ensure that all responses will be held strictly confidential.

I wish to thank the district for participating in this study and for contributing to the body of research that supports the effects of scaffolding questions. If you have any questions, please feel free to contact me or my primary advisory.

Sincerely,

Jason McKinnon
jmckinnon@ridgefield.org
203-947-1704

Frank LaBanca, Ed.D
franklabanca@sbcglobal.net

I agree that the study described above can be conducted in the

Date
February 2011

Dear [Name],

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. Please accept this letter as my formal request for you to take part in this research study. This research will take place in the months of April to June.

The purpose of this study will enable educators to better understand the benefits of instructional scaffolding, particularly its relationship with higher order thinking questions. Currently, research studies do not provide a clear link between the scaffolding of higher order thinking questions, reader self-efficacy and critical thinking.

This research study has been reviewed and approved by Western Connecticut State University’s Institutional Review Board (I.R.B. Protocol Number 1011-71). Results of this study will enable educators to better understand the inquiry science which foster critical and creative thinking.

Participation in this study is completely voluntary and participants may withdraw from the study at any time. The questionnaires are coded to ensure that all responses will be held strictly confidential. A copy of the results will be available upon request.

If you have any questions, or would like further information about the study, please contact me via email at jmckinnon@ridgefield.org or at 203-947-1704.

Thank you for your cooperation and contribution to this research study.

Sincerely,

Jason McKinnon

Participant Teacher Name

Participant Signature Date 2/15/11
Student Information Form to Participate in a Research Study

December 2010

Dear Student,

I am in a doctoral program at Western Connecticut State University. I am doing an exciting research study. I would like you to be a part of my study. I will send a permission slip home with you. But first, I would like you to know about my study.

The study is on higher order thinking questions and the ways in which you ask questions that will make you a better reader. I will need to use a few tests in my study. You will take the California Measure of Mental Motivation (CM3) and the Reader Self-Perception Survey (RSPS). Taking these tests will only take about 20 minutes. These tests will provide some information on how you think and feel about learning.

I will not use your name in the study; I will use numbers. The tests we use will have nothing to do with report card grades or homework. All of the information will be kept private. If you have questions, please ask me.

If you would like to be in my study, please print and sign your name below:

______________________________________________________________
Print student name

X______________________________________________________________
Student signature

Thank you,

Mr. McKinnon

Frank LaBanca, Ed.D

franklabanca@sbcglobal.net
Appendix C: Treatment plan and protocols
Scaffolding HOT questions: McKinnon Treatment plan

Permission to use photo
# Table of Contents

## Overview

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson Format A1</td>
<td>5</td>
</tr>
<tr>
<td>Scaffolding Learning Learning A2</td>
<td>6</td>
</tr>
<tr>
<td>Question Identification Worksheet A3</td>
<td>7</td>
</tr>
<tr>
<td>English Language Arts Standards A4</td>
<td>8</td>
</tr>
<tr>
<td>Scaffolding Map A5</td>
<td>9</td>
</tr>
<tr>
<td>Critical Thinking Flowchart A6</td>
<td>10</td>
</tr>
</tbody>
</table>

## Section 1

| Question Framework (Lower Level): 1A | 11 |
| Question Framework (Higher Level): 1B | 12 |
| Active Question Report: 1C | 13 |
| Question Slip: 1D | 14 |
| Challenge a Friend with a Question: 1E | 15 |
| Stop and Question (Author’s Purpose): 1F | 16 |
| Author’s Purpose: 1G | 17 |
| Stop and Question: 1H | 18 |
| Short Answer Response: 1I | 19 |

## Section 2

| Sample Lesson Plan 2A | 20 |
| Sample Lesson Plan Template 2A | 21 |
| Short Answer Response Rubric 2B | 22 |
| Unit of Study 2C | 23 |
| Bloom’s Revised Taxonomy 2D | 24 |
| Bloom’s Revised Taxonomy 2D | 25 |
Research Treatment Overview
Scott's Ridge Middle School
4-4-11

Excerpt from Abstract:

This study will examine the potential benefits of scaffolding the development of Higher Order Thinking (HOT) questions on reader self-efficacy and critical thinking. It will measure students' critical thinking, self-efficacy and HOT question use. The explicit instruction of HOT questions involves five steps: (a) training English teachers in the scholarly descriptions of questioning; (b) selecting Bloom's taxonomy to identify effective questions strands; (c) assessing HOT questions use through the Classroom Practice Records (CPR); (d) implementing strategy instruction focusing on instructional scaffolding and allowing time to practice the implementation of strategies during assigned lessons for a period of eight weeks; and, (e) evaluating student self-efficacy, critical thinking and HOT question use.

Potential benefits

The potential results of this research will help determine if scaffolding the development of Higher Order Thinking (HOT) questions will significantly improve reader self-efficacy and critical thinking. Knechteloe and Wail (2004) note that critical thinking is a process that involves disciplined questioning by the teacher and participation by students. It is hypothesized that an increased exposure to HOTs questions will likely enhance students' critical thinking and therefore deepen comprehension. This study aims to explore if the specific identification and use of scaffolding steps, along with a description of student-centered and teacher-centered scholarly questions, will help students become more efficient learners. Consequently, it is the hope of this researcher that the current study can provide teachers with clear scaffolding steps and questioning strategies that will improve reading instruction while increasing our understanding of student learning.

Design

This study will involve pre and post testing. Students will be expected to take 2x20 minute tests (online) prior to an eight-week treatment and at the completion of the treatment. Both tests are standardized measures; they are named the California Test of Mental Measures (CMB) and the Reader Self-Perception Survey (RSPS). They measure student dispositions in the area of critical thinking and reader self-efficacy respectively.

Treatment

As noted above, an eight-week treatment is necessary to conduct this research. I would work closely with 6th grade teachers and determine what their focus is during April-May 2011. For example, if teachers are studying a particular whole class novel during this period, I would develop my questioning frameworks based on this text/s. Alternatively, if teachers are utilizing a reader's workshop approach to instruction, I would design a unit of study with shorter texts in mind. An appealing aspect to this study is its versatility—i.e. the focus on questions. Therefore, this researcher can embed questions into a wide variety of instructional approaches. I believe this approach is less intrusive while also benefiting participating teachers and students.
Professional Development

Teachers will receive four hours of professional development in scaffolding instruction, HOT questions (using Bloom's revised Taxonomy), and the implementation of the Unit of Study scope and sequence framework. Essentially, training will be broken into manageable periods of time. The first professional development session will consist of a 2.5 hour presentation that will focus on the use of question frameworks and scaffolding strategies. The following two hours will be delivered in 4x20 minute sessions during a teacher's 'activity' period (free period) during the eight-week treatment; these sessions will target Bloom's taxonomy and the use of questions stems. The shorter 30-minute sessions will be designed to embed strategies that correspond directly to what 6th grade teachers are currently working on.
Lesson Format: A1

A typical lesson format should provide opportunities for teacher modeling or explicit instruction, guided learning, independent practice with teacher feedback and classroom discussion. This gradual release of responsibility model will facilitate the use of explicit student scaffolding of HOT questions during the lesson.

**Connect and Engage (5 minutes)**

- Engage the students with the teaching point. (See unit of study). Today, we’ll go into focus on ...
- Small learning target. (A learning target should convey to your students what today’s lesson should mean for them)
  - What will I be able to do when I’ve finished this lesson?
  - How can I question this story more deeply?
  - How can I show that I can do this?
- Students can record their small learning target in a journal

**Model (10 minutes)**

- Reinforce previous learning.
- Model use of strategy with text. (Short story or whole class novel is acceptable)
- Share the specific template that supports this lesson and expectations for how students can complete the work.
- Demonstrate how to use the specific question type/strategy during shared reading.
- Model how to answer a HOT question using evidence from the story.
- Model how to ask a HOT question using the text based on the specific teaching point.

**Guide and Scaffold (10 minutes)**

- Initiate shared reading (or read aloud) with class. Model stopping points and asking HOT questions. At other stopping points, ask students to ask HOT questions.
- Facilitate small groups or partnerships.
- Scaffold student questions using the HOT flip chart, scaffolding questions chart, heuristic question chart, and scaffolding models. Also, scaffold student questions by encouraging students to provide evidence from the text.
- Model how to turn lower level questions, typically with simple phrase answers, into HOT level questions. Teachers can raise student thinking by asking the student to increase the level of the question. For example, students can add verbs like: contrast, distinguish, evaluate, recommend, prove, appraise, judge, debate, predict, etc.

**Practice Independently (10 minutes)**

- During independent practice, students can read independently or in a small group, stop and think to ask questions; discuss a question with a friend; answer short-answer questions while scoring their work or a friend’s work with a rubric.
- Practice using a specific skill from the unit of study or completing a specific template.
- Teacher can work with a small group or confer one-to-one with a student.

**Share the learning (5 minutes)**

- Review the question strategy or key teaching point with the class (chart on easel to post in classroom)
- Select specific students to share comments, HOT questions or written responses.
Scaffolding Student Learning: A2

Scaffolding is defined as a “course of action that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts” (Wood, Bruner & Ross, 1976, p. 90). In this study, scaffolding will consist of questions, prompts, cues, modeling and dialogue.

Confirmation and heuristic questions to stretch thinking to a higher level
- So, you’re arguing that…? What clues did you use to work this out?
- If I were looking for more information about this ________, where could I look?
- What are you thinking?
- Do you consider this text to be an easy or difficult? Why?
- What strategies helped you the most to understand this text? Explain.
- Would you recommend this story to a friend? Explain.

Clarification requests and elaboration questions
- Can you show me where you found this information?
- Why is that your answer?
- Can you defend that answer with evidence from the story?
- What other information do you need to know?
- How else can a character say that? Explain
- What kind of person would enjoy this story? Explain.
- What other questions do you have after reading this story so far? Why?
- Rate this story out of ten. Ten being an amazing story. Defend your opinion.

Prompts to activate learning
- I want to remind you about ____________?
- Do you remember the part about ____________?
- What did you learn today?
- What do you know about ____________ so far?
- What has happened so far ____________? Take a look at the text for clues.
- How do you know?
- Tell me how you tried your best.
- What surprised you about this story?

Cues
- Cue the reader to text features: title, headings, pictures, photographs, italics etc. Ask them to reread
- Have the student develop a basic graphic organizer
- Repeat a student’s statement
- Use intonation, increase or decrease volume of speech
- Point to an environment chart or the flip book
- Ask the student to underline, highlight, or take notes

Comprehension checks
- Do you understand this? Does this make sense?
- So, you’re saying ____________?
- Can you say that another way?
- I see, you’re saying ____________?
Question Identification worksheet: A3

Now that you've listed questions from your story and identified their level, you can practice using the flip book to identify the below questions. Place a check mark to identify questions as either lower level (remembering & understanding) or the remaining levels which are Higher Order Thinking Levels (HOT).

<table>
<thead>
<tr>
<th>Question Samples for Practice</th>
<th>Lower Level</th>
<th>HOTs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: Can you construct a model that would change...?</td>
<td>✔️</td>
<td></td>
</tr>
<tr>
<td>Example: How would you summarize...?</td>
<td></td>
<td>✔️</td>
</tr>
<tr>
<td>Who were the main...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can you make use of the facts to...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How would you summarize...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What questions would you ask in an interview with...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What inference can you make...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What conclusions can you draw...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What judgment would you make about...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can you construct a model that would change...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How would you describe...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What other way would you plan to...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is the relationship between...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How would you explain...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Based on what you know, how would you explain...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What could be done to minimize [maximize]...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can you predict the outcome if...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is the main idea of...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can you identify the different parts...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What changes would you make to solve...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How would you prioritize...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How did ____ happen?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How would you compare...? Contrast...?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can you elaborate on the reason...?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

158
English Language Arts Standards » Reading: Literature » Grade 6: A4

Standards in this strand:

Key Ideas and Details

- RL.6.1. Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
- RL.6.2. Determine a theme or central idea of a text and analyze how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.
- RL.6.3. Describe how a particular story's or drama's plot unfolds in a series of episodes as well as how the characters respond or change as the plot moves toward a resolution.

Craft and Structure

- RL.6.4. Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings; analyze the impact of a specific word choice on meaning and tone.
- RL.6.5. Analyze how a particular sentence, chapter, scene, or stanza fits into the overall structure of a text and contributes to the development of the theme, setting, or plot.
- RL.6.6. Explain how an author develops the point of view of the narrator or speaker in a text.

Integration of Knowledge and Ideas

- RL.6.7. Compare and contrast the experience of reading a story, drama, or poem to listening to or viewing an audio, video, or live version of the text, including contrasting what they “see” and “hear” when reading the text to what they perceive when they listen or watch.
- RL.6.8. (Not applicable to literature)
- RL.6.9. Compare and contrast two or more texts in different forms or genres, e.g. stories and poems, historical novels and fantasy stories, in terms of their themes and points of view.

Range of Reading and Level of Text Complexity

- RL.6.10. By the end of the year, read and comprehend literature, including stories, dramas, and poems, in the grades 6–8 text complexity band proficiently, with scaffolding as needed at the high end of the range.
Figure 3. Question tree that illustrates teacher steps to scaffold student understanding. Adapted from "Identifying Instructional Moves During Guided Learning," by N. Frey and D. Fisher, 2010 The Reading Teacher, 64(2), p. 87.
Critical Thinking Flowchart: A6
Use this flowchart to determine whether questions are lower level or higher level questions

Start

Ask yourself, "Am I asking my students to exhibit memory of previously-learned materials by recalling facts, terms, basic concepts?"

Yes

That's Lower

No

Ask yourself, "Am I asking my students to demonstrate understanding by organizing, comparing, translating, interpreting, giving descriptions and stating main ideas?"

That's Higher

Yes

Ask yourself, "Am I asking my students to examine and break information into parts by looking at motives, causes and relationships?"

No

That's Lower

Yes

No

Ask yourself, "Am I asking my students to solve problems by new situations by understanding learned knowledge, facts, or rules in a different way?"

Yes

Ask yourself, "Am I asking my students to put information together in a different way by combining elements in a new pattern or proposing a different solution?"

No

Re-think & Re-evaluate

Re-think & Re-evaluate

Adapted with permission from Critical thinking and formative assessments, by N. Moore and T. Stanley (2019), Larchmont, NY: Eye on Education
Question Framework (lower level): 1A

Name: ___________________________ Period: _______________________

Story Name: ______________________ Pages: _______________________

Write a question from Levels 1, 2 and 3 (Remembering, Understanding, Applying). Identify key words in your question by circling them.

For example: How would you summarize this story?

| Key Word Bank for Level 1: Understanding |
|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Choose                        | Label                        | Recall                       | Spell                        |
| Define                        | List                          | Relate                       | Tell                          |
| Find                          | Match                         | Select                       | What                          |
| How                           | Name                          | Show                         | When                          |
|                               |                               |                              |                               |
|                               |                               |                              |                               |

Remembering: Level 1

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

Key Word Bank for Level 2: Remembering

| Classify                      | Explain                      | Interpret                    | Show                           |
| Compare                       | Extend                       | Outline                      | Summarize                      |
| Contrast                      | Illustrate                   | Relate                       | Translate                      |
| Demonstrate                   | infer                        | Rephrase                     |                               |

Understanding: Level 2

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

Key Word Bank for Level 3: Applying

| Apply                          | Develop                      | Make use of                  | Select                        |
| Build                          | Experiment with              | Model                        | Solve                          |
| Choose                         | Identify                     | Organize                     | Solve                          |
| Construct                      | interview                    | Plan                         | Utilize                         |

Applying: Level 3

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________
# Question Framework (higher level): 1B

Name: ___________________________  Period: ___________________________

Story Name: ___________________________  Pages: ___________________________

Write a question from Levels 4, 5 and 6 (Analyzing, Evaluating and Creating). Identify key words in your question by circling them.

For example: How would you summarize this story?

## Key Word Bank for Level 4: Analyzing

<table>
<thead>
<tr>
<th>Analyze</th>
<th>Contrast</th>
<th>Function</th>
<th>Simplify</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assume</td>
<td>Discover</td>
<td>Inference</td>
<td>Survey</td>
</tr>
<tr>
<td>Categorize</td>
<td>Dissect</td>
<td>Inspect</td>
<td>Take part in</td>
</tr>
<tr>
<td>Classify</td>
<td>Distinguish</td>
<td>List</td>
<td>Test for</td>
</tr>
<tr>
<td>Compare</td>
<td>Divide</td>
<td>Motive</td>
<td>Theme</td>
</tr>
<tr>
<td>Conclusion</td>
<td>Examine</td>
<td>Relationships</td>
<td></td>
</tr>
</tbody>
</table>

**Analyzing: Level 4**

________________________________________________________________________

________________________________________________________________________

## Key Word Bank for Level 5: Evaluating

<table>
<thead>
<tr>
<th>Agree</th>
<th>Conclude</th>
<th>Determine</th>
<th>Judge</th>
<th>Prioritize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appraise</td>
<td>Criteria</td>
<td>Dispute</td>
<td>Justify</td>
<td>Prove</td>
</tr>
<tr>
<td>Assess</td>
<td>Criticize</td>
<td>Estimate</td>
<td>Measure</td>
<td>Rate</td>
</tr>
<tr>
<td>Award</td>
<td>Decide</td>
<td>Importance</td>
<td>Opinion</td>
<td>Recommend</td>
</tr>
<tr>
<td>choose</td>
<td>deduct</td>
<td>Influence</td>
<td>Perceive</td>
<td>support</td>
</tr>
</tbody>
</table>

**Evaluating: Level 5**

________________________________________________________________________

________________________________________________________________________

## Key Word Bank for Level 6: Creating

<table>
<thead>
<tr>
<th>Adapt</th>
<th>Compile</th>
<th>Discuss</th>
<th>Improve</th>
<th>Modify</th>
<th>Propose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build</td>
<td>Construct</td>
<td>Elaborate</td>
<td>Invent</td>
<td>Original</td>
<td>Solve</td>
</tr>
<tr>
<td>Change</td>
<td>Create</td>
<td>Estimate</td>
<td>Make up</td>
<td>Originate</td>
<td>Suppose</td>
</tr>
<tr>
<td>Choose</td>
<td>Delete</td>
<td>Formulate</td>
<td>Maximize</td>
<td>Plan</td>
<td>Test</td>
</tr>
<tr>
<td>Combine</td>
<td>Develop</td>
<td>Imagine</td>
<td>Minimize</td>
<td>Predict</td>
<td>Theory</td>
</tr>
</tbody>
</table>

**Creating: Level 6**

________________________________________________________________________

________________________________________________________________________
Active Question Report: 1C

<table>
<thead>
<tr>
<th>Remembering Questions:</th>
<th>Understanding Questions:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Applying Questions:</th>
<th>Analyzing Questions:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaluating Questions:</th>
<th>Creating Questions:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Select a question to answer from your questions above: (Use the rubric to score your response)

<table>
<thead>
<tr>
<th>Question 1</th>
<th>Question 2</th>
<th>Question 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Question Slip (1D)

<table>
<thead>
<tr>
<th>Name: __________________________</th>
<th>Period: __________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Story Name: __________________</td>
<td>Pages: __________________</td>
</tr>
</tbody>
</table>

A question that I asked today that helped me understand this story at a higher level is...

- Applying
- Analyzing
- Evaluating
- Creating

*(Circle the question level you selected from the above HOT categories)*

<table>
<thead>
<tr>
<th>Question: __________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Answer: __________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Name: __________________________</th>
<th>Period: __________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Story Name: __________________</td>
<td>Pages: __________________</td>
</tr>
</tbody>
</table>

A question that I asked today that helped me understand this story at a higher level is...

- Applying
- Analyzing
- Evaluating
- Creating

*(Circle the question level you selected from the above HOT categories)*

<table>
<thead>
<tr>
<th>Question: __________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Answer: __________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Challenge a friend with a question (1E)

Name: ____________________________  Period: ________________

Story Name: _______________________  Pages: ________________

Think of a challenging HOT question from the story, invite a friend to answer the question.

Applying  Analyzing  Evaluating  Creating

(Circle the question level you selected from the above HOT categories.)

Question:

______________________________

______________________________

______________________________

Answer:

______________________________

______________________________

______________________________
Stop and Question (LF)

**Name:** __________________________  **Period:** __________________________

**Story Name:** __________________________  **Pages:** __________________________

*Directions:* Good readers often stop and think about what they're reading. Sometimes there is a turning point in a story when something dramatic occurs. You may ask, “What is the purpose of this turning point in the story?” Monitor your thinking closely when you read and practice pausing to ask important questions. Identify your stopping point, the reason for stopping and a HOT question you may have.

<table>
<thead>
<tr>
<th>Stopping Point (pages #’s)</th>
<th>Reason for Stopping</th>
<th>HOT Question/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 &amp; 6: Evaluating &amp; Creating</td>
<td>3</td>
</tr>
<tr>
<td>3 &amp; 4: Applying &amp; Analyzing</td>
<td>2</td>
</tr>
<tr>
<td>1 &amp; 2: Remembering &amp; Understanding</td>
<td>1</td>
</tr>
</tbody>
</table>

**Challenge Activity:**

1. Score your HOT questions according to the rubric.
2. Have a friend (F) score your questions as well.
Authors always write with a purpose. Develop three HOT questions that explore what an author’s intentions may be.

Question 1:

Question 2:

Question 3:

Select one question to answer from your questions above: (Use rubric 2A to score your response)

Answer:

<table>
<thead>
<tr>
<th>Rubric</th>
<th>Criteria</th>
<th>Student Score</th>
<th>Teacher Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stopping Point (pages #’s)</td>
<td>Reason for Stopping</td>
<td>HOT Question/s</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Level | Score
--- | ---
5 & 6: Evaluating & Creating | 3
3 & 4: Applying & Analyzing | 2
1 & 2: Remembering & Understanding | 1

Challenge Activity:
1. Score your HOT questions according to the rubric.
2. Have a friend (F) score your questions as well.
Short Answer Response: 1

Name: ___________________________ Period: _________________

Story Name: _____________________ Pages: _________________

Teachers will pose a question or make a statement that students need to respond to using a short-answer response format. Students and teachers can score this response by the Written Response Rubric 2A.

Teacher Question or Statement:
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

Student Answer:
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

<table>
<thead>
<tr>
<th>Rubric</th>
<th>Criteria</th>
<th>Student Score</th>
<th>Teacher Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Sample Lesson Plan: 2A

<table>
<thead>
<tr>
<th>Title</th>
<th>Author's Purpose and Turning Point: Week 2 (Tuesday)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teaching Point</strong></td>
<td>Today I want to teach you that when good readers notice a turning point in the story (where the characters or events change), they know something dramatic will happen to the characters or the direction of the plot. We can pause at these turning points to ask, “What's the purpose of this turning point in the larger story? What is going to happen, and how might this fit into the whole story?”</td>
</tr>
<tr>
<td><strong>Small learning target</strong></td>
<td>Students recognize that the author purposefully embeds his or her own message in the story.</td>
</tr>
<tr>
<td><strong>Modeling</strong></td>
<td>Select a short story as a Read Aloud. For example, <em>The Properties of Water</em>. At the end of chapter 1 (page 4), What does the author have the character Lacey imagine it was her sister dying into the lake? At the end of chapter 2, the lake has quickly emerged as a theme in this story. Why does the author have an ominous feeling concerning the lake? Stop at the end of chapter 3. How is the author trying to engage the reader? Teacher can use template 1F to scaffold student learning.</td>
</tr>
<tr>
<td><strong>HOT questions</strong></td>
<td></td>
</tr>
</tbody>
</table>
|  | • Is there a better solution to...?  
  | • Judge the value of... What do you think about...?  
  | • Can you defend your position about...?  
  | • Can you distinguish between...?  
  | • What were some of the motives behind...?  
  | • What was the turning point?  
  | • What was the problem with...?  
  | • Can you group by characteristics such as...?  
  | • Which factors would you change if...?  
  | • What questions would you ask of...?  |
| **Heuristic Questions** | Would you use word parts or context clues to figure out the meaning of this word?  
  | If I were looking for information about _______ in this book, where could I find it?  
  | How do you know when you have run out of ways to answer this question?  
  | Are their techniques you used to make a judgment about _______?  
  | Does this make sense to you?  
  | Does this sound true to you?  
  | What do you already know about _______ before you begin reading?  
  | What do you know about _______ so far?  
  | What surprised you about this story? Would you recommend this story? Why? |
| **Prompts or Cues** |  |
| **Prompts:** |  
  | Prompt (for background knowledge)...  
  | Prompt (for episodic knowledge) (where, when, who with...).  
  | Prompt (for reflective knowledge) (what have you learned about _______?)  
  | **Cases:** |  
  | • You need to underline _______.  
  | • Listen carefully to this next direction...  
  | • Try that again... try that another way...  
  | • You said _______ Does that sound right?  |
| **Environmental Chart** |  
  | Environmental Print or charts should be changed frequently... if it is too familiar, the learner filters it out. Social distance ~12 feet.  
  | Specific charts will be developed based on specific mini-lesson.  
<p>| See rubric for asking HOT questions on back page of HOT flip book. |</p>
<table>
<thead>
<tr>
<th><strong>Title</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teaching Point</strong></td>
<td>Today I want to teach you</td>
</tr>
<tr>
<td><strong>Small learning target</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Modeling</strong></td>
<td></td>
</tr>
</tbody>
</table>
| **HOT questions** | • Is there a better solution to...?  
• Judge the value of... What do you think about...?  
• Can you defend your position about...?  
• Can you distinguish between...?  
• What were some of the motives behind...?  
• What was the turning point?  
• What was the problem with...?  
• Can you group by characteristics such as...?  
• Which factors would you change if...?  
• What questions would you ask of...? |
| **Heuristic Questions** | • Would you use word parts or context clues to figure out the meaning of this word?  
• If I were looking for information about ________ in this book, where could I find it?  
• How do you know when you have run out of ways to answer this question?  
• Are there techniques you used to make a judgment about ________?  
• Does this make sense to you?  
• Does this sound true to you?  
• What do you already know about ________ before you begin reading?  
• What do you know about ________ so far?  
• What surprised you about this story? Would you recommend this story? Why? |
| **Prompts or Cues** | **Prompts:**  
• Prompt for background knowledge...  
• Prompt for episodic knowledge... (where, when, who with...)  
• Prompt for reflective knowledge... (what have you learned about ________?)  
**Cues:**  
• You need to underline ________  
• Listen carefully to this next direction...  
• Try that again... try that another way...  
• You said ________, Does that sound right? |
| **Environmental Chart** | • Environmental Print or charts should be changed frequently... if it is too familiar, the learner filters it out. Social distance <12 feet  
• Specific charts will be developed based on specific mini-lesson  
• See rubric for asking HOT questions on back page of HOT flap book. |
<table>
<thead>
<tr>
<th>Criteria</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Thinking</td>
<td>Strong</td>
<td>Developing</td>
<td>Deficient</td>
</tr>
<tr>
<td>Question is HOT level (Applying, Analyzing, Evaluating, &amp; Creating)</td>
<td>Question is lower level: Remembering &amp; Understanding</td>
<td>Cannot identify level</td>
<td></td>
</tr>
<tr>
<td>Thoroughness</td>
<td>The response is a thoughtful and thorough examination of the text with the ability to use this information to make judgments beyond the boundaries of the text.</td>
<td>The response is a sufficient, though limited, examination of the text and makes some attempt to use information to make judgments beyond the boundaries of the text.</td>
<td>The response is a cursory examination of the text, but does not make judgments beyond the boundaries of the text.</td>
</tr>
<tr>
<td>Accuracy &amp; Evidence</td>
<td>The answer is completely accurate: the answer is clearly based on the text. The student provides evidence from the text to support their response.</td>
<td>The answer is partially accurate. The student provides limited evidence from the text to support their response.</td>
<td>The answer is clearly inaccurate. The student provides no evidence from the text to support their response.</td>
</tr>
<tr>
<td>Organization</td>
<td>The answer is logically organized and sequenced accurately.</td>
<td>The answer is marginally organized. Parts of the response may be out of order.</td>
<td>The answer is poorly organized with no sequential order. It may be incoherent with no sense of direction.</td>
</tr>
</tbody>
</table>

**Rubric Instructions:**

- ✓ After considering the criteria, shade 2, 1, or 0 based on the indicators. The overall score is calculated based on considering all four criteria. For example, if three out of the four criteria are shaded in category two, then the overall score is a 2.

- ✓ If two criteria are shaded from two categories and the decision is split, this response receives the lower score.
<table>
<thead>
<tr>
<th>Week 1</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select a read aloud or short story. Initiate a shared reading with the class and stop at pre-determined stopping points for students to share questions they have about the text. Record student and teacher questions on chart paper. Complete and discuss the story.</td>
<td>Revise the previous lesson to review the story and question chart. Distribute HOT flip books. Work with students to identify questions as HOT questions or lower level by using the HOT flip book. Use AS worksheet.</td>
<td>Today, we’re going to focus on Remembering and Understanding questions when reading. Stop and ask HOT questions at pre-determined stopping points. Discuss questions as a class. Use 1A work sheet.</td>
<td>Today, we’re going to focus on HOT questions when reading. Stop and ask HOT questions at pre-determined stopping points. Use active reader report to record questions. Use 1C w.s.</td>
<td>Today, we’re going to focus on all questions when reading. Stop and ask HOT questions at pre-determined stopping points. Use active reader report to record questions. Use 1C w.s.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 2</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Today I want to teach you that good readers notice when we have strong feelings or reactions to the text, and we take this opportunity to ask questions about our characters and their motives. Encourage students to record their questions on post-it notes. Students should share questions with partners or in a small group and discuss. Teachers should record their questions on a chart and discuss their specific level. Lower or HOT level?</td>
<td>Today I want to teach you that good readers notice when we have strong feelings or reactions to the text, and we take this opportunity to ask questions about our characters and their motives. Encourage students to record their questions on post-it notes. Students should share questions with partners or in a small group and discuss. Teachers should record their questions on a chart and discuss their specific level. Lower or HOT level?</td>
<td>Today I want to teach you that when great artists notice when we have strong feelings or reactions to the text, they choose the right words and patterns to make us feel certain ways.</td>
<td>Today I want to teach you that great artists notice when we have strong feelings or reactions to the text, they choose the right words and patterns to make us feel certain ways.</td>
<td>Today I want to teach you that great artists notice when we have strong feelings or reactions to the text, they choose the right words and patterns to make us feel certain ways.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 3</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Today I want to teach you that good readers do a great job of making predictions and taking notes. They can read with confidence and speed, and they can listen to their teachers and parents.</td>
<td>Today I want to teach you that when great artists notice when we have strong feelings or reactions to the text, they choose the right words and patterns to make us feel certain ways.</td>
<td>Today I want to teach you that when great artists notice when we have strong feelings or reactions to the text, they choose the right words and patterns to make us feel certain ways.</td>
<td>Today I want to teach you that when great artists notice when we have strong feelings or reactions to the text, they choose the right words and patterns to make us feel certain ways.</td>
<td>Today I want to teach you that when great artists notice when we have strong feelings or reactions to the text, they choose the right words and patterns to make us feel certain ways.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 4</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Today I want to teach you that good readers don’t stop thinking when we close our books. For this activity, you may have to use a short story with an ending point. When we finish reading, we often have lingering questions. We can write about them, talk to others about them, or do research on them. Record any questions you have and ask a friend to see if they have insight that may help you. Use template 1E.</td>
<td>Today I want to teach you that when great artists notice when we have strong feelings or reactions to the text, they choose the right words and patterns to make us feel certain ways.</td>
<td>Today I want to teach you that when great artists notice when we have strong feelings or reactions to the text, they choose the right words and patterns to make us feel certain ways.</td>
<td>Today I want to teach you that when great artists notice when we have strong feelings or reactions to the text, they choose the right words and patterns to make us feel certain ways.</td>
<td>Today I want to teach you that when great artists notice when we have strong feelings or reactions to the text, they choose the right words and patterns to make us feel certain ways.</td>
<td></td>
</tr>
</tbody>
</table>
Revised Blooms Taxonomy: 2D

Figure 1. Bloom's Revised Taxonomy and Level of Thinking

Figure 1. Comparison of Bloom's Earlier Taxonomy to the Revised Bloom's Taxonomy (Anderson, Krathwohl, et al., 2001) and identification of Higher Order Thinking levels (Pohl, 2000).

Questions for Remembering
- What happened after...?
- How many...?
- What is...?
- Who was it that...?
- Can you name...?
- Find the definition of...
- Describe what happened after...
- Who spoke to...?
- Which is true or false...

Questions for Understanding
- Can you explain why...?
- Can you write in your own words?
- How would you explain...?
- Can you write a brief outline...?
- What do you think could have happened next...?
- Who do you think...?
- What was the main idea...?
- Can you clarify...?
- Can you illustrate...?
- Does everyone act in the way that... does?
Questions for Applying

- Do you know of another instance where...?
- Can you group by characteristics such as...?
- Which factors would you change if...?
- What questions would you ask of...?
- From the information given, can you develop a set of instructions about...?

Question for Analyzing

- Which events could not have happened?
- If...happened, what might the ending have been?
- How is...similar to...?
- What do you see as other possible outcomes?
- Why did...changes occur?
- Can you explain what must have happened when...?
- What are some of the problems of...?
- Can you distinguish between...?
- What were some of the motives behind...?
- What was the turning point?
- What was the problem with...?

Questions for Evaluating

- Is there a better solution to...?
- Judge the value of... What do you think about...?
- Can you defend your position about...?
- Do you think...is a good or bad thing?
- How would you have handled...?
- What changes to...would you recommend?
- Do you believe...? How would you feel if...?
- How effective are...?
- What are the consequences...?
- What influence will...have on our lives?
- What are the pros and cons of...?
- Why is...of value?
- What are the alternatives?
- Who will gain & who will loose?

Questions for Creating

- Can you design a...to...?
- Can you see a possible solution to...?
- If you had access to all resources, how would you deal with...?
- Why don't you devise your own way to...?
- What would happen if...?
- How many ways can you...?
- Can you create new and unusual uses for...?
- Can you develop a proposal which would...?

Retrieved from Pohl (2000) Learning to Think, Thinking to Learn
Appendix D: Permission to Adapt Thinking Critical Thinking Flowchart
McKinnon, Jason

From: Heather Stern <stern@eyeoneducation.com>
Sent: Tuesday, March 29, 2011 11:28 AM
To: McKinnon, Jason
Subject: RE: Permission to use figure

Hi Jason,

Upon review of your request described below, we can grant permission at no charge. Please include a full bibliographic reference in all your materials.

Thank you very much,

Heather Stern,
Permissions Editor
Eye On Education
6 Depot Way West
Larchmont, NY 10538
Ph: (888) 299-5350
Fax: (914) 833-0761
www.eyeoneducation.com

From: McKinnon, Jason [mailto:jmckinnon@ridgefield.org]
Sent: Monday, March 28, 2011 1:54 PM
To: stern@eyeoneducation.com
Cc: McKinnon, Jason
Subject: Permission to use figure

Dear Ms. Stern,

I hope this email finds you well. I recently purchased Critical Thinking and Formative Assessments by B. Moore and T. Stanley. I’m currently working on my dissertation and I would like to use the figure on page 138 titled ‘Critical Thinking Flowchart’ in my appendix. I will of course cite the source according to APA guidelines. Do I have your permission to use this figure and cite it accordingly.

Sincerely,

Jason

Jason McKinnon
Principal
Branchville Elementary School
jmckinnon@ridgefield.org
203-644-7980 (Office)
203-644-7984 (Fax)

Wisdom begins with wonder - S
Appendix E: Permission to Use the Reader Self-Perception Survey (RSPS)
Subject: FW: RSPS Survey

Agreed.

Steven A. Melnick, Ph.D.
Professor of Education

On Thu, Sep 23, 2010 at 7:34 AM, Henk, William <william.henk@marquette.edu> wrote:

Sorry for the delay. It’s a busy time of year.

What you’ve provided satisfies me as long as Dr. Melnick is OK with what you’re proposing.

BH

From: Henk, William [mailto:william.henk@marquette.edu]
Sent: Monday, September 13, 2010 7:55 PM
To: McKinnon, Jason
Cc: Steven A. Melnick
Subject: RE: RSPS Survey

Jason—

The RSPS is a public domain instrument so you don’t need our permission to use it as long as it won’t be put to a commercial use. I’m copying Dr. Melnick because I don’t know how he’ll feel about including it in the appendix to your dissertation.

BH

Dr. Bill Henk, Dean
College of Education
Marquette University

From: McKinnon, Jason [mailto:jmckinnon@ridgefield.org]
Sent: Monday, September 13, 2010 6:07 PM
To: Henk, William
Subject: RSPS Survey

Dear Dr. Henk,

I hope this email finds you well. I would like to use your instrument, the RSPS, as part of my doctoral research. I recently passed my Comprehensive exams and I plan to schedule my proposal this fall. May I have permission to use the RSPS for my dissertation? And, may I use feature it in my appendix?

If you need more information, please let me know.
Appendix F: Connecticut State Department of Education: Grade 6 Language Arts Curriculum excerpt
GRADE 6

READING
Students comprehend and respond in literal, critical and evaluative ways to various texts that are read, viewed and heard.

<table>
<thead>
<tr>
<th>State Framework</th>
<th>Grade-Level Expectations</th>
<th>Assessments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Reading and Responding</strong></td>
<td><strong>Vocabulary</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Students read, comprehend and respond in individual, literal, critical and evaluative ways to literary, informational and persuasive texts in multimedia formats. | 1. Use word origins to determine the meaning of unknown words.  
2. Use abstract, derived root words, prefixes and suffixes from Greek and Latin to analyze the meaning of complex words, e.g., *process, procession*.  
3. Define vocabulary critical to the meaning of content-area texts and use that knowledge to interpret the texts, e.g., *property* in science or social studies. |     |
# GRADE 6

## READING
Students comprehend and respond in literal, critical and evaluative ways to various texts that are read, viewed and heard.

<table>
<thead>
<tr>
<th>State Framework</th>
<th>Grade-Level Expectations</th>
<th>Assessments</th>
</tr>
</thead>
</table>
| **Making Reader/Text Connections** | | C1 Make connections between the text and outside experiences and knowledge.  
C2 Select, synthesize and/or use relevant information within the text to write a personal response to the text. |
| 1. Explain how information in a text could be applied to understand a similar situation or concept in another text. | | |
| **Content and Structure** | | D1 Select, synthesize and/or use relevant information within the texts to extend or evaluate the texts.  
D2 Demonstrate an awareness of an author’s or character’s values, customs and beliefs included in the text. |
| 2. Explain the impact of literary devices on meaning, e.g., flashback, tone, bias, dialect, irony/satire, and use of fragments.  
3. Evaluate the author’s use of various techniques to influence readers’ perspectives, e.g., appeal of characters in a graphic novels and picture books, logic and credibility of plots and settings, use of figurative language.  
4. Understand how social, cultural and historical contexts contribute to an author’s perspective.  
5. Draw a conclusion about how text might be useful to someone.  
6. Decide if the author’s ideas are grounded in fact.  
7. Evaluate the credibility, accuracy and bias of informational text, including Internet sites, electronic recordings, visuals and other technology resources. | | |
## GRADE 6

### READING

Students comprehend and respond in literal, critical and evaluative ways to various texts that are read, viewed and heard.

<table>
<thead>
<tr>
<th>State Framework</th>
<th>Grade-Level Expectations</th>
<th>Assessments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reading and Responding</td>
<td>Reading Reflection/Behaviors</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>8. Choose a variety of genres to read, hear, view and write for personal enjoyment.</td>
<td></td>
</tr>
<tr>
<td>2. Exploring and Responding to Literature</td>
<td>9. Recommend books to others and explain the reason for the recommendation.</td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>10. Set and monitor reading goals making adjustments and corrections as needed.</td>
<td></td>
</tr>
</tbody>
</table>