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An Investigation of the Support for Literacy Instruction in Elementary Mathematics Textbooks

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AN INVESTIGATION OF THE SUPPORT FOR LITERACY INSTRUCTION IN ELEMENTARY MATHEMATICS TEXTBOOKS

by

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ABSTRACT

AN INVESTIGATION OF THE SUPPORT FOR LITERACY INSTRUCTION IN ELEMENTARY MATHEMATICS TEXTBOOKS

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The purpose of this study was to investigate the kinds of support offered for integrating literacy strategies into mathematics instruction in elementary mathematics textbooks so that students are given opportunity to achieve the vision NCTM (2000) has for mathematical power for all. The research methodology for this was a qualitative content analysis using *a priori* codes. Two textbook series were chosen for this study. In each series examples of literacy integration ideas based on Trabasso's and Bouchard's (2002) effective comprehension strategies to teach comprehension were cited and analyzed. The results show that there is support for teachers to integrate literacy in mathematics instruction. Improvements can be made in both the classroom and during teacher preparation.

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TABLE OF CONTENTS

List of Tables

CHAPTER 1

INTRODUCTION

Statement of the Problem

The National Council of Teachers of Mathematics (NCTM) (2000) has presented a vision of mathematical power for all. With this focus on mathematics instruction, NCTM (2000) has placed *equity* as one of the six principles for school mathematics. The equity principle states, "Excellence in mathematics education requires equity—high expectations and strong support for all students" (NCTM, 2000, p. 12). While insisting on high expectations for mathematics learning to be communicated to all students, the equity principle also demands "reasonable and appropriate accommodations be made as needed to promote access and attainment for all students" (NCTM, 2000, p. 12). NCTM (2000) emphasizes that when students have access to high-quality mathematics instruction, each student can learn. With this focus on mathematics instruction, NCTM supports that high-quality instruction needs to become the norm rather than the exception (NCTM, 2000).

One way teachers can create high-quality mathematics instruction is to teach according to the guidelines put forth by the *Standards* for school mathematics documents NCTM has published (NCTM, 2000). Using *Standards*-based mathematics instruction encourages teachers to support students' mathematical communication (NCTM, 2000). Mathematical communication includes opportunity, encouragement, and support for reading, writing, and speaking mathematically (NCTM, 2000).

When students communicate the results of their reasoning orally or in writing, students learn to be clear and definite in their thinking (NCTM, 2000). For example, in math textbooks students oftentimes are frequently asked to answer problem-solving questions. One of these questions might read, "Samantha said that the value of x in the equation 8.6 + x =12.8 was 2.14. Is she correct? Explain." (Charles, Dossey, Leinwand, Seeley, & Vonder Embse, 1999, p.170). Writing mathematically helps students to strengthen their understanding through reflection on their work (NCTM, 2000).

Helping children learn to read and write in mathematics is important and one of the goals of content area literacy (Draper, 2002). However, it is not the norm in mathematics classrooms (Draper, 2002). In conversations with colleagues about possible reasons for the lack of literacy instruction in mathematics, one possibility is that publishers may not include literacy ideas in the lesson plans provided in teacher editions of mathematics textbooks. These conversations lead me to ask the question: How are publishers of mathematics textbooks helping mathematics teachers in grades K-6 integrate literacy in their teaching of mathematics?

Statement of Purpose

The purpose of this study was to investigate the kinds of support offered for integrating literacy strategies and opportunities into mathematics instruction in elementary mathematics textbooks, giving students opportunities to achieve the vision NCTM (2000) has for mathematical power for all.

Definition of Terms

While definitions of *literacy* and *content area literacy* change with time and with context (Draper, Smith, Hall, & Siebert, 2005), for this paper I will define *literacy* as the ability to interact meaningfully in activities that require reading and writing as well as speaking, listening, viewing, and performing (Draper et al., 2005). *Content area literacy* focuses on helping students to "convey meaning within the discipline" and acquire the skills and knowledge needed to successfully negotiate the subject-specific text (Draper et al., 2005, p.14).

CHAPTER 2

REVIEW OF LITERATURE

The face of content area literacy is changing (Moss, 2005). Once exclusively associated with middle and high school instruction, today attention to the importance of content area literacy instruction at the earliest levels is becoming prominent (Moss, 2005). At least three significant factors have converged to create this change: *Standards*-based mathematics education (NCTM, 2000), emphasis on standardized-test performance, and technology (Moss, 2005). The rising of standards-based education throughout the United States has definitely heightened interest in students' abilities to read informational texts (Moss, 2005). In almost every state, including Utah, the language arts standards relate to the reading, writing, and comprehension of informational texts. (Moss, 2005, Utah State Core, 2007). Standards for comprehending informational texts appear in every grade level, from kindergarten through high school (Moss, 2005, Utah State Core, 2007).

Content Area Literacy

The pressure for improved standardized-test performance has helped to create an emphasis on content area literacy (Moss, 2005). Teachers across all grade levels are becoming aware of the need to teach to the state standards relating to informational texts (Moss, 2005). Student performance on national assessments provides additional support for the idea that teachers need to do a better job with informational reading (Block & Pressley, 2001). The National Assessment of Educational Progress (NAEP, 2006), which serves as an audit of each state's annual assessment of student achievement in grades 3-8 as part of the *No Child Left Behind* legislation (2002), has shown that 50% of fourth-grade-level test content requires students to read narrative texts and 50% involves reading informational texts (NAEP, 2006). By the eighth grade 43% of the test is based on reading to gain information from informational texts and 30% is reading to perform a task (NAEP, 2006). On the NAEP assessment, students do not do as well with informational texts as they do with narrative texts; the transition from reading fiction in the primary grades to reading diverse informational materials beginning in fourth-grade may account for the slump in reading scores that shows up between third and fourth-grades (Block & Pressley, 2001).

Another factor changing the face of content area literacy is the role of technology in society (Moss, 2005). Today the United States economy stresses a higher level of literacy than ever before (Moss, 2005). The literacy demands of today's technological society require individuals to "read and write not only in the print world but also in the digital world" (Schmar-Dobler, 2003, p. 81). The ability to use the Internet to access information, sort through the volume of text, assess content, and synthesize what was read from a variety of sources is central to success at school and in the workplace (Moss, 2005; Schmar-Dobler, 2003).

In the workplace reading to locate information is a common occurrence (Dreher, 1993). In schools children are also required to read to locate information; however, many children are unable to locate information using informational texts (Dreher, 1995). According to Venezky (2000), there is a chasm, "a big, yawning hollow that exists between the form of literacy that is promulgated by the schools under the curricular title of reading instruction and what adults need to survive as good citizens" (p. 20). In a study of school-aged children beyond the primary grades, Snowball (1995) found that the majority of daily reading was informational. By the sixth-grade, three-fourths of everything a student reads is non-narrative and nonfiction (Venezky, 2000). Smith (2000) conducted a similar study, in which adults kept a journal of their reading throughout the day. Smith found that most reading was informational, both on the job as well as for pleasure reading (2000). The older students become the more informational texts they will need to read and understand (Venezky, 2000). If teachers do not offer students experiences with informational texts, those teachers are contributing to students' future difficulties (Yopp & Yopp, 2000). By the time students reach adulthood, nearly 100% of what is read is read for information (Venezky, 2000). While the literacy needs of adults center primarily on obtaining information from nonfictional texts, literacy instruction in the schools concentrates almost exclusively on fictional texts and literacy appreciation (Venezky, 2000).

The critical evidence for the chasm argument is not simply the weighing of two different genres, but rather the analysis of competency skills required for obtaining meaning from different types of materials (Venezky, 2002). What adults read is heavily laden with graphs and charts, compound and complex sentences, quantifiers and qualifiers, and logical conditions (Venezky, 2002). The competencies required to read and understand texts such as tax forms, automobile warranties, and operating guides for a microwave are very different from the literary skills needed to understand *Great Expectations* (Venezky, 2002). There is no argument that literary skills are important and needed. However, these skills alone seldom help students to learn and understand nonfiction materials (Venezky, 2002).

There is ample evidence that the majority of students in urban schools who do not develop the comprehension skills necessary to read are less likely to learn these skills later in life, leading to an "educational free fall" into high school (Moss, 2005, p. 47). By the time U.S. students reach the 10^{th} grade, only one third are proficient readers (Moss, 2005). Nearly half of 17-year-olds are unable to read at a ninth grade level, and in 35 major U.S. cities, almost half of the high schools graduate only 50% (de Leon, 2002).

The *Principles and Standards for School Mathematics* by National Council of Teachers of Mathematics (NCTM, 2000) has called for a more student-centered mathematics classroom. A more student-centered classroom needs to teach students to understand informational texts and become literate in content areas. "To help students become literate in a content area does not mean to teach them *how* to read or write. Instead, reading and writing are tools that they use to think and learn with the text in a given subject area" (Vacca &Vacca, 2002, p.17, original italics). Students who are given this support for reading, writing, and speaking mathematics will reap dual benefits: They will communicate to learn mathematics and learn to communicate mathematically (NCTM, 2000).

Literacy and Content Knowledge

Content area literacy seeks to use literacy in three primary ways: (a) making the discourse expectations explicit within the content area, (b) using literacy as a tool for learning content matter, and (c) improving students' use of literacy skills through content area learning (Alvermann & Phelps, 2002; Stephens & Brown, 2000; Topping & McManus, 2002; Vacca & Vacca, 2002). In this respect, content area literacy strategies strive to give power to students as learners and thinkers through a participatory model of learning (Lesley, 2005).

However, in today's educational society there seems to be a dualism between literacy and content knowledge (Draper et al., 2005). Most elementary schools in the United States spend 90—180 minutes each day on literacy instruction that is devoid of content area instruction, while in upper elementary or secondary schools, content area instruction is lacking literacy instruction (Draper et al., 2005).

This dualism is problematic in two ways. First, the dualism suggests, falsely, that literacy instruction apart from content will be sufficient for students to read and understand the texts they come across in content area classrooms (Draper et al., 2005). However, in reality literacy instruction without content is problematic because there is no acknowledgement that texts vary depending on specific content areas (Draper et al., 2005). Second, the literacy-content dualism downplays the important role of texts and literacy in a content area discipline, which in turn suggests to content area teachers that they have very little responsibility to provide literacy instruction (Draper et al., 2005). However, because of the specific texts used in content area instruction, and the appropriate way to read and write those texts depends upon the discipline (Draper & Siebert, 2004), teachers are not only obligated to present content area instruction but those teachers are also *uniquely qualified* to teach discipline specific literacy instruction (Draper et al., 2005, p. 3).

With this dualism confronting educators, I find myself asking the question Block and Pressley (2001) have asked: If informational reading makes up the majority of what many students read, and if nonfiction literacy tasks are necessary for success on tests as well as achievement, what are educators doing to prepare students for this reality? What principles and practices of informational reading are necessary for student success?

Principles and Practices of Informational Reading

Skilled readers of informational texts are focused and actively engaged in what they are reading (Block & Pressley, 2001). Instruction that involves the reader and requires a shift from memorization to engagement and comprehension with the author's ideas and construction of meaning will help students to be successful (Block & Pressley, 2001). Students are likely to learn when they see the purpose or relevance of what is taught (Ogle & Blachowicz, 2002). When a classroom situation is guided by principles that ensures everyone reads, students engage in learning and are able to read texts for learning (Block & Presley, 2001). Teachers can focus on developing a repertoire of strategies to ensure that students become independent (Block & Presley, 2001).

Proficient readers attend to both the external physical organization of text and the internal structure of ideas (Ogle & Blachowicz, 2002). van den Broek and Kremer (2000) stated,

> When reading is successful, the result is a coherent and usable mental representation of the text. This representation resembles a network; with nodes that depict the individual text elements (e.g., events, facts, setting) and connections that depict the meaningful relations between elements. (p. 2)

In order to provide the knowledge needed to read informational texts students need enough experiences with informational texts to develop an understanding of the structure most commonly used to organize these texts (Ogle & Blachowicz, 2002). Students who learn to use these internal organization and structure of informational texts are better able to comprehend and retain key ideas (Ogle & Blachowicz, 2002). Because informational texts are set up in many ways, and because there is little similarity in text structure between informational texts and narrative texts, students will need explicit instruction and guidance to provide students with the background knowledge for anticipating, predicting, and monitoring texts (Ogle & Blachowicz, 2002).

When students are purposefully and actively engaged in what they read, they attend to both the external physical organization of texts and the internal structure of the texts (Ogle & Blachowicz, 2002). Students also need to read strategically and employ a small set of powerful strategies (Ogle & Blachowicz, 2002). Strategy instruction should be taught in a rich environment where students can draw and build on existing knowledge and within which they can use procedural knowledge and see its effect (Ogle & Blachowicz, 2002). Therefore, learning should be imbedded in a rich content, ideally one that is thematic and integrated (Ogle & Blachowicz, 2002).

In 1944, Davis carried out pioneering research in the hope of narrowing the list of comprehension skills to the most powerful strategies (Davis, 1944). His work helped educators and researchers alike get a clearer picture of which strategies contribute most to reading comprehension of informational texts (Ogle & Blachowicz, 2002). These strategies that Davis (1944) found to improve comprehension of informational texts emphasize: using knowledge and text clues to make predictions and to monitor and colons clarify or extend those predictions; using internal and external features of informational texts to predict and monitor; generating questions about informational texts; generating elaborations about texts; organizing and reorganizing texts; combining information across texts; critically reflecting personally on informational reading; and using oral and written language to formulate, express, and reflect on ideas.

In successful classrooms, comprehension strategy instruction is both explicit and implicit, requiring modeling, practice, and reflection (Ogle & Blachowicz, 2002). Good instruction provides models, practice, and reflection and is explicit to the degree necessary for students to see the principles in action (Ogle & Blachowicz, 2002). Quality strategy instruction also requires students and teachers to put in the time and the effort necessary to see success (Ogle & Blachowicz, 2002).

Comprehension Instructional Practices

"Reading is central to learning—in school, in the workplace, and in everyday life" (Texas Reading Initiative [TRI], 2002, p. 1). The purpose of reading is comprehension, making meaning from texts (TRI, 2002). Comprehension is the process of constructing meaning utilizing the reader's existing knowledge, the information in the texts, and the purpose for reading. Comprehension requires the reader to apply strategies and monitor understanding of narrative and informational texts (Utah State Language Arts Core, 2007).

The National Reading Panel (NRP) found that comprehension is critically important to the development of reading skills and is essential for academic learning in all content areas as well as lifelong learning (NRP, 2000). The NRP (2000) noted three major themes in the research on the development of reading comprehension:

> (1) Reading comprehension is a complex cognitive process that cannot be understood without a clear description of the role that vocabulary development and vocabulary instruction play in the understanding of what has been read;

(2) Comprehension is an active process that requires an intentional and thoughtful interaction between the reader and the text; and

(3) The preparation of teachers to better equip students to develop and apply reading comprehension strategies to enhance understanding is intimately linked to students' achievement in this area. (p.13)

Nature of Skilled Readers

The act of constructing meaning is threefold. First, it is interactive, involving not just the reader, but also the text as well as the context in which the text is read (Heilman, Blair, & Rupley, 1998). Second it is strategic, as readers use a variety of skills to construct meaning (Baker & Bown, 1984). Lastly, it is adaptable, as readers change strategies as they read different texts (Dole, Duffy, Roehler, & Pearson, 1991).

Skilled readers, or what others term as *strategic readers*, use a number of comprehension strategies to get meaning from their texts (Pressley, 2002). Comprehension strategies are conscious plans or procedures that are under the control of the reader to make decisions about what strategies to use before reading, during reading, and after reading (TRI, 2002).

Before reading, skilled readers tend to set goals for their reading (Pressley, 2002; TRI, 2002). Skilled readers pay attention to the organization of the text and often create a mental overview of the text to help them determine what is and is not relevant to their preconceived goal (TRI, 2002).

During reading, skilled readers are alert to ideas in the text that relate to their reading goals (Pressley, 2002). Skilled readers read words accurately and simultaneously interpret the meaning of those words and, possibly, the meaning of the words and sentences surrounding those words (TRI, 2002). Skilled readers connect the meaning of sentences together (TRI, 2002). Skilled readers are constantly monitoring their reading to ensure their understanding of the text (Pressley, 2002). When their understanding becomes confused, skilled readers use their prior knowledge to try to clarify the meaning of the text (TRI, 2002). Skilled readers interact with the text while reading by asking themselves questions about the content and reflecting on those answers (TRI, 2002). Skilled readers use their background knowledge to make predictions, to understand the ideas encountered, and to evaluate their predictions and revise as needed (Paris, Waski, & Turner, 1991; Pressley, 2002). Skilled readers also use their prior knowledge to infer information that the author has not directly provided (Pressley, 2002; TRI, 2002). Skilled readers constantly monitor their comprehension (Paris, Lipson & Wixon, 1983). When their comprehension becomes unclear, skilled readers may ask questions about the meaning of the text they are reading, or possibly summarize what they have read and look up difficult words (TRI 2002).

After reading, skilled readers will reflect on the text they have just read (Pressley, 2002; TRI, 2002). Skilled readers will often summarize the major points in the text and possibly go to other sources to fill any gaps (TRI, 2002). Skilled readers will also evaluate how the information read can be used in the future (Pressley, 2002).

In 1997 Keene and Zimmerman offered a new instructional paradigm that focuses on instruction of comprehension strategies used by skilled readers (Keene & Zimmerman, 1997).There is evidence consistent with Keene and Zimmerman's (1997) hypothesis that students must be taught comprehension strategies and learn to monitor their reading for those comprehension strategies (Keene & Zimmerman, 1997). Skilled and strategic reading does involve the comprehension strategies featured by Keene and Zimmerman's work, with monitoring and interpretation of what is read constantly being affected by the reader's prior knowledge (Pressley, 2002).

Research Based Comprehension Strategy Instruction

Comprehension has moved from the mentioning, practicing, and assessing procedures (Durkin, 1978) to the concept of reading comprehension as a complex and active process to construct meaning (Dole, Duffy, Roehler, & Pearson, 1991). Comprehension instruction strategies are specific, learned procedures that foster active, competent, self-regulated, and intentional reading that requires the reader to be an active participant who constructs meaning through deliberate problem solving processes (Trabasso & Bouchard, 2002).

Explicit teaching uses *strategy* to mean "a technique that *readers* learn to control as a means to better comprehend" instead of a strategy the "*teacher* controls to guide students reading" (Duffy, 2002, original italics). Explicit instruction is deliberate about teaching how strategies work in order to put readers in a better position to control their own comprehension (Duffy, 2002).

Pearson and Dole (1987) describe explicit comprehension instruction using five steps: First, teachers model the strategy and provide an explanation of how, why and when a strategy ought to be used (Pearson & Dole, 1987). Second, teachers provide opportunities for guided practice in which teachers and students work together to figure out how to go about applying the strategy (Pearson & Dole, 1987). In this second step it is important for the teacher to release responsibility gradually until students are capable of completing the task on their own (Pearson & Dole, 1987). Third, teachers help students see what the skill or strategy is and how to apply it (Pearson & Dole, 1987). Fourth, students practice independently, assuming near total responsibility for determining what strategy should be used and how to apply it (Pearson & Dole, 1987). Fifth, teachers ask students to apply the strategy, and students look for examples in other texts (Pearson & Dole, 1987). Application is a critical step that is often absent from instruction (Pearson & Dole, 1987). Explicit comprehension instruction plays a very important role in the curriculum of today's schools (Pearson & Dole, 1987).

Trabasso and Bouchard (2002) identified twelve strategies of comprehension instruction found to be effective in teaching comprehension strategies and improving comprehension. These strategies fall into two main categories. One category refers to *comprehension instructional strategies*—the strategies teachers use to teach readers. The second category is the *cognitive strategies* used by readers, as they comprehend text (Trabasso & Bouchard, 2002). The following strategies have a place in content area classrooms.

Comprehension Instructional Strategies

Use of graphic organizers. Graphic organizers, used as an instructional strategy, are used to teach readers to organize their ideas with graphic representations of what they read (Trabasso & Bouchard, 2002). "Graphic organizers illustrate concepts and interrelationships among concepts in a text, using diagrams or other pictorial devices" (National Institute for Literacy, 2003, p.50). Teachers who use graphic organizers help readers see relationships between concepts and learn to read from informational texts in content areas (National Institute for Literacy, 2003; Trabasso & Bouchard, 2002). Graphic organizers can help students focus on text structure as they read; provide students with the tools they can use to examine and visually represent relationships in a text; and help students write well organized summaries of a text (National Institute for Literacy, 2003, p.51; Trabasso & Bouchard, 2002).

Use of mnemonic instruction. Mnemonic instruction, an instructional strategy, uses an external memory aid as proxy for a concept in order to generate an internal association of the concept (Trabasso & Bouchard, 2002). Key word methods provide prompts that improve recall for complex passages about people, events, or places.

Instruct vocabulary. Vocabulary instruction as a cognitive strategy promotes word knowledge that enhances text comprehension (Trabasso & Bouchard, 2002). Skilled reading involves the coordinated use of several cognitive strategies (Trabasso & Bouchard, 2002). Readers can learn and flexibly organize multiple strategies to construct meaning from texts (Trabasso & Bouchard, 2002). Much of the trouble students have comprehending informational material relates to the specific vocabulary used to communicates concepts (Ogle & Blachowicz, 2002). Research has documented that students' active involvement in identifying and learning vocabulary is critical to vocabulary learning and related content learning (Ogle & Blachowicz, 2002). A strong vocabulary leads to better reading and listening comprehension as well as improvement in content area achievement (Trabasso & Bouchard, 2002). Good readers have a more extensive vocabulary than do weaker readers (Anderson & Freebody, 1983).

Activate prior knowledge. The activation of prior knowledge is an instructional strategy used by teachers to help students recall prior knowledge to aid in comprehension (Trabasso & Bouchard, 2002). By Activating prior knowledge students are able to infer and elaborate on what was read (Trabasso & Bouchard, 2002). Using their prior knowledge, students are also able to fill in missing of incomplete information from the text they are reading Trabasso & Bouchard, 2002).

Answer questions. Question answering instruction as an instructional strategy teaches students how to find answers available in the text and encourages students to ask their own questions to improve their "active processing of the text" to focus on important content (National Institute for Literacy, 2003, p.51; Trabasso & Bouchard, 2002).

Generate questions. Teachers can employ question generation as an instructional strategy to help readers comprehend. Question generation teaches readers to self-question their thinking and thought process while reading a new text and to learn to ask questions of themselves that integrates information learned from other texts (National Institute for Literacy, 2003; Trabasso & Bouchard, 2002). Once teachers explicitly demonstrate through thinking aloud how to generate questions from texts during reading, readers can practice generating answers while reading a text (Trabasso & Bouchard, 2002).

Cognitive Strategies

Summarize. Summarization is a cognitive strategy helpful for both students and teachers alike. Summarization is a strategy used by teachers to teach readers to use summarization to improve comprehension (National Institute for Literacy, 2003). Strategic readers apply summarization to their reading to comprehend a text (National Institute for Literacy, 2003). Summarizing requires students to determine what is important in the text, condense the information learned from the text, and to put the newly acquired information into their own words (National Institute for Literacy, 2003). Summarization can make readers more aware of how ideas are related and how text is structured (Trabasso & Bouchard, 2002). Summarization improves memory for what is read through recall and answering questions (Trabasso & Bouchard, 2002).

Activate prior knowledge. "Good readers draw on prior knowledge and experience to help them understand what they are reading" (National Institute for Literacy, 2003, p.55). When used as a cognitive strategy, the activation of prior knowledge directs the readers to infer and elaborate on what was read (Trabasso & Bouchard, 2002). This enables students to fill in missing or incomplete information and to construct memory representations that facilitate recall of what was read and understood (Trabasso & Bouchard, 2002).

Answer questions. Question answering as a cognitive strategy can increase memory for what was read by helping readers through the why and how questions (Trabasso & Bouchard, 2002). The National Institute of Literacy (2003) has said that questions appear to be effective for improving learning from reading because they

> …give students purpose for reading; focus students' attention in what they are to learn; help students to think actively as they read; encourage students to monitor their comprehension; and help students to review content and relate what they have learned to what they already know. (p.51)

Through question answering, readers can learn to distinguish questions that can be answered based on the text versus those questions that need to be answered using inferences and drawing conclusions (Trabasso & Bouchard, 2002).

Generate questions. Readers can use question generation as a cognitive strategy to comprehend texts because question generation during reading benefits reading comprehension by improving memory, accuracy, and integration and identification of main ideas (Trabasso & Bouchard, 2002). Question generation teaches students to ask their own questions to improve their “active processing of the text” (National Institute for Literacy, 2003, p. 51).

Skilled reading involves the coordinated use of several cognitive strategies (Trabasso & Bouchard, 2002). Readers can learn and flexibly organize multiple strategies to construct meaning from texts (Trabasso & Bouchard, 2002). According to Pressley, the best way to teach comprehension strategies is to teach them one at a time, with a great deal of time devoted to each one (Pressley, 2001). Once teachers have modeled each strategy, students should then practice each strategy with a variety of texts, while the teacher encourages student self-regulated use of the strategies by gradually releasing control of the strategies from the teacher to the student (Pressley, 2001).

Investigating Textbooks

In order for teachers to provide the kind of comprehension instruction that would help children develop the skills and habits of strategic readers, teachers need curricular materials. Therefore, examining the curricular materials to see how they support the comprehension instruction is essential.

Durkin (1981) examined the teachers’ manuals of five basal reader programs, kindergarten through grade six, looking for comprehension instruction recommendations (Durkin, 1981). Durkin found that the manuals gave more attention to practice and assessment than to comprehension instruction.

Durkin (1985) also investigated comprehension instruction in classroom basal reader manuals and reading methodology textbooks. Durkin (1985) found that specific descriptions of comprehension instruction were either scarce or missing altogether.

Kragler, Walker, and Martin (2005) studied the comprehension strategy instruction found in primary science and social studies textbooks to see how these texts supported comprehension instruction. Kragler, Walker, and Martin (2005) found that in each textbook they studied there was limited modeling, and graphic organizers were being used without any instruction as to why graphic organizers are a positive comprehension strategy.

No studies were located that examined how mathematics textbooks provide support for comprehension instruction. In order for students to understand, interpret and analyze narrative and informational grade level texts, content area literacy needs to become the standard in schools. With the research available to educators that supports and presents the need for content area literacy, there seems to be very little integration of content area literacy in elementary classrooms, especially in mathematics.

In conversations with colleagues about possible reasons for the lack of literacy instruction across the mathematics curriculum, we discovered a lack of literacy ideas in the provided lesson plans in teacher editions of mathematics textbooks. This leads to the question of this study: How are publishers of mathematics textbooks helping mathematics teachers in grades K-6 integrate literacy into their teaching of mathematics?

CHAPTER 3

METHODOLOGY

Purpose

The purpose of this study was to investigate how publishers are providing lesson plans designed to help teachers of mathematics in grades K-6 integrate literacy in their mathematics instruction. Because of NCTM's (2000) vision of mathematical power for all, it is important that students be given every opportunity to achieve that vision. By integrating literacy and mathematics readers will be able to listen, read, write, and talk about mathematics on a level that will help them to succeed (NCTM, 2000; Draper, 2002).

Design

Content analysis research is divided according to three major purposes: "to describe the characteristics of content, to make inferences about the cause of content, and to make inferences about the effect of content" (Holsti, 1969, p. 43). The purpose of this study, similar to one purpose of content analysis, is to "make inferences by objectively and systematically identifying specified characteristics of messages" found in mathematics textbooks (Holsti, 1969, p. 25). With this purpose in mind, the research methodology used for this study is qualitative content analysis using *a priori* codes.

Content analysis can involve both qualitative and quantitative strategies (Carney, 1972). Like other research techniques, its purpose is to provide "new insights, a representation of 'facts', and a practical guide to action" (Krippendorf, 1980, p. 21). Historically, content analysis is performed using quantitative designs in which the researcher uses *a priori* codes and the data are analyzed based on the frequency of terms within a text (Holsti, 1969; Krippendorf, 1980). Qualitative content analysis differs from quantitative analysis in that it is a process by which documents are analyzed to "reveal a person's or group's conscious or unconscious beliefs, attitudes, values, and ideas" (Fraenkel & Wallen, 1993, p. 389). It is important to note that while I was interested in the quality of literacy strategies found in mathematics teacher manuals, I used open coding and *a priori* codes (see appendix A), which are generally used in a quantitative content analysis methodology (Hodson, 1999). Qualitative content analysis also uses "reflexive analysis" to expose implicit and explicit messages in a text (Altheide, 1987, p. 65). In addition to the *a priori* coding, to ensure that all data was thoroughly analyzed, I was open to any other codes that arose.

In order to find quality comprehension strategies, I needed to use reflexive analysis that helped to expose implicit and explicit examples in the text. Explicit examples state the comprehension strategies directly, whereas implicit examples do not. In order to find implicit examples, I needed to be aware of the language that prompts these strategies. For example the sixth-grade text states, "Ask students what an experiment is. Then ask them to discuss the meaning of probability. Assist students in blending the meanings of the two words to develop a definition for experimental probability." (*Houghton Mifflin Math*, 2007, p. 494A). This example refers to vocabulary instruction. The words that inform me that it is vocabulary instruction are *meanings* and *definition*.

Another example from second-grade reads, "You may wish to review these words with children. Difference: the answer to a subtraction problem. Related facts: addition and subtraction facts that use the same numbers" (*Houghton Mifflin Math*, 2007, p. 57A).

This is an example of activating prior knowledge. The word that let me know it is prior knowledge is *review*.

Data Sources

Two textbook series were chosen for this study. The textbook series chosen are the approved series for the school district where I currently teach. The district selected *Houghton Mifflin Math* (2007) and *Everyday Mathematics* (2007) as textbook series for the district. Both textbook series met the criteria developed by the district math specialists. The district math specialists created a rubric to evaluate different textbook series to see which series met the predetermined criterion (See Appendix B). This rubric was used to judge what students would learn as a result of using a particular textbook series. The criteria included in the rubric looked at the information and support material given to teachers in the teacher editions of the textbook series (D. Bradley, personal communication, November 19, 2007).

Houghton Mifflin Math boasts that "*Houghton Mifflin Math* offers teachers students, and parents research-based approaches in a highly accessible format so all students can reach grade-level success and beyond" (*Houghton Mifflin Math*, 2007,). *Houghton Mifflin Math* claims their series includes high interest activities to engage students, researched-based lesson plans, differentiated instruction, and technology tools for lesson planning (*Houghton Mifflin Math*, 2007).

Everyday Mathematics (2007) is a comprehensive pre-kindergarten through sixth-grade mathematics curriculum developed by the University of Chicago Mathematics Project. More than 175,000 classrooms and 2.8 million students currently use *Everyday*

Mathematics (*Everyday Mathematics*, 2007). Similar data were not available for *Houghton Mifflin Math*.

Development of *Everyday Mathematics*, 2007, began with a research phase in which authors of curriculum reviewed existing research on mathematical thinking and on curriculum and instruction. Instructional practices in other countries were observed. Based on the findings in the research, the authors established several basic principles that guided the development of *Everyday Mathematics*.

The guiding principles of *Everyday Mathematics* (2007) are as follows: (a) students acquire knowledge and skills and develop understanding from their own experiences, (b) children begin school with more mathematical knowledge and intuition previously believed, so the curriculum should be built on an intuitive and concrete foundation; and (c) teachers, along with their ability to provide excellent instruction, are the key factors in the success of any program.

Data Collection

To begin my research process, I collected mathematics textbooks for grades K-6 from the *Houghton Mifflin Math* series and *Everyday Mathematics*. In each series I looked for examples of literacy integration ideas based on Trabasso's and Bouchard's (2002) effective comprehension strategies to teach comprehension. Each example was cited and analyzed.

Each page of the teacher manuals was read to identify and record comprehension strategies that fell into any of the Trabasso's and Bouchard's (2002) six comprehension strategies. As with reflexive analysis, the comprehension strategies did not have to be explicitly written. The focus of this study are the lesson plans available for teachers teaching mathematical principles. However, workbook pages, assignments and assessments were also analyzed when a suggestion for their use appeared in a lesson plan in the teacher's edition.

Data Analysis

Phase I. In keeping with Draper's (2002) notion of reading for quality, the codes I used were selected *a priori* and categorized to determine the quality and meaning of the mathematical instruction available. The two categories the codes were divided into were cognitive comprehension strategies and instructional comprehension strategies.

Cognitive comprehension strategies are the individual thinking strategies readers utilize when reading: activation of prior knowledge, question answering, question generation, and summarization. Cognitive comprehension strategies are specific, learned procedures that foster active, competent, self-regulated and intentional comprehension (Trabasso & Bouchard, 2002). Cognitive strategies also help students become literate in a subject area by using literacy as a tool to think and learn in a given subject area (Alvermann & Phelps, 2002; Stephens & Brown, 2000; Topping & McManus, 2002; Vacca & Vacca, 2002).

Instructional comprehension strategies are strategies chosen by a teacher to help students achieve learning objectives, these strategies are: activation of prior knowledge, question answering, question generation, graphic organizers, and mnemonic instruction. Teachers implement instructional comprehension strategies by demonstrating, modeling, or guiding students gain knowledge and power as learners and thinkers to interact meaningfully with the text (Lesley, 2005).

The mathematic textbook series selected for this study were read with the intent of finding quality comprehension strategies that will help students become literate in mathematics. I was not searching for the number of times a specific strategy was named, but in the quality of the use of the strategy—how the textbook series supported the teaching of comprehension during mathematics lessons.

The *a priori* categories see (Appendix A) have been divided into cognitive strategies and informational strategies. These categories were the *a priori* codes for this study. While these codes were the basis for my study, I was open to additional codes that appeared during the data collection.

Phase II. The textbooks in each series were read multiple times with the original *a priori* codes and any newly created codes acting as a guide. The textbooks were reread until all data had been placed within a specific category and I was sure that further reading would not produce new codes or themes.

The Researcher

Because the methodology used for this study is qualitative in nature, I am the primary instrument for investigating and analyzing the data. As a result, my experience and knowledge of both literacy and mathematics played an active role during the analysis of the data, making it necessary to include a description of myself, the researcher.

I am currently studying in a Teacher Education masters program focusing on literacy, including a course on content area literacy. Because of this course, I am now aware of the different ways individuals view literacy and of the importance of literacy across the curriculum.

As an elementary school teacher in my eighth year of teaching, my mathematical experiences are strong. I have taught mathematics to fourth, fifth, and sixth-grade students. I was asked by the Utah State Office of Education to create and teach mathematics lesson plans to teachers around the state of Utah at an annual CORE Academy (2005). It is through the lenses of these backgrounds that I examined these textbook series and determined the literacy messages available for other teachers to use to integrate mathematics.

Limitations

Because this study uses only two mathematics textbook series, it would be unfair to assume that the results found are true of all mathematics textbook series. Also, only textbook series for grades two, four, and six were used, so results may not be typical of other grade level mathematics textbook series.

CHAPTER 4

RESULTS

I had preconceived expectations that mathematics textbooks contained few or no literacy strategies. However, I found that support for teachers is offered for integrating comprehension strategies and opportunities into mathematics instruction in elementary mathematics textbooks. Even with these opportunities, not all comprehension strategies, and the help needed to integrate those strategies, were available for teachers. While some strategies were better represented than others, there were a number of literacy strategies (see Appendix C and D) found in the pages of the mathematics textbooks. It is important to note that while looking for both cognitive and instructional strategies, instructional comprehension strategies were prevalent to teachers. The textbooks afforded fewer ideas for cognitive strategies.

Table 1 shows that among the instructional strategies, vocabulary instruction was the most available and consistent comprehension strategy found in both *Houghton Mifflin Math* and *Everyday Mathematics*. *Houghton Mifflin Math*, across the three grade levels, had, on average 11.8% of the pages used vocabulary instruction as a comprehension strategy to help students better understand mathematics. Table 2 shows that 9.8% of the pages in *Everyday Mathematics*' second, fourth and sixth-grade textbooks had instances of *vocabulary instruction* used as a comprehension strategy.

Table 1

Percent of Pages in Houghton Mifflin Math *Including Comprehension Strategies*

	Grade 2	Grade 4	Grade 6
Instructional Strategies			
Question Generation	0.16%	0.00%	0.00%
Question Answering	0.31%	0.64%	0.00%
Mnemonic Instruction	0.16%	0.16%	0.32%
Graphic organizers	0.78 %	0.16%	0.00%
Vocabulary Instruction	12.00%	14.00%	9.50%
Activate Prior Knowledge	0.00%	0.00%	0.00%
Visualization	3.4 %	0.96%	1.11%
Cognitive Strategies			
Question Answering	0.00%	0.00%	0.00%
Question Generation	0.16%	0.00%	0.00%
Activate Prior Knowledge	1.40 %	6.00%	7.80%
Summarization	0.31%	0.32 %	0.16%

Table 2

Percent of Pages in Everyday Mathematics *Including Comprehension Strategies*

	Grade 2	Grade 4	Grade 6
Instructional Strategies			
Question Generation	0.00%	0.00%	0.00%
Question Answering	0.00%	0.00%	0.00%
Mnemonic Instruction	0.00%	0.00%	0.10%
Graphic organizers	0.10 %	0.00%	0.00%
Vocabulary Instruction	3.80%	11.00%	14.00%
Activate Prior Knowledge	0.10%	0.21%	0.00%
Visualization	4.49 %	1.50%	2.11%
Cognitive Strategies			
Question Answering	0.00%	0.10%	0.10%
Question Generation	0.16%	0.00%	0.10%
Activate Prior Knowledge	1.40%	6.00%	0.10%
Summarization	0.31%	0.00%	0.00%

In this chapter I report the findings from my investigation regarding the support for literacy instruction in *Houghton Mifflin Math* and *Everyday Mathematics*. My results will be divided into the two categories of literacy strategies Trabasso and Bouchard (2002) identified as being effective when teaching comprehension. These categories are cognitive strategies and instructional strategies.

Cognitive Strategies

Cognitive comprehension strategies are specific, learned procedures that foster competent and intentional comprehension (Trabasso & Bouchard, 2002). The cognitive comprehension strategies that have a place in content area classrooms are: activating prior knowledge, summarization, question answering, and question generation. Individuals to help them comprehend texts use these cognitive strategies.

Activate prior knowledge. Activating prior knowledge used as a cognitive strategy helps students recall prior knowledge to aid in comprehension. In the *Everyday Mathematics* (2007) series only one the second-grade textbook that prompted teachers to activate students' prior knowledge. Both of the instances in the second-grade textbook had to do with reviewing vocabulary. One such example from *Everyday Mathematics* (2007) second-grade textbook states,

> Review place-value names (**ones** or **1s**; **tens** or **10s**; **hundreds** or **100s**; **thousands** or **1,000s**; and **ten-thousands** or **10,000s**), calling children's attention to the labels on their place-value tools. Discuss the relationships between the values of the places; 1 ten is 10 ones (or 1 is 1/10 of 10), 1 hundred is 10 tens (or 10 is 1/10 of 100), and so on. This "ten-for-one" relationship is fundamental to the base-ten place-value system. (p. 771, original boldface)

The other second-grade example from *Everyday Mathematics* (2007) states,

> Write the amount $12.37 on the board and label it accordingly with “whole dollar amount,” “decimal point,” and “cents amount.” Remind children that the period after the 12 is called the **decimal point**. The digits before the decimal point stand for the whole dollar amounts; the digits after the decimal point stand for cents amounts (less than a dollar). Point out that in dollars-and-cents notation, there are always two digits after the decimal point. (p. 733, original boldface)

Houghton Mifflin Math had a total of 85 instances in grades two, four, and six that prompted teachers to activate student’s prior knowledge. Of these 85 instances, each instance revolved around reviewing vocabulary. One of the nine examples found in the *Houghton Mifflin Math* second-grade textbook states, “You may wish to review these words with children. **Row** information arranged in horizontal lines; **columns** information arranged in vertical lines.” (*Houghton Mifflin Math*, 2007, p. 557A, original boldface).

The *Houghton Mifflin* (2007) fourth-grade textbook had 37 instances, one of which says:

> You may wish to review these words with students. **Product** the answer in a multiplication problem; **factors** the numbers that when multiplied together give a product. To help students review words associated with multiplication, ask them to use each of the following words meaningfully in a sentence: **multiply**, **factor**, **multiple**, **product**. (p. 146A, original boldface)

The *Houghton Mifflin Math* (2007) sixth-grade textbook has 49 instances that prompt teachers to help students activate their prior knowledge. One of these instances from *Houghton Mifflin’s* (2007) sixth-grade textbook states,

> You may want to review these words with students. **Algebraic expression** an expression that consists of one or more variables; **term** a number in a sequence. On the chalkboard, write 7 + 3, 3 + b, and a + b. Explain that in mathematics, these are called expressions. What is different about these expressions? (One has numbers, one has a number and a letter, and the last has letters.) Point out that the first is a numerical expression and the last two are algebraic expressions because they contain at least one variable. Each part of the expression is called a term. 7, 3, b, and a are all terms. (p. 20A, original boldface)

Summarize. Summarization is a cognitive strategy that helps readers become more aware of how ideas are related. The second-grade *Everyday Mathematics* textbook had three examples of summarization. Each of these three examples prompted students to make a summarization statement, for example, " Children show someone at home how to solve division number stories. Then they make up and solve a number story of their own" (*Everyday Mathematics*, 2007, p.828). This example, like the other two, prompted students to summarize the mathematical concept found in the math lesson using summarization as a literacy strategy.

Houghton Mifflin Math had five instances in which students were asked to summarize information learned in grades two, four, and six. An example in the second-grade textbook says, "Pretend a new child just arrived in your class. How would you explain estimating sums by rounding?" (*Houghton Mifflin Math*, 2007, p. 292).

One example from the fourth-grade textbook read, "Have students write a summary of what they learned about angles in this lesson. Then have them draw a diagram of intersecting lines that form different kinds of angles. Have students label the figures in their diagram and describe and classify the angles" (*Houghton Mifflin Math* 2007, p. 409).

Other strategies. Question answering as a cognitive strategy is used to help students increase their memory for what was read by answering why and how questions. Neither *Houghton Mifflin Math* nor *Everyday Mathematics* had any examples of question answering.

Question generation as a cognitive strategy helps identify the main ideas. Initially I thought *Houghton Mifflin Math* had two examples of question generation in the second-grade textbook. However, only one instance focused on a literacy example: "Make up your own word for *regrouping*. Tell why your word makes sense" (*Houghton Mifflin Math*, 2001, p.361, original italics). This example shows how using question generation as a literacy strategy helps students understand the word regrouping and identify the main ideas from the mathematics lesson. No instances of question generation were found in *Everyday Mathematics*.

Instructional Strategies

Instructional strategies are the strategies teachers use to teach students how to comprehend texts (Trabasso & Bouchard, 2002). Instructional strategies include vocabulary instruction, graphic organizers, activate prior knowledge, mnemonic instruction, question generation, and question answering. Visualization was an instructional strategy I felt was important to add to my coding process.

Throughout the data analysis process I found it necessary to add another code to my already determined codes. "Readers who visualize during reading understand and remember what they read better than readers who do not visualize" (National Institute for

Literacy, 2003, p.56). *Visualization* as an instructional strategy is used to help student form mental pictures, or images, as they read new concepts to improve comprehension and understanding. (National Institute for Literacy, 2003; Trabasso & Bouchard, 2002).

Instruct vocabulary. Vocabulary instruction promotes word knowledge that enhances text comprehension (Trabasso & Bouchard, 2002). Vocabulary instruction was the most commonly found literacy strategy found in both *Houghton Mifflin Math* and *Everyday Mathematics*. In *Houghton Mifflin Math*, second, fourth, and sixth-grade had a total of 224 instances of vocabulary instruction. *Everyday Mathematics* had a total of 268 instances of vocabulary instruction.

Despite the many examples of vocabulary instruction found in *Houghton Mifflin Math*, each example was worded the same in second, fourth, and sixth-grade. An example from *Houghton Mifflin's* (2007) second-grade textbook states,

> Discuss with children the vocabulary, **hour**, **half-hour**, **minute hand**, and **hour hand**. Explain that the hour hand is the short hand and the minute hand is the long hand. Take time during the day to have children watch the hands as they move around the clock, observing the placement on the hour, the half-hour, and the following hour. **Hour** a unit of time equal to 60 minutes; **Half-hour** a unit of time equal to 30 minutes; **minute hand** the longer hand on an analog clock that mediates time to the minute; **hour hand** the shorter hand on an analog clock that indicates time to the hour. (p. 435A original boldface)

Another second-grade example from *Houghton Mifflin* (2007) reads,

> Write a 2-digit subtraction problem on the board such as 43-28. Ask a volunteer to **round** each number to the nearest ten and then to estimate the difference. Have

a different volunteer describe what the child did using the vocabulary words.

> **Round** find about how many or about how much by expressing a number to the nearest ten, hundred, thousand, and so on. **Estimate** an answer that is close to the exact amount. (p.351A, original boldface)

An example from fourth-grade *Houghton Mifflin Math* (2007) textbook reads,

> **Decade** a unit of time; 1 *decade* = 10 years; **century** a unit of time; 1 *century* = 100 years. Use the vocabulary cards for century and decade to relate each term to other words students know with the same prefix, such as centimeter (100 cm = 1m; 1 century = 100yr) and decimeter (10 dm = 1 m; 1 decade = 10 yr). (p. 334, original boldface and italics)

A similar example from the fourth-grade *Houghton Mifflin Math* (2007) textbook reads,

> **Integer** the set of positive whole numbers, their opposites, and 0; **opposite** a **integer's opposite** is the same distance form 0 as the integer, but in the opposite direction; *negative integer* the opposite of a positive integer; *positive integer* a whole number that is greater than 0. Discuss with students that integers can represent both positive and negative amounts, such as temperatures above and below 0. Guide students to read the numbers as *integers* rather that minus; they should say **negative 6** for -6, not **minus 6**. Explain that all integers have an **opposite** and that 0 is its own opposite. (p. 624A, original boldface and italics)

An example from the *Houghton Mifflin Math* (2007) sixth-grade textbook says,

> Perimeter the distance around a figure; **area** the number of square units that cover a figure completely without overlapping. Sketch a rectangle on the board. Ask students to tell what kind of measure they are looking for when they want to

build a frame around a picture (*perimeter*). Ask students what kind of measure they are looking for when they want to know how much glass is needed to cover the picture (*area*).” (p. 200A, original boldface and italics)

A similar example from *Houghton Mifflin Math* (2007) sixth-grade states,

Inequality a relation that is expressed by placing an inequality symbol between two expressions; **solution to an inequality** any value of a variable that makes an inequality true. Display <, >, and = and review the meaning of each. Point out that only the equal sign is a sign of *equality*—the quantities on both sides of the sign are in balance, or equal. Explain than an inequality is a relationship where the expressions on both sides of the sign are not equal. Display > and <, and replace = with ≠. (p. 618A, original boldface and italics)

With each teacher’s edition of *Houghton Mifflin Math,* a *Building Vocabulary Kit* is included. This kit includes grade level vocabulary cards and additional grade level teaching strategies for unit vocabulary (*Houghton Mifflin Math*, 2007). The difference in the *Building Vocabulary Kit* in each grade level is that the vocabulary is grade level specific. For example, in the second-grade textbook of *Houghton Mifflin Math* (2007) one instance of vocabulary instruction reads:

Display a blank grid and tell children that it is called a grid. Explain that they will be using a grid to locate things. Then hold up the card **ordered pair**. Have children explain what a pair is. Tell children that they will use ordered pairs to find and name points on the grid.” (p. 89A, original boldface). The fourth-grade textbook says, “**circle graph**-a graph that represents data as part of a circle. Use the vocabulary cards for **circle graph**. Talk about why a circle graph is called a

> graph sometimes and other times it is called a *pie chart*. Then ask them to tell where they have seen circle graphs used outside of the classroom. (*Houghton Mifflin Math*, p. 378A, original boldface)

An example from *Houghton Mifflin Math* (2007) sixth-grade textbook says:

> **Surface area**-the total area of the surface of a solid. **Net** a flat pattern that can be folded to make a solid. Remind students that a **net** is a two dimensional representation of a solid figure. Explain that **surface area** is found by adding the areas of all of the faces of a figure, like those on nets. (p. 565A, original boldface)

The textbook directs teachers to the Building Vocabulary Kit to introduce new vocabulary at the beginning of each unit in a paragraph called "Learning Vocabulary". One example from the *Houghton Mifflin Math* (2007) second-grade textbook says:

> Write vocabulary cards for the words **inch**, **foot**, **yard**, **centimeter**, **meter**, **cup**, **pint, quart, gallon, milliliter**, and **liter**. Read each card aloud as you place them in a box. Remind children that the words in the box are used for measuring how tall something is, or how much something can old. Create two word webs on the board; one asking *How tall is it?* and the other asking *How much can it hold?* Have volunteers take turns choosing a card from the box and copying the word on the correct web until all of the cards are used. (p. 472, original boldface and italics)

In the fourth and sixth-grade *Houghton Mifflin Math* textbooks the same *Learning Vocabulary* paragraph appears before each unit. For example, the fourth-*grade Learning Vocabulary* paragraph says,

> Go over the list of new vocabulary words with the class. Help students pronounce the words correctly and explain that they will learn about these words as they work on this unit. If students are keeping Math Journals, be sure that they enter the words and their definitions as they find them in the unit. The *Building Vocabulary Kit* includes vocabulary cards and additional teaching strategies for unit vocabulary. (p. 1c, original italics)

The sixth-grade *Learning Vocabulary* paragraph in *Houghton Mifflin Math* (2007) says,

> Go over the list of new vocabulary words with the class. Help students pronounce the words correctly and explain that they will learn about these words as they work on this unit. If students are keeping Math Journals, be sure that they enter the words and their definitions as they find them in the unit. The *Building Vocabulary Kit* includes vocabulary cards and additional teaching strategies for unit vocabulary. (p. 1c, original italics)

In *Everyday Mathematics*, vocabulary instruction increases with grade level. For example, in second-grade 37 examples of vocabulary instruction were found, compared to 105 instances in 4th grade, and 126 instances in 6th grade. While the instances increased, the quality of vocabulary instruction stayed the same. Each vocabulary instruction example in *Everyday Mathematics* uses the Word Bank Template. This template is used to help students organize their thoughts as they draw a graphic representation of a specific vocabulary word. For example, in the *Everyday Mathematics* (2007) second-grade textbook it states,

> To provide language support for the words *odd* and *even*, have children use the Word Bank Template found in the *Differentiation Handbook*. Ask children to

> write the word *odd*, list examples of numbers that are odd, and draw an odd number of dots to represent the word. Ask children to do the same with *even*. (p. 23 original italics)

In the fourth-grade textbook it says, “To provide language support for geometry, have students use the Word Bank Template found in the *Differentiation Handbook*. Ask students to write the term *intersect*, draw pictures relating to the term, and write other related words” (*Everyday Mathematics*, p. 72, original italics).

In sixth-grade I found a similar example, “To provide language support for data landmarks, have students use the Word Bank Template found in the *Differentiation Handbook*. Ask students to write the terms *minimum*, *maximum*, *median*, and *mode* and then represent the terms with pictures and other words that describe them” (*Everyday Mathematics*, p. 31 original italics).

Each vocabulary instruction example in *Everyday Mathematics* uses the Word Bank Template. This template is used to help students organize their thoughts as they draw a graphic representation of a specific vocabulary word. For example, the second-grade textbook states, “To provide language support for multiplication number stories, have children use the Word Bank Template found in the *Differentiation Handbook*. Ask children to write the terms *known, unknown,* and *equal groups*, draw pictures representing each term, and write other related words.” (*Everyday Mathematics*, p. 823 original italics).

The fourth-grade text states, “To provide language support for fractions, have students use the Word Bank Template found in the *Differentiation Handbook*. Ask students to write the terms *numerator* and *denominator,* draw pictures relating to each term, and write other related words.” (*Everyday Mathematics*, p. 575 original italics).

The sixth-grade textbook says, “To provide language support for the Pythagorean theorem, have students use the Word Bank Template found in the *Differentiation Handbook.* Ask students to write the terms *square of a number, perfect square,* and *hypotenuse*, draw pictures depicting to each term, and write other related words.” (*Everyday Mathematics*, p. 575, original italics).

Use of graphic Organizers. Graphic organizers are used as an instructional strategy to teach readers to organize their ideas with graphic representations of what was read. *Everyday Mathematics* had one example of using a graphic representation to help students see relationships among concepts. The example is found in the second-grade text on page 342.

Houghton Mifflin Math had 24 examples—seven in second-grade and nine in sixth-grade. Of the seven second-grade examples, only two of them are literacy examples. One such example from the second-grade textbook that helps clarify vocabulary says, “Make a diagram or drawing to show that there are 10 hundreds in 1,00” (*Houghton Mifflin Math*, 2007, p. 599). The other example also clarifies some vocabulary from the text: “make a drawing showing there are 10 tens in 100 (*Houghton Mifflin Math*, 2007, p. 579).

Each of the eight examples in the fourth-grade text revolved around vocabulary. As part of an introduction to each unit there is a reviewing vocabulary section. One such section from the fourth-grade *Houghton Mifflin Math* (2007) reads:

> Write the vocabulary words and their meanings on the board. Underline parts of the definition to help students understand the concept. This will also help them visualize the idea in their minds. Draw a picture for each vocabulary word.
>
> Each of the nine examples in the 6th grade text had to do with vocabulary. At the beginning of every unit there is a reading mathematics section, which includes a review vocabulary section, which is to help teachers ensure that students had an "adequate understanding and fluency with the unit vocabulary." (p. 350)

Another example from *Houghton Mifflin Math* (2007) reads:

> Explain that students can use can use diagrams to help them remember the meanings of vocabulary words. Emphasize that this strategy is especially helpful when several words relate to each other. Draw diagrams on the board to represent *angle* and *vertex*. Discuss how these words relate to each other.
>
> Draw diagrams for the words *polygon* and *diameter*. Ask students for other words that relate to these words. (polygon and square; diameter and circle) Use the same strategy to discuss the word *plane*. Reminding students that a plane is infinite. (p. 350, original italics

Visualize. During the data analysis process I found it necessary to add visualization to my already determined codes. *Everyday Mathematics* had a total of 59 instances in grades two, four, and six in which teachers where prompted to use visualization. Each of these instances had to do with vocabulary. One of the 26 examples from the *Everyday Mathematics* (2007) second-grade textbook reads:

> To provide language support for addition facts, have children use the Math Word Bank template found in the *Differentiation Handbook.* Ask children to write the

> term *turn-around facts*, draw a picture representing the term, and write other related words. Encourage them to illustrate the action of switching of the addends. (p.115)

Similar examples are found in the *Everyday Mathematics* (2007) fourth-grade textbook. One of the 14 examples reads:

> To provide language support for area, have children use the Math Word Bank template found in the *Differentiation Handbook*. Ask children to write the terms *area* and *square unit*, draw pictures representing the term, and write other related words. Encourage them to illustrate the action of switching of the addends. (p. 674)

The 19 instances in the *Everyday Mathematics* (2007) sixth-grade textbook also have to do with vocabulary. One such instance states,

> To provide language support for solving equations, have children use the Math Word Bank template found in the *Differentiation Handbook.* Ask children to write the term *equivalent equations, transform, inverse operations, solve,* and *original equation*, draw a picture representing the term, and write other related words. Encourage them to illustrate the action of switching of the addends. (p. 589)

Houghton Mifflin Math had 2 instances of visualization in grades two and four. The example from the fourth-grade textbook says, “Have students list and define the three types of transformations and how to remember each type” (*Houghton Mifflin Math*, 2007, p. 435).

Other instructional strategies. The other instructional strategies I was looking for were, mnemonic instruction, question answering, question generation, and activating prior knowledge. There were no instances of any of these strategies in either *Houghton Mifflin Math* or *Everyday Mathematics*.

In conclusion, both *Houghton Mifflin Math* and *Everyday Mathematics* had a number (see Appendix C and D) of comprehension strategies present. Even with the number of strategies present, not all strategies were represented.

CHAPTER 5

DISCUSSION AND IMPLICATIONS

The National Council of Teachers of Mathematics (NCTM) (2000) has presented a vision of mathematical power for all, inspiring a focus on mathematics instruction to include six principles for school mathematics. One of these principles is the *equity principle*. The equity principle states, “Excellence in mathematics education requires equity—high expectations and strong support for all students” (NCTM, 2000, p. 12). NCTM (2000) also states that when students have access to quality mathematics instruction each student can learn.

Using *Standards*-based mathematics instruction encourages teachers to help students’ communication in mathematics (NCTM, 2000). Communication in mathematics includes the opportunity, the encouragement, and the support to read, speak, and write mathematically (NCTM, 2000). Helping children learn to read and write in mathematics is important and one of the goals of content area literacy (Draper, 2002). However, it is not the norm in mathematics classrooms.

The 1989 NCTM representation standard states,

> Students should understand that written representations of mathematical ideas are an essential part of learning and doing mathematics. It is important to encourage students to represent their ideas in ways that make sense to them, even if their first representations are not conventional ones. It is also important that they learn conventional forms of representation to facilitate both their learning of mathematics and their communication with others about mathematical ideas. (NCTM, 1989, p. 67)

In order to get teachers to create and teach quality mathematics lessons, teachers must first understand how to use an instructional strategy. It is equally important that teachers understand the use of cognitive strategies and how to teach those strategies to students.

In conversations with colleagues about why literacy and mathematics are not being taught together, we concluded that the publishers of mathematics textbooks are not providing literacy ideas and comprehension strategies in the mathematics textbooks. These conversations led me to ask the question of this study: How are publishers of mathematics textbooks helping mathematics teachers in grades K-6 integrate literacy in their teaching of mathematics?

The purpose of this study was to investigate what support is offered to teachers to help them integrate comprehension literacy strategies into mathematics instruction in elementary classrooms. The results show that there is support for literacy in mathematics textbooks; there are some improvements that can be made in the classroom and during teacher preparation. In this chapter I will report my conclusions and implications for teaching mathematics. It should be noted that while this thesis discusses mathematics explicitly, these same implications might have a place in other content area classrooms as well.

With the support given to teachers in mathematics textbooks, teachers must be acquainted with cognitive and instructional strategies. It is imperative that teachers understand how to use cognitive strategies themselves and are able to explicitly teach cognitive strategies to their students. Readers who are given cognitive strategy instruction make significant gains on comprehension compared to students who are trained with "conventional instructional procedures" (Trabasso & Bouchard, 2002, p. 177).

Instructional strategies and strategies taught by teachers to help readers improve their comprehension. An example of an instructional strategy is the use of graphic organizers. Graphic organizers are used to help readers to organize their ideas with graphic representations of what they read and to see relationships between concepts (Trabasso & Bouchard, 2002).

One example found in *Houghton Mifflin Math's* 6th grade textbook states, "Have students graphically depict the rounding rules in a way that helps them quickly understand how to use them when making numerical estimates" (*Houghton Mifflin Math*, 2007, p. 12). This literacy strategy is assigned by the teacher to help students improve their comprehension of the rounding rules.

Another way to use graphic organizer as an instructional strategy would be to instruct students to fill in a concept definition map to summarize what was learned about a specific vocabulary word. Again students would be instructed to use a graphic organizer to better comprehend the text.

Although it may not be easy for teachers to help students to develop comprehension strategies, helping teachers become "good strategy teachers" will help their students confront the "complexities of learning and living" (Trabasso & Bouchard, 2002, p. 187). To implement strategy instruction in the classroom will require more than providing students with opportunities to practice the comprehension and more than knowing the value of the strategies and how to use them (Trabasso & Bouchard, 2002).

Houghton Mifflin Math and *Everyday Mathematics* both had many descriptions of literacy strategies that support teachers in their teaching of mathematics. However, these descriptions did not include explicit instruction. Without explicit instruction, a connection is missing between what is being read by students and the strategies they should be using to better comprehend the text. For example, Houghton *Mifflin Math*'s second-grade textbook states, "**Math Journal Prompt**: Draw a picture to show how you regroup 10 ones and 1 ten" (*Houghton Mifflin Math*, 2007, p. 269, original boldface). While this journal prompt may help students visualize mathematics in a way that makes sense to them, visualization is never explicitly taught to students as a strategy to better comprehend the text even though "readers who visualize during reading understand and remember what they read better than readers who do not visualize" (National Institute for Literacy, 2003, p.56).

Another example of this disconnect is found in the *Houghton Mifflin Math* (2007) sixth-grade textbook.

> Go over the list of new words with the class. Help students pronounce the words correctly and explain that they will learn about these words as they work on this unit. If students are keeping Math Journals, be sure that they enter the words and their definitions as they find them in the unit. (p. 419)

Using this example, students may be involved in vocabulary instruction as a way to promote word knowledge to enhance text comprehension. "Students learn vocabulary directly when they are explicitly taught both individual words and word-learning strategies" (National Institute for Literacy, 2003). Explicit vocabulary instruction aids reading comprehension (National Institute for Literacy, 2003). However, vocabulary instruction is never explicitly mentioned, creating a missing connection between what is being read in the text and the strategies needed to comprehend the text.

The National Institute of Literacy (2003) also emphasizes, “comprehension strategies are not ends in themselves; they are a means of helping students understand what they are reading. It is important to help students learn to use comprehension strategies in natural learning situations—for example, as they read in the content areas” (p. 56). “Multiple-strategy instruction teaches students how to use strategies flexibly as they are needed to assist their comprehension” (National Institute for Literacy, 2003, p. 54).

It is imperative to give students every opportunity to read, speak, and write mathematically (NCTM, 2000). One way teachers can do this is by creating their own literacy lesson plans to teach the strategies needed in literacy and a new set of lesson plans to teach the same strategies during mathematics using the appropriate examples. Therefore, text instruction can be improved by instruction that is explicit and helps readers use specific comprehension strategies (National Institute for Literacy, 2003, p. 49).

Comprehension strategies need to be taught explicitly, following Pearson and Dole’s (1987) guidelines. Teachers who teach both mathematics and literacy need to be aware of how these two subjects relate so that they will be able to explicitly teach comprehension strategies during reading by naming the strategy, modeling, and describing the strategy before giving the students time to practice on their own.

During mathematics, teachers need to be willing to teach the same comprehension strategies used in reading texts when teaching mathematics (National Institute for

Literacy, 2003). It is this reinforcement of comprehension strategy instruction in two different subject areas that will help students create a connection since effective comprehension strategy instruction helps readers use comprehension strategies flexibly (National Institute for Literacy, 2003).

In order for teachers to know how to use instructional strategies and teach cognitive strategies, there is a need for more information on how teachers can be effective in comprehension strategy instruction. Professional development needs to be available to provide the necessary support to instruct their students in comprehension strategies. If professional development gave teachers the experience and knowledge necessary to transfer the comprehension strategies associated with literacy into the mathematics curriculum, students would be able to meet NCTM’s (2000) vision of mathematical power for all and excellence in mathematics education.

REFERENCES

Alvermann, D., & Phelps, S. (2002). *Content reading and literacy: Succeeding in today's diverse classrooms*. Boston: Allyn & Bacon.

Altheide, D. (1987). Reflections: Ethnographic content analysis. *Qualitative Sociology, 10*(1), 65-77

Anderson, R. C. & Freebody, P. (1983). *Effects of vocabulary difficulty, text cohesion, and schema availability on reading comprehension, 18*(3) 277-294

Baker, L., & Brown, A.L. (1984). Metacognitive skills in reading. In P.D. Pearson (Ed.), Handbook of reading research (pp. 353–394). New York: Longman.

Block, C. & Pressley, M. (2002). *Comprehension instruction: Research based best practices.* New York: Guilford Press.

Carney, T. (1972). *Content analysis: A technique for systematic inferences from communications*. Winnipeg: University of Manitoba Press

Charles, R., Dossey, J., Leinwand, S., Seeley, & C., Vonder Embse, C. (1999) *Scott Foresman-Addison Wesley Math*. Menlo Park, CA: Addison Wesley Longman Inc.

Davis, F.B. (1944). Fundamental factors of comprehension in reading. *Psychometrika*, *9*(3), 285-197

De Leon, A. (2002). Moving beyond storybooks: Teaching our children to read to learn. *Carnegie Reporter, 2*(1), 3-12.

Dole, J. A., Duffy, G. G., Roehler, L. R., & Pearson, P. D. (1991). Moving from the old to the new: Research on reading comprehension instruction. *Review of Educational Research, 61*, 239–264.

Draper, R.J., (2002). School mathematics reform, constructivism, and literacy: A case for literacy instruction in t he reform-oriented math classroom. *Journal of Adolescent and Adult Literacy, 45*(6), 520-529.

Draper, R. J., & Siebert, D. (2004). Different goals, similar practices: Making sense of the mathematics and literacy instruction in a standards-based mathematics classroom. *American Educational Research Journal. 41*(4), 927-962.

Draper, R. J., Smith, L., Hall, K., & Siebert, D. (2005). What's more important—literacy or content? Confronting the literacy-content dualism. *Action in teacher education, 27(2)*, 12-21.

Dreher, M. (1993). Reading to locate information: societal and educational perspectives. *Contemporary Educational Psychology*, *18*, p.129-138

Duffy, G. (2002). The case for direct explanation of strategies. In C. Block & M. Pressley (Eds.), *Comprehension Instruction: Research-based best practices*, (28-41). New York: Guilford Press

Durkin, D. (1978–1979). What classroom observations reveal about reading comprehension instruction. *Reading Research Quarterly, 15*, 481–533.

Durkin, D. (1981). Reading comprehension instruction in five basal reader series. *Reading Research Quarterly, 16*(4), 515-544.

Durkin D, Illinois Univ. U, Bolt B. Reading Methodology Textbooks: Are They Helping Teachers Teach Comprehension? Reading Education Report No. 59. October 01, 1985. Available from: ERIC, Ipswich, MA. Accessed October 3, 2008.

Everyday Mathematics. Retrieved on November 1, 2007 from www.everydaymath.uchicago.edu.

Fraenkel & Wallen (1993). *How to design and evaluate research in education.* New York: McGraw-Hill

Heilman, A. W., Blair, T. R., & Rupley, W. R. (1998). Principles and practices of teaching reading. Upper Saddle River, NJ: Merrill/Prentice–Hall.

Hodson, R. (1999). *Analyzing documentary accounts*. London: Sage.

Holsti, O. (1969). *Content analysis for the social sciences and humanities.* Reading, MA: Addison Wesley.

Houghton Mifflin Math. Retrieved November 1, 2007 from www.schooldirect.com.

Keene, E. & Zimmerman, S. (1997). *Mosaic of thought: Teaching comprehension in a reader's workshop.* Portsmouth, NH: Heinemann

Kragler, S., Walker, C. & Martin, L. (2005). Strategy instruction in primary content textbooks. *The Reading Teacher, 59*(3), 254-261.

Krippendorf, K. (1980). *Content analysis: An introduction to its methodology*. Beverly Hills, CA: Sage.

Lesley, M. (2005). Looking for critical literacy with postbaccalaureate content area literacy students. *Journal of Adolescent and Adult Literacy, 48*(3), 320-335.

Moss, B. (2005). Making a case and a place for effective content area literacy instruction in the elementary grades. *The Reading Teacher*, *59*(1), 46-56.

National Assessment of Educational Progress (NAEP) retrieved on November 18, 2006 from http://nces.ed.gov/nationsreportcard

National Council of Teachers of Mathematics. (2000). Principles and standards for school mathematics. Reston, VA: Author

National Institute for Literacy (2003). Put reading first: The research building blocks for teaching children to read (2nd ed.). Jessup, MD

National Reading Panel, Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction: Reports of the Subgroups (Washington, D.C.: National Institute of Child Health and Human Development, 2000).

No Child Left Behind Act of 2001, Pub. L. No. 107-110, 115 Stat. 1425 (2002).

Ogle, D. & Blachowicz, C. (2002). Beyond literature circles: Helping students comprehend informational texts. In C. Block & M Pressley (Eds.), *Comprehension Instruction: Research-based best practices* (259-274). New York: Guilford Press

Paris, S.G., Lipson, M.Y., & Wixson, K.K. (1983). Becoming a strategic reader. *Contemporary Educational Psychology*, *8*, 293–316.

Paris, S. C., Wasik, B. A., & Turner, J. C. (1991). The development of strategic readers. In R. Barr, M. L. Kamil, P. B. Mosenthal, & P. D. Pearson (Eds.), Handbook of reading research (Vol. 2, pp. 609–640). New York: Longman.

Pearson, P.D., & Dole, J. (1987). Explicit comprehension instruction: A review of research and a new conceptualization of instruction. *The Elementary School Journal, 88(2)*, 151-165.

Pressley, M. (2002). Comprehension strategies instruction: A turn-of-the-century status report in C. Block & M. Pressley (Eds.) Comprehension instruction: Research based best practices (pp. 11-27). New York: Guilford Press.

Schmar-Dobler, E. (2003). Reading on the Internet: The link between literacy and technology. *Journal of Adolescent & Adult Literacy, 47*(1), 80-85.

Smith, M. C. (2000). The real-world reading practices of adults. *Journal of Literacy Research 32*(1) 25-52.

Snowball, D. (1995). Building Literacy Through Nonfiction. *Teaching PreK-8 25*(8) 63-63

Stephens, E. & Brown, J. (2000). *A handbook of content area literacy strategies: 75 practical reading and writing ideas*. Norwood, MA: Christopher Gordon.

Texas Reading Initiative (2002). Retrieved on November 30, 2008 http://ritter.tea.state.tx.us/reading/

Topping, D., & McManus, R. (2002). *Real reading, real writing: Content area strategies*. Portsmouth, NH: Heinemann

Trabasso, T & Bouchard, E. (2002). Teaching readers how to comprehend text strategically. In C. Block & M Pressley (Eds.), *Comprehension Instruction: Research-based best practices* (176-200). New York: Guilford Press

Utah State Core retrieved on August 13, 2007 from http://www.uen.org.

Vacca, R.T., & Vacca, J.A.L. (2002). *Content area reading: Literacy and learning across the curriculum* (7th ed.). Boston: Allyn and Bacon.

van den Broek, P., & Kremer, K. E. (2000). The mind in action: What it means to comprehend during reading. In B. M. Taylor, M. F. Graves, & P. van den Broek (Eds.), *Reading for meaning: Fostering comprehension in the middle grades* (pp.1-31). Newark, DE: International Reading Association.

Venezky, R. (2000). The origins of the present-day chasm between adult literacy needs and school literacy instruction. *Scientific Studies of Reading, 4*(1) 19-39

Venezky, R. (2002). Introduction to this special issue: Reading development in adults. *Scientific Studies of Reading, 6*(3) 217-220

Yopp, R. H., & Yopp H. K. (2000). Sharing informational text with young children. *Reading Teacher, 53*, 410-423

APPENDIX

Appendix A

Strategies of Comprehension Instruction

Cognitive Strategies

Before reading
Activate prior knowledge (eg. Students recall prior knowledge to increase comprehension)

Vocabulary instruction (eg. Promotes word knowledge to enhance comprehension before reading)

During reading
Question answering (eg. Teach students to find answers in the text)

Question generation (eg. Teach students to self question while reading a text)

Vocabulary instruction (eg. Promotes word knowledge to enhance comprehension while reading)

After reading
Summarization (eg. Makes readers more aware of how ideas in the text are related)

Vocabulary instruction (eg. Promotes word knowledge to enhance comprehension after reading)

Instructional Strategies

Before reading
Activate prior knowledge (eg. The reader infers and elaborates on what was read while filling in incomplete information.)

Graphic organizers (eg. A graphic representation of what was read and relationships between concepts)

During reading
Question answering (eg. Focuses student on specific text to find answers)

Question generation (eg. Employ questions to help readers comprehend text)
Graphic organizers

After reading
Graphic organizers (eg. A graphic representation of what was read and relationships between concepts)

Mnemonic instruction (eg. A picture or concept is used to generate an internal association if concepts)

Appendix B

TEXTBOOK REVIEW: GRANITE SCHOOL DISTRICT

Title/Publisher: ____

Reviewer Number: __________________ Overall Rank: __________

By using this program, *students* learn to:	**Does not meet criteria**	**Somewhat meets criteria**	**Meets criteria**	**Exceeds criteria**
1. Learn mathematics through a variety of problem solving opportunities. Supporting Evidence:	1	2	3	4
2. Develop new mathematical knowledge by connecting and building on prior knowledge. Supporting Evidence:	1	2	3	4
3. Develop a variety of strategies for computation. Supporting Evidence:	1	2	3	4
4. Communicate mathematical ideas both oral and written, using age-appropriate terminology and notation. Supporting Evidence:	1	2	3	4
5. Recognize and apply mathematics in contexts outside mathematics, including other subject areas and real world applications. Supporting Evidence:	1	2	3	4
6. Make sense of mathematics through the use of manipulatives and technology. Supporting Evidence:	1	2	3	4
7. Explain their thinking and consider the reasonableness of their answers. Supporting Evidence:	1	2	3	4
The program provides *teachers* with:				
8. Background material for teachers who may need additional information about a particular topic of mathematics and student thinking. Supporting Evidence:	1	2	3	4
9. Suggestions for initiating mathematical discussions, both oral and written, including effective questioning techniques. Supporting Evidence:	1	2	3	4

10. Background information about student learning, including prior knowledge, effective strategies and ways of thinking, and possible misconceptions. Supporting Evidence:	1	2	3	4
11. Various forms of assessments, both formative and summative, including rubrics and scoring samples, included before, during, and after instruction. Supporting Evidence:	1	2	3	4
12. Support materials to meet the individual needs of students, including second language learners, special needs, gifted, etc. Supporting Evidence:	1	2	3	4
13. Assessments that focus on students' understanding (explain their reasoning) as well as procedural skills (practice). Supporting Evidence:	1	2	3	4
14. A lesson structure with support materials that are "user-friendly" for teachers. Supporting Evidence:	1	2	3	4
15. Assistance with utilizing technology in appropriate situations. Supporting Evidence:	1	2	3	4

The program provides:

16. Examples and exercises that are mathematically accurate using age-appropriate language. Supporting Evidence:	1	2	3	4
17. Differentiated practice (routine, application, challenging) to meet the individual needs of students. Supporting Evidence:	1	2	3	4
18. Sufficient practice for students to develop and retain conceptual and computational fluency. Supporting Evidence:	1	2	3	4
19. Initial training and on-going assistance for teachers using the program.	1	2	3	4

Other considerations not listed above:

Overall holistic score: 1 2 3 4

Rationale for your score, including strengths and weaknesses of the program in relation to student experiences and the teacher's role:

Appendix C

Houghton Mifflin Math Coding Table

	Grade 2	Grade 4	Grade 6
Instructional Strategies			
Question Generation Teachers employ question generation to help readers comprehend	3		
Question Answering Teaches students how to find answers available in the text	384, 545,	61, 104A, 128, 216	
Mnemonic Instruction Memory aid to generate an internal association of concepts	221	435	49, 362
Graphic organizers • Teach readers to organize their ideas with graphic representations of what they read • Readers see relationships between concepts	437B, 547, 553A, 579, 599, T67, T68	156A	12, 86, 350, 373
Vocabulary Instruction Promotes word knowledge that enhances text comprehension	4, 11, 134, 174, 27A, 29A, 31A, 63A, 77A, 81A, 83A, 87A, 89A, 91A, 95A, 125A, 127A, 129A, 135A, 145A, 147A, 147A, 149A, 151A, 155A, 157A, 181A, 183A, 185A, 191A, 193A, 197A, 209A, 211A, 229A, 231A, 235A, 263A, 265A, 267A, 291A 327A, 351A, 357A, 383A, 383B, 391A, 411B, 433A, 435A, 441, 475,	1B, 1C, 4A, 6A, 10A, 14A, 16A, 24A, 26A, 30A, 38A, 40A, 60A, 61, 62A, 70A, 72A, 84A, 88A, 90A, 102A, 110A, 112A, 116A, 117, 126A, 140, 142, 143, 202, 205, 206A, 214A, 251, 252A, 254A, 262A, 271, 280A, 300, 302, 312A, 318A, 320A, 322A, 326A, 334A, 336A, 344A, 356A, 366A, 376A, 378A, 380A, 382A, 401,	1C, 87, 113, 132A, 142A, 156A, 164A, 183, 188A, 194A, 200A, 210A, 214, 216A, 220A, 234A, 238A, 240, 244A, 246A, 248A, 271A, 274A, 324, 326A, 350, 354A, 356A, 358A, 360A, 364A, 368A, 374A, 382A, 386A, 388A, 390A, 400A, 419, 422A, 424A, 248A, 436A, 462A, 470A, 472A, 478A, 522, 526A,

	479A, 483A, 485A, 489A, 491A, 493A, 507A, 511A, 513A, 515A, 519A, 521A, 553A, 557A, 561A, 577A, 583A, 593A, 597A, 611A, 613A, 615A, 619A, 631A, 633A, 641A,	404A, 410A, 412A, 416A, 422A, 430A, 434A, 440A, 452A, 454A, 456A, 468A, 490A, 492A, 494A, 508A, 516A, 528A, 530A, 542A, 544A, 570A, 96A, 598A, 602A, 608A, 616A, 618A, 620A, 624A	528A, 536A, 540A, 552A, 558A, 564A, 585, 588A, 592A, 618A, 620
Activate Prior Knowledge • Helps the reader infer and elaborate on what was read • Helps the reader fill in missing or incomplete information			
Visualization	29B, 30, 32, 42, 51B, 56, 269, 317, 321D, 323A, 323B, 324 (P.S. 12.1), 326 (PS 12.2), 333A, 333, 334, 336 (#11), 337, 339, 389, 391A, 396,	1B, 10A, 13, 276, 378A, 435	91, 109, 131, 193, 245, 289, 498
Cognitive Strategies			
Question Answering Increase memory for what was read by helping readers through the why and how questions	521		
Question Generation Integration and identification of main ideas	330, 361		
Activate Prior Knowledge Help students recall prior knowledge to aid in comprehension	51A, 53A, 57A, 133A, 137A, 199A, 271A, 273A, 335	40A, 40, 64A, 68A, 74A, 92A, 94Z, 98A, 100A, 146A, 148A, 164A, 172A, 178A, 208A, 210A, 220A, 228A, 230A, 234A, 240A, 264A, 272A, 306A, 308A, 310A,	4A, 6A, 8A, 10A, 20A, 22A, 32A, 36A, 38A, 46A, 48A, 50A, 58A, 60A, 62A, 66A, 70A, 72A, 90A, 92A, 94A, 98A, 112A, 126A, 130A, 150A, 160A, 162A, 198A,

		364A, 384A, 436A, 470A, 524A, 546A, 550A, 558A, 568A, 604A, 628A	282A, 288A, 302, 304, 306, 320, 432A, 444A, 446A, 452A, 454A, 464A, 474A, 532A, 538A, 544A, 554A, 560A, 590A, 606A
Summarization Make readers more aware of how ideas are related and how text is structured	292, 328, 450,	409, 619	350

Appendix D

Everyday Mathematics Coding Table

	Grade 2	Grade 4	Grade 6
Instructional Strategies			
Question Generation Teachers employ question generation to help readers comprehend			
Question Answering Teaches students how to find answers available in the text			
Mnemonic Instruction Memory aid to generate an internal association of concepts			527
Graphic organizers Teach readers to organize their ideas with graphic representations of what they read Readers see relationships between concepts	342		
Vocabulary Instruction Promotes word knowledge that enhances text comprehension	19, 30, 50, 72, 73, 98, 112, 115, 118, 255, 261, 287, 293, 328, 333, 356, 385, 393, 413, 417, 423, 577, 667, 695, 700, 702, 733, 765, 815, 829, 825, 826, 831, 879, 880, 885, 903	15, 25, 30, 32, 37, 38, 42, 43, 45, 49, 53, 56, 59(?), 90, 95, 96, 99, 108, 114, 115, 118, 120, 125, 133, 156, 164, 165, 168, 181, 185, 196, 202, 204, 205, 207, 215, 245, 251, 256, 267, 269, 273, 279, 282, 310, 316, 319, 326, 328, 330, 339, 350, 357, 363, 362, 401, 418, 426, 427, 430, 432, 433, 436, 438, 439, 442, 444, 445, 450, 451, 571, 572, 575,	24, 26, 28, 29, 44, 49, 50, 54, 61, 64, 70, 77, 78, 97, 104, 105, 107, 109, 110, 115, 119, 122, 136, 140, 142, 148, 149, 153, 161, 181, 182, 192, 197, 206, 204, 207, 215, 216, 218, 227, 226, 255, 256, 263, 273, 274, 295, 314, 337, 342, 347, 352, 357, 358, 361, 364, 365, 370, 376, 383, 399, 400, 406, 416, 424, 425, 532, 536, 543, 549, 555, 556, 562.,

		583, 584, 586, 604, 637, 660, 669, 671, 674, 682, 683, 694, 695, 743, 761, 795, 801, 806, 811, 817, 818, 823, 824, 848, 855, 856, 861, 868, 871, 911, 928, 954	563, 568, 572, 573, 574, 578, 586, 589, 591, 592, 595, 597, 598, 623, 628, 634, 640, 641, 652, 657, 691, 693, 698, 702, 712, 717, 723, 724, 743, 749, 758, 762, 799, 800, 803, 805, 811, 817, 842, 853, 855, 858, 861, 881, 882, 885, 887, 891, 893, 897, 899, 900, 902
Activate Prior Knowledge Helps the reader infer and elaborate on what was read Helps the reader fill in missing or incomplete information	771	42, 115,	
Visualization	49, 50, 63, 98, 115, 200, 222, 228, 264, 270, 286, 287, 292, 293, 294, 330, 336, 341, 347, 410, 417, 423, 547, 563, 580, 608, 614, 629, 664, 681, 692, 697, 741, 746, 756, 773, 778, 822, 823, 848, 869, 888, 894, 898	185, 207, 270, 282, 319, 418, 430, 442, 586, 637, 674, 686, 761, 804	26, 64, 70, 107, 122, 161, 207, 218, 361, 536, 589, 595, 657, 702, 797, 803, 858, 885, 902
Cognitive Strategies			
Question Answering Increase memory for what was read by helping readers through the why and how questions		185,	
Question Generation Integration and identification of main ideas			
Activate Prior			28

Knowledge Help students recall prior knowledge to aid in comprehension			
Summarization make readers more aware of how ideas are related and how text is structured	828, 834, 981		