A DESCRIPTIVE STUDY OF NORTHWEST OHIO SEVENTH GRADE MATH
TEACHERS’ ATTITUDES AND STRATEGY INTEGRATION USED TO PROMOTE
LITERACY IN THE CLASSROOM

Kerry L. Helm

A Thesis

Submitted to the Graduate College of Bowling Green
State University in partial fulfillment of
the requirements for the degree of

MASTER OF EDUCATION

August 2005

Committee:

Dr. Cindy Hendricks, Advisor
Dr. Trinka Messenheimer
Dr. Rachel Vanatta
Junior high math students are faced daily with worksheets, textbook assignments, and projects that require a substantial amount of reading and writing. From technical vocabulary to reading story problems, students are faced with literature across the content areas. Therefore, if a student is a struggling reader, these seemingly trivial assignments could quickly become overwhelming and tedious. However, some teachers still believe that math class is where students learn about the manipulation of numbers and symbols and that teaching students to read is not their responsibility.

Therefore, for this study, the research question posed was four-fold: (a) What are the attitudes of math teachers in northwest Ohio’s seventh grade classrooms towards integrating reading into their instruction? (b) What types of tools and strategies do seventh grade math teachers provide to integrate reading into their math instruction? (c) What are the teachers’ perceptions of the effectiveness of selected tools and strategies? and (d) What correlation lies between the teachers’ attitudes towards literacy integration into math instruction and the frequency with which they actually do so?

A twenty-three item survey was designed and mailed to all northwest Ohio seventh grade math teachers in public schools. The strategies included were: directed reading-thinking activity, journals and learning logs, graphic organizers, KWL, notetaking, question-answer relationships, and vocabulary activities. Overall, results indicate that seventh grade math teachers support the integration of literacy into their classrooms.
Furthermore, the most frequently used strategy was notetaking and the most effective strategy was identified as Question-Answer Relationships. Finally, results indicate an overall significant correlation between teachers' attitudes toward literacy integration and amount of times that they actually do utilize the given strategies.
Dedicated to my Dad, Mom, Brad, and Amy for all their love, support, encouragement, and dedication throughout my academic and athletic journeys.
ACKNOWLEDGMENTS

I would like to express my appreciation and thanks to those who contributed to the completion of this research. I will be forever grateful for the time, effort, and support of my committee members, Dr. Cindy Hendricks, Dr. Trinka Messeneheimer, and Dr. Rachel Vanatta. A special thank you to my committee chair, Dr. Hendricks, for your patience and guidance in writing this "little book report." Thank you to the entire Reading Center gang for all your encouragement, advice, and laughter over the past year of classes, work, and thesis writing.

Thank you to all the participating teachers who aided in the data collection. Your dedication to the continuation of educational research is admired and commended.

Thank you to my mom, dad, brother, and sister for their encouragement throughout my graduate experience and the writing of this thesis. Without your love and support, I would not have made it here at the "big school." Thank you to the Georgia Girls, Lindsay Luidhardt and April Bils, for keeping me focused, encouraging me every step of the way, and teaching me all the tricks of the trade in Falcon Country. Thank you to Nate for all your support, patience, and encouragement over the past year. You were my rock during writing this thesis, going to class, and job searching. Last but not least, thank you to Grandma Betty for making sure I had clean clothes and cupcakes to get me through the rough weeks.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Statement of the Problem</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Research Questions</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Rationale</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Definition of Terms</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Limitations</td>
<td>6</td>
</tr>
<tr>
<td>II</td>
<td>REVIEW OF LITERATURE</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Attitudes of Teachers Toward Content Area Reading</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Strategies for Teaching Reading in the Middle Grades Math Classroom</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Directed Reading-Thinking Activity</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Journals and Learning Logs</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Graphic Organizers</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>KWL</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Note-taking</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Question-Answer Relationship (QAR)</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Vocabulary Activities</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Summary</td>
<td>35</td>
</tr>
<tr>
<td>III</td>
<td>METHODS AND PROCEDURES</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Methods</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Research Design</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Participants</td>
<td>36</td>
</tr>
</tbody>
</table>
APPENDIX B. ATTITUDES OF SEVENTH GRADE MATH TEACHERS TOWARD
LITERACY INTEGRATION................................................................. 70
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mean Responses of Survey Questions 1-15</td>
<td>43</td>
</tr>
<tr>
<td>2</td>
<td>How Often Seventh Grade Teachers Are Integrating Literacy</td>
<td>46</td>
</tr>
<tr>
<td>3</td>
<td>Literacy Strategy Effectiveness in a Seventh Grade Math Classroom</td>
<td>49</td>
</tr>
</tbody>
</table>
### LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Frequencies of Literacy Strategy Integration</td>
<td>45</td>
</tr>
<tr>
<td>2</td>
<td>Literacy Strategy Effectiveness in a Seventh Grade Math Classroom</td>
<td>48</td>
</tr>
<tr>
<td>3</td>
<td>Correlation of Use Frequency with Reading Attitudes</td>
<td>51</td>
</tr>
</tbody>
</table>
CHAPTER I. INTRODUCTION

Reading and math are two skills people of varied ages use simultaneously as well as daily in their lives. From reading a recipe to reading a map, adolescents and adults combine reading and math skills to be functional in today’s world. However, the National Adult Literacy Survey (NALS), a study of 14,000 adults ages 16 and over, revealed that 44 million adults could not read well enough to read the label on a food can (National Institute for Literacy, 2002). In spite of these alarming statistics, middle childhood education still tends to focus on subject-matter (mathematics, science, social studies, English), while the sole responsibility for teaching reading lies with the primary teachers (grades K-3), leaving 37% of fourth-graders and 26% of eighth graders reading below the basic level (The Nation’s Report Card, 2003). Therefore, ways in which to more efficiently prepare adolescents for higher education and the real world in the area of literacy has become a focus for many researchers.

Over the years, researchers have found that “literacy levels of secondary students are directly correlated to their academic achievement across the curriculum” (Fisher & Frey, 2004, p. 2); yet most middle childhood students are not enrolled in a specific reading class. Where are they learning and practicing to read? Even though “student achievement is the responsibility of all educators regardless of their specific content area” (Fisher & Frey, p. 2), many teachers today have varying attitudes when it comes to teaching reading across the curriculum, especially in a math classroom where numbers and symbols form the basis of instruction as well as the text.

Statement of the Problem

According to Bintz and Moore (2002), “math teachers know math, but often have little knowledge of and experience with using literature to teach math” (p. 26). Because academic licenses for middle childhood teachers are designed for two concentrations from any
combination of the four main subject areas (math, science, social studies, and reading/language arts), a middle childhood (grades 4-9) teacher may hold concentrations in math and science with no reading background at all and be expected to integrate literacy into his/her classroom. Teachers are not prepared to take on the tedious and time-consuming task of aligning the state standards with their curriculum and textbook all the while incorporating supplemental literacy; therefore, they simply choose not to include literacy instruction. Summarizing Jackson’s 1979 study of 150 junior and senior high school teachers in four states across the United States, Gillespie and Rasinski (1989) concluded that “half of those surveyed felt they were not optimally qualified to teach the reading skills needed in the content areas” (p. 52).

On the other hand, some teachers believe that math class is where students learn about the manipulation of numbers and symbols only from a textbook, and that teaching students to read is not their responsibility. A study conducted by the United States Department of Education (1997) showed that 60% of U.S. teachers described their goals for their students in terms of what they can do. On the other hand, only 24% described goals related to understanding subject matter. With the large demand on meeting the academic content standards, teachers become bogged down with quantity of instruction versus quality. As long as students can crunch the numbers necessary to complete an algorithm, teachers may have to move on regardless of comprehension. Gillespie and Rasinski (1989) reported in their literature review that a study conducted with 210 principals, 185 reading specialists, and 216 content teachers in Pennsylvania, “the authors concluded that content area teachers have apparently abdicated their responsibility for helping the poor reader” (p. 47). Apparently, teachers may believe that they simply do not have the time to teach two subject areas: reading and math.
According to Gillespie and Rasinski (1989), the major factor influencing teachers’ attitudes toward content area reading was “content area responsibility” (p. 46). Teachers supported the idea of integrating reading instruction in their math, science, social studies, and/or language arts classroom; however, they were concerned about the time needed to successfully implement reading, because they are required to cover a vast array of subject matter throughout the school year.

Furthermore, as in all businesses, finances play a key role in the opportunities that await the employees. School systems are no different. To foster reading in the math classroom, an additional set of materials outside of the textbook may need to be purchased to accommodate every level of student in the middle childhood math classroom. Because even though the students may come to class grouped by mathematical ability, they still may bring a wide range of reading levels (Bintz & Moore, 2002). Humphrey (2002) states, “The approximate cost of supplementary print materials for a middle-grades reading teacher—including a variety of levels that feature comprehension, fluency, and vocabulary—is $2,000” (p. 757). There are many schools that simply cannot afford this extra expenditure, and therefore would not be able to properly run a middle grades curriculum that fosters reading in the math classroom.

Research Questions

While much research has been conducted hypothesizing whether the teaching reading in the content areas is beneficial for the student, little research shows the attitudes of the teachers on this controversial issue and which procedures work best in a math classroom in northwest Ohio. Sturtevant and Linek (2003) explain, “It remains that much more is known about teachers who seem to have difficulty blending literacy strategies into content instruction than about the perceptions, beliefs, and experiences of those who are somewhat to very successful in doing so”
Therefore, the research question posed was four-fold: (a) What are the attitudes of math teachers in northwest Ohio’s seventh grade classrooms towards integrating reading into their instruction?” (b) What types of tools and strategies do seventh grade math teachers provide to integrate reading into their math instruction? (c) What are the teachers’ perceptions of the effectiveness of selected tools and strategies? and (d) What correlation lies between the teachers’ attitudes towards literacy integration into math instruction and the frequency with which they actually do so? A survey will be sent to northwest Ohio seventh grade math teachers for data collection.

Rationale

Students who cannot read or struggle with reading and comprehending the mathematics textbook are likely to have greater trouble grasping difficult mathematical concepts. According to Fisher and Frey (2004), “Mathematical textbooks are distinctly different from those encountered in other content areas” (p. 6). Therefore, it is the teacher’s responsibility to ensure comprehension of the materials chosen for students to reach their full potential in the classroom.

Additionally, reading and writing are complimentary processes. Both reading and writing are used simultaneously to ensure comprehension of text. Communication in the form of writing has been shown to enhance children’s potential for learning in the math classroom (Dickson, 1995). Therefore, providing students with specific literary strategies to supplement and add to the required text is likely to ensure greater success for students.

Finally, research (Gillespie & Rasinski, 1989) shows that to be an effective teacher of reading one must have a positive attitude toward reading instruction. As reflective decision makers, teachers need to contemplate how they intend to approach the teaching of reading in the math classroom and analyze the research to determine the most widely practiced and effective
tools, strategies, and environment that enhance literacy integration into the math classroom.

According to Gillespie and Rasinski, “teachers attitudes toward reading have been identified as a potential obstacle because the nature of content area teachers’ attitudes toward reading instruction has not been fully explicated” (p. 46).

**Definition of Terms**

This section defines terminology necessary to understand this study. The terms are in alphabetical order.

1. **Achievement Levels**- “Performance standards set by the National Assessment Governing Board (NAGB) to provide context for interpreting student performance on the National Assessment of Educational Progress (NAEP). These levels are used to report what students should know and be able to do at the Basic, Proficient, and Advanced levels of performance in each subject area and at each grade assessed” (The Nation’s Report Card, 2003, p. 2).

2. **Content Areas**- Refer to specific subject areas (English, math, social studies, and science) in the junior high and high school setting (Fisher & Frey, 2004). The focus of this study was the content area of math.

3. **Content Area Literacy**- practices dealing with reading and writing about narrative and expository text, any supplemental material, and/or Internet material in a specific subject area classroom (English, math, social studies, and science) (Bean, 2001).

4. **Middle Grades**- refers to children in grades six through eight for this study. However, seventh grade is the main focus for this particular research investigation.

5. **Supplemental Material**- any extra material that a teacher brings to the classroom in addition to the required textbook.
Limitations

This study was limited to seventh grade math teachers in northwest Ohio, which is a predominately rural region. Therefore, the demographics, including race, religion, ethnicity, and socioeconomic status of the area studied are not representative of the country on a whole. In addition, the survey was only sent to math teachers; therefore, the research is not able to be generalized for all content areas. Furthermore, this study only includes public school districts, which excludes any data from private and parochial school systems in northwest Ohio. Moreover, the survey instrument required teachers to self-report. Therefore, the teachers may have responded in ways that were expected rather than respond truthfully or accurately.

In addition, the survey was designed with the assumption that teachers were familiar with the given literacy strategy terminology. Therefore, if teachers misunderstood or misinterpreted the terminology used in the survey, then the accuracy of their responses may be limited. For example, participants may have assumed that the Question-Answer Relationship (QAR) strategy simply involved the teacher asking questions and the students answering. However, this study intended QAR to involve students categorizing the type of question that textbooks or worksheets are asking—Right There, Think and Search, or On My Own (Raphael, 1982). Furthermore, teachers may not be familiar with all given strategies, which may also alter results.
CHAPTER II. REVIEW OF LITERATURE

Trela (2004) explains the differences in reading instruction between the early years and middle school grades, “In early grades children learn to read—in later grades they read to learn. At least that’s how educators hope school systems work” (p. 4). Unfortunately, this ideal picture is not the one always implemented in middle schools (grades six through eight) today. Many middle school students still cannot read or struggle with writing and reading and are not receiving any formal reading instruction because their course schedule consists of all content areas (math, science, social studies, and English). Because middle grades teachers may believe they are unqualified to teach reading in their content area, or they may believe that they do not have the time, and/or they may believe that they do not have the materials necessary to provide reading instruction to their students, they simply choose not to incorporate reading in their daily instruction. Furthermore, middle grade teachers assume that students leave elementary schools equipped with the necessary reading skills (Blanton, 1991). Regrettably, according to Sturtevant and Linek (2003), “few reports of middle and secondary teachers who have experienced success in blending effective literacy practices into their content instruction are available” (p. 75).

In the middle grades math classroom, students who cannot read or struggle with reading suffer when attempting to comprehend a textbook, which is full of symbols, notations, and a high degree of technical vocabulary. Therefore, for this investigation, the research question posed was four-fold: (a) What are the attitudes of math teachers in northwest Ohio’s seventh grade classrooms towards integrating reading into their instruction?” (b) What types of tools and strategies do seventh grade math teachers provide to integrate reading into their math instruction? (c) What are the teachers’ perceptions of the effectiveness of selected tools and strategies? and (d) What correlation lies between the teachers’ attitudes towards literacy
integration into math instruction and the frequency with which they actually do so? This chapter summarizes previous studies on the attitudes of teachers towards content area reading and includes a discussion of research-based reading strategies typically incorporated into content classrooms.

**Attitudes of Teachers Toward Content Area Reading**

While the middle grades represent a significant time in a student’s life intellectually, emotionally, physically, and mentally, it is also this time that students “solidify conceptions about themselves as learners of mathematics” (National Council of Teachers of Mathematics [NCTM], 2004b, p. 1). Therefore, throughout their middle grades mathematical experience, according to NCTM, students will learn to “use their emerging capabilities of finding and imposing structure, conjecturing and verifying, thinking hypothetically, comprehending cause and effect, and engaging in abstraction and generalization” (2004b, p. 1). However, these in-depth goals will be difficult to achieve if the student cannot read or struggles with reading. If the classroom teacher is not implementing reading strategies for the non-reader or struggling reader, it will be difficult for the student to be successful; therefore, Readence, Kile, and Mallette (1998) believe it is necessary to investigate teachers’ beliefs and attitudes about literacy in the math classroom.

The answer to the students’ problems with reading the required textbook may be a result of the teacher’s attitude toward the problem (Vaughn, 1977). Vaughn believed that researchers needed a method to measure teachers’ attitudes toward content area reading. Therefore, he developed a system to assess attitudes that has been investigated for construct validity in three studies, unlike any of the other past questionnaires, checklists, or Likert scales that have attempted to measure teacher attitudes (Vaughn). According to Vaughn, the research
investigations clearly demonstrated the reliability and validity of his scale. He believes the reliability and validity studies add strength to his scale.

Vaughn’s scale (1977) consists of fifteen statements with nine positive items and six negative items regarding teachers’ attitudes toward teaching reading in the content areas. Responses to the attitude survey require the use of a seven-point Likert scale, which reportedly provides greater reliability versus the typical five-point scale (Vaughn). Responses can range from a seven (the teacher strongly agrees with the statement) to a one (the teacher strongly disagrees). Other acceptable responses in Vaughn’s scale are “agree, tend to agree, neutral, tend to disagree, and disagree” (p. 607). Furthermore, the scale can be administered individually or in groups, and the teachers are not subject to a time constraint while they are responding. When scoring the final results, whether the item is positive or negative needs to be taken into account, because “the negative items should be scored in reverse from the positive items” (p. 608). Vaughn provides a table to assist in scoring and ensure correct interpretation of the results.

While this scale was designed to calculate and determine teachers’ attitudes toward content area reading, it has been useful in a variety of situations. For example, the University of Arizona used this scale as a pre and post test for classes dealing with preservice teachers who were supposed to be learning strategies and techniques to incorporate literacy into their future content area classroom (Vaughn, 1977). Additionally, the scale has been given to reading professors, reading coordinators, and reading specialists and was used during an evaluation of several junior high school reading programs in an attempt to determine the staff’s attitudes toward content reading. According to Vaughn, even though the scale is given to teachers, the purpose is to help students learn better.
Farrell and Cirrincione (1984) conducted a study surveying 224 randomly selected content area Oregon teachers. The results of the study revealed that all teachers believed they were qualified to teach reading, and they all believed that teaching reading was highly beneficial. In addition, it is worth noting that since 1973, the state of Oregon has required all secondary teachers to complete a content area reading course (Farrell & Cirrincione). Therefore, Hock and Deshler (2003) assert the need for a change in all preservice teacher preparation programs. They suggest that by giving added attention to strategies and methods for effective literacy instruction with adolescents during undergraduate programs, teachers will feel more prepared to integrate literacy strategies to ensure comprehension across the curriculum and students will benefit greatly.

Usova (1979) surveyed 210 principals, 185 reading specialists, and 216 content area teachers in Pennsylvania about their attitudes toward reading instruction. Usova found no significant differences in rural, urban, and suburban teachers’ mean attitude scores. Further, Usova’s results indicated that reading specialists had significantly more favorable attitudes toward the teaching of reading than did principals or content area teachers, and principals had significantly more positive attitudes than did content area teachers. It is appropriate to note that reading specialists had more reading instruction training than principals and general education teachers, and in the state of Pennsylvania, principals were required to complete a course in reading instruction, while content area teachers were not. Usova concluded that for content area teachers to have positive attitudes toward reading instruction, they should be provided with proper training to be successful teachers of reading. Therefore, Hock and Deshler (2003), fully support “professional development programs that teach administrators and teachers how to implement scientifically based practices” in content area classrooms to integrate literacy
instruction (p. 34). Furthermore, they believe that current practices proven efficient and successful with adolescents through research need to be identified, described, and then used.

O’Rourke (1980) surveyed 60 junior high and 60 senior high school teachers from Nebraska who represented a variety of content areas to determine their attitudes toward reading instruction. After compiling the data, O’Rourke found that the only content area teachers responding positively toward reading instruction were the English teachers. Math teachers’ attitudes scores had a 75.5 average. Scores also showed that junior high teachers responded with a 77.3 average mean score (O’Rourke). It is clear from this investigation that math teachers were less positive than other teachers regarding incorporating reading instruction into the content areas.

Furthermore, O’Rourke (1980) found that there were no significant differences in attitudes based on years of teaching experience. Interestingly, 68% of those surveyed had neither taken a university course nor participated in a workshop on reading. There was a significant difference in attitude score between those who had not taken a reading course (74.1 average score) and those who had taken a reading course (82.3 average score) (O’Rourke). The results show that teachers surveyed believed they were unprepared and unqualified to teach reading in their content area. However, according to O’Rourke, “We have been operating on a false assumption—namely, that knowledge about teaching in content classrooms would be sufficient to convince teachers to do so” (p. 337). O’Rourke suggests additional research to investigate the relationship between teachers’ attitudes and their practices, “it is only when we focus on the results of incorporating reading into our content classrooms that we can begin to make more than just pious claims” (O’Rourke, p. 339). Therefore, Hock and Deshler (2003) strongly support and encourage further research specific to adolescent student literacy needs. They believe that we need to “make
research on adolescent literacy as high a priority in this decade as early reading was during the 1990s” (p. 35). In return, Hock and Deshler believe schools will consider adopting new and improved district-wide policies that create an overall framework devoted to literacy development for all students, which will in turn feed the need for added attention to the adolescent generation.

In addition, Putney and Cass (1998) report that over the past two decades, discussion around the correlation of math teachers’ attitudes to their instructional effectiveness has been greatly evolving. They have found that math teachers’ attitudes are closely related to the students’ scores on standardized tests. In other words, teachers tend to have more positive attitudes towards math instruction when their students are performing on or above level. However, in contrast Putney and Cass report that teachers with negative attitudes display these actions through gestures and verbal remarks, and then students tend to adopt this same mind-set. Moreover, “when surveyed to determine if the academic or affective component of teaching is more important in instruction and effective classrooms, teachers as well as students more frequently describe the affective attitudes as opposed to academic perceptions as more important” (p. 2). Therefore, teachers displaying positive attitudes in the adolescent math classroom have a greater chance of generating students with an appreciation of and understanding for mathematics. In other words, before students can be required to have a positive attitude towards mathematics, teachers must first possess and display this desired positive attitude.

While a few of the abovementioned studies may seem outdated, their results are highly beneficial, because according to Donahue (2003), teachers still “see themselves as subject area specialists, with reading relegated to English teachers or reading specialists” (p. 24). Donahue reported that even current middle schools and junior highs create a segmented environment with
teams of grades or teams of specific subject areas, which leads to a drastic decrease in communication across those barriers. Therefore, Donahue is a strong advocate for breaking down the abovementioned barriers and encouraging content area teachers in middle schools and junior highs to talk about their “common duty to ensure that all students read well” (p. 24).

Unfortunately, despite research conducted in the past, there has been little change in incorporating reading into the content areas. The studies from Oregon, Pennsylvania, and Nebraska were conducted under old teacher certification programs that were leaving teachers unprepared and unqualified to teach reading in the content areas. However, the Alliance for Excellent Education conducted a study in 2004 under the most up-to-date teacher certification programs, and they still are trying to enhance reading across the curriculum, while focusing on identifying “15 elements to improve literacy, primarily through teacher training and comprehension development” (Trela, 2004, p. 4). Therefore, regardless of all the research from past to present, there is still a need for more investigation as to how to best provide literacy instruction for adolescents.

Because eight million students from grades 4-12 could be categorized as struggling readers and almost 70% of students entering ninth grade could be considered as reading below grade level, five researchers joined with Carnegie Corporation of New York and the Alliance for Excellent Education to devise a plan to address and conquer these reading problems (Biancarosa & Snow, 2004). According to Biancarosa and Snow, “The researchers were asked to envision the kinds of changes necessary to improve student outcomes based on current knowledge of the field, while simultaneously envisioning a way to propel the field forward by building a more thorough knowledge base” (p. 10).
The report that was developed focuses on the elements of intervention that are most promising for struggling students who decode accurately but struggle with reading and writing after third grade. More specifically, the report establishes “The Fifteen Elements of Effective Adolescent Literacy Programs” to improve middle and high school literacy achievement across the curriculum immediately (Biancarosa & Snow, 2004). According to the alliance’s interim president, “We’re as a country doing very little to reach middle and high school students who have reading difficulties, and in most cases, when kids leave third grade, we’re not teaching them to read anymore” (Trela, 2004). Therefore, the plan calls for language arts teachers and content area teachers working together to use each others’ textbooks and instructional ideas to incorporate practice in reading and writing skills to specific subject areas. In addition, the plan calls for two to four hours of reading instruction and practice throughout the school day, which will require literacy to be integrated into language arts and content area classes (Biancarosa & Snow). With all of this time being devoted to literacy instruction across the curriculum, teachers need to have a variety of available strategies. Biancarosa and Snow explain:

Fortunately, a survey of the literacy field shows that educators now have a powerful array of tools at their disposal. We even know with a fair degree of certitude which tools work well for which type of struggling reader. However, we do not yet possess an overall strategy for directing and coordinating remedial tools for the maximum benefit to students at risk of academic failure, nor do we know enough about how current programs and approaches can be most effectively combined. (p. 3)

More specifically to a math classroom, Dolgin (1977) found that teachers have assumed that low intelligence was the sole issue for struggling math students, and they overlooked reading ability when striving for mathematical achievement. Dolgin suggests that this point of view
abdicates responsibility from the teachers and places it on the students. Blanton (1991) believes that math teachers see a lack of mathematics intelligence, rather than reading comprehension difficulties, as the reason for student failure in math classrooms; these teachers resort to more math instruction as the cure to the student’s problems. However, more mathematical symbols, notations, and highly technical vocabulary may cause more problems than it solves. Therefore, Blanton believes that until students can read the required material on their own, they cannot be expected to think mathematically. According to Brennan and Dunlap (1985), to read math, students must learn to integrate basic reading skills and computational skills, which could be a complicated process. Dolgin argues that the best person to teach the style of writing and technical vocabulary associated with mathematical concept development is the math teacher. Blanton believes that to help our students develop math skills, more reading instruction in the math classroom needs to occur.

The debate on whether or not content area teachers should incorporate literacy skills and strategies into their subject matter has been ongoing for over a half of a century, but according to Farrell and Cirrincione (1984), this ongoing debate must end; content teachers should realize that they are responsible for teaching reading. However, the most critical issue is whether teachers actually are teaching reading in the content areas. Vaughn (1977) believes that teachers must not only be aware of the value of teaching reading in the content areas, but they must implement what they learn into their classrooms. He adds that there is no value in teaching teachers about directed reading lessons, study guides, and vocabulary activities if that knowledge is not transferred into the classroom. Unfortunately, according to Farrell and Cirrincione (1984), the primary role of content teachers has been to be responsible for their subject; instruction in reading skills has been of secondary importance. Requiring teachers to take a course in reading
methods and altering their philosophy of reading instruction in the classroom are two totally
different concepts (Farrell & Cirrincione). While all of the previously mentioned studies discuss
teachers’ attitudes toward integrating literacy into their subject matter, “positive attitudes do not
necessarily guarantee actual or effective reading instruction in the content area classroom”
(Gillespie & Rasinski, 1989, p. 48).

Strategies for Teaching Reading in the Middle Grades Math Classroom

According to Hoffner (2004), teachers are torn between meeting the subject matter
requirements set by the Ohio Academic Content Standards and helping students become more
efficient readers; in many middle grades math classrooms, students are required to read and
comprehend vocabulary-loaded textbooks, and perform algorithms all at the same time (Baer &
Nourie, 1993). Unfortunately, according to Baer and Nourie, experience shows this approach
frequently fails. Additionally, teachers many times inaccurately assume that students come to
their classroom with the ability to read and comprehend the required mathematical text
effectively. Baer and Nourie believe that certain students are doomed for failure from the start
because they are expected to read materials that go beyond their ability levels. Therefore, it is
crucial for teachers to make changes in the instructional procedures and materials that they
choose to use to accommodate every student and ensure that everyone has the opportunity for
success in the math classroom (Baer & Nourie). Following is a brief summary of seven different
literacy strategies particularly applicable to the mathematics classroom.

Directed Reading-Thinking Activity

According to Fisher and Frey (2004), before, during, and after reading strategies are
necessary for students to successfully conquer any difficult reading endeavor. In addition, as
students reach the middle grades, comprehension requirements are heightened; therefore, it is
imperative that middle grades teachers provide research-based instruction (Schorzman & Cheek, 2004). Therefore, to focus on improving comprehension, Stauffer (1969) created the Directed Reading-Thinking Activity (DR-TA) that requires students to use their prior knowledge and experiences, decoding skills, and context clues to make sense of the text, nonfiction or fiction. According to Stauffer (1969), “it seems that all people agree that reading without understanding is not reading, and many agree also that the reading and thinking processes are almost identical” (p. 37). McIntosh and Bear (1993) noted:

Using Directed Reading-Thinking Activities (DR-TAs) is one way of enabling middle school and high school mathematics students to begin developing facility in learning from other reading materials, to learn to tap their own knowledge, and to use their textbooks more efficiently. (p. 1)

Stauffer (1969) firmly believes that for the DR-TA to be effective, the teacher must fully mediate the process from beginning to end with the use of three questions: “(1) What do you think? (2) Why do you think so? and (3) Can you prove it?” (p. 40). Furthermore, Fisher and Frey (2004) report that to promote critical thinking in the classroom through the use of a DR-TA, there are four main steps to follow. The first step is to introduce background knowledge. Next, students should make predictions. After predictions are made, students should be directed to read a section of text, stopping at predetermined places in the text so teachers can ask students to check and revise their predictions, and, fourth, after the reading is completed, students’ predictions should be used as a discussion tool. By including these procedures in a middle school math classroom, a teacher will be promoting students’ taking responsibility for their own learning and reading, since a Directed Reading-Thinking Activity provides opportunities for students to regulate, evaluate, and monitor themselves (Fisher & Frey). According to Fisher and
Frey, dividing the text into smaller portions allows the students to focus on the process of responding to higher-order questions. Chunking the text in this manner allows the reader to concentrate on concepts as well as supporting details. If used effectively, according to Tierney, Readance, and Dishner (1990), the DR-TA “has the potential to equip readers with the abilities to determine purposes for reading, extract, comprehend, and assimilate information, examine reading material based upon purposes for reading, suspend judgments, and make decision based upon information gleaned from reading” (p. 12).

According to Schorzman and Cheek (2004), it is time for in-depth investigations of instructional strategies for teaching comprehension to middle school students. Schorzman and Cheek conducted a study including 103 sixth-grade students in six classrooms divided between two middle schools in southern suburban school districts. By teaching pre-planned lessons for 28 consecutive days in one middle school and following the normal district curriculum in the other middle school, this study investigated the effectiveness of the Directed Reading-Thinking Activity, the Pre-reading Plan, and graphic organizers, which are three strategies used prevalently with middle school teachers. Sixty percent of the pre-planned lessons included Directed Reading-Thinking Activities (Schorzman & Cheek). The DR-TA method applied for this particular study involved creating a hypotheses, reading a selection of text, and revising the hypotheses. At the end of the 28-day period, the students were subjected to two assessments—one informal (cloze procedure) and one formal (Gates –MacGinitie Reading Test) (Schorzman & Cheek). The researchers reported a significant difference between the groups according to the informal assessment but no significant difference according to the formal assessment. The differences on the informal assessment (cloze procedure) suggest that intervention was effective in increasing students’ reading comprehension abilities.
Another study, which surveyed teachers who had previously taken a “Teaching Reading in the Content Area” college course, was conducted in an effort to determine which reading strategies they used most predominately in their content area classroom and why they used them (Barry, 2002). A total of 123 returned surveys were evaluated (Barry). Results indicated that “the sixteen mathematics teachers used an average of nine instructional strategies and that Directed Reading-Thinking Activities were used 34% of the time” (pp. 138-139). When discussing the reasons for not integrating any or all of the reading strategies, teachers responded by saying that there was not enough time; they lacked motivation, and pre-service teachers (during student teaching) simply did not have enough confidence to attempt to integrate literacy strategies into the content areas (Barry). Therefore, Barry concluded that “content reading courses have...been a godsend for teachers of the adolescents who fall into the National Assessment of Educational Progress Basic achievement level” (p. 141).

While the latter research suggests that Directed Reading-Thinking Activities are beneficial in a content area classroom when promoting comprehension, they also provide opportunities for students to share personal background information and experiences (Haggard, 1988). Directed Reading-Thinking Activities encourage student responses and attempt to provide a risk-free environment where students are not afraid to answer. According to Haggard, using a DR-TA creates a special kind of “magic” in the classroom (p. 532): “The elements of that magic are active, engaged students, discussions with depth and texture, teachers who willingly allow students to assume more and more responsibility for their own learning, and time that flies” (p. 532). McIntosh and Bear (1993) believe that many students at the middle school and high school level may be reluctant to talk in class about mathematics, so it is important for teachers to hear the students’ responses about what they like and dislike, as well as hear their questions and
concerns to better provide instruction in the future. Finally, by incorporating DR-TAs in the middle grades math classroom, students will be receiving instruction on how to draw from their prior knowledge and make valuable use of the textbook to further their mathematics and reading abilities (McIntosh & Bear).

**Journals and Learning Logs**

According to Brennan and Dunlap (1985), parents and teachers generally view reading as a process for identifying a message being conveyed by written words and they view mathematics as a computation. Brennan and Dunlap suggest that the truth is that the two subjects use very similar thought processes and techniques so children should learn to integrate the two subjects. Biancarosa and Snow (2004) report that the study conducted by the Alliance for Excellent Education identified one way to help improve adolescent literacy: integrate writing into all subject areas. Biancarosa and Snow believe that “many of the skills involved in writing, such as grammar and spelling, reinforce reading skills, and effective interventions will help middle and high school students read like writers and write like readers” (p. 19). Barry (2002) found that 73% of 123 content area teachers surveyed are using strategies to promote writing to learn in their classroom. According to Burns and Silbey (2001), a math journal is one of the most effective and efficient ways to integrate writing into a math class.

Burns and Silbey (2001) believe the use of math journals in the classroom depends on the teacher’s purposes, preferences, and the particular age and needs of his/her students. Some teachers have their students write in their journals daily by keeping all of their class notes and calculated practice problems from that day’s lesson in the journal (Burns & Silbey). Other teachers allow students to write only at the end of the math class where they ask questions, discuss what they have learned, and describe any activities that they liked or disliked from that
day (Burns & Silbey). Still others, will only use the journals on particular selected days in which
the students will respond to a teacher directed prompt or write out exactly how a problem should
be computed in words (Burns & Silbey). In one example, a teacher asked her students to write
why a square was a special kind of rectangle.

According to NCTM (2004a, p. 1), “effective mathematics teaching requires understanding
what students know and need to learn and then challenging and supporting them to learn it well.”
Therefore, by reading the students’ math journals, teachers are providing themselves the
opportunity to assess the students’ strengths and weaknesses and to evaluate students’ progress
daily or periodically (Burns & Silbey, 2001). Thus, the math journal serves as a learning tool for
the teacher and the students. Additionally, by having the opportunity to communicate with the
teacher through writing in math class, students are able to extend their thinking beyond numbers
and attempt to think through a confusing problem on paper (Burns & Silbey). According to
Burns and Silbey, “When children write in journals, they examine, express, and keep track of
their reasoning, which is especially useful when ideas are too complex to keep in their heads” (p.
1).

Commander and Smith (1996) state that journal writing assignments tend to focus on
feelings and personal reflections, which in turn ends up to be a conversation on paper between a
teacher and a student. In contrast, a learning log requires reflections on specific cognitive aspects
of subject material. However, according to Commander and Smith, assigning a grade to learning
logs should not be considered, because the main purpose of integrating a learning log into the
content area classroom is to encourage students to think in detail about their own work.
Therefore, “the learner’s private record reveals an understanding and a perception that may not
be anticipated by the teacher, and such revelations can help the teacher identify changes that
need to be made in the classroom instruction in order to get the intended result” (p. 453).

Commander and Smith believe that learning logs merge the affective domain with the cognitive but the primary focus of learning logs is on assessing cognitive development. Sanders (1985) believes learning logs are a type of informal assessment that should not replace formal assessment. Learning logs and journals provide an opportunity for students to learn from writing and a means for teachers to use when planning future instruction (Sanders).

**Graphic Organizers**

Graphic organizers are tools used by teachers to enhance textbook comprehension for students. This idea of using graphic organizers originated with Ausubel. According to Ivie (1998), “Ausubel views knowledge as representing an integrated system, [where] ideas are linked together in an orderly fashion” (p. 2). Ivie explains that Ausubel believed that if subject matter ideas are linked in our heads, then linking these ideas on paper through the use of graphic organizers would prove to be beneficial. Ivie reports that Ausubel found below average students benefited the most from using graphic organizers, because they needed assistance in arranging and categorizing their thoughts.

Barry (2002) reports that, out of 123 content area teachers surveyed, 77% used graphic organizers in their classroom. After reviewing the surveys, Barry found that teachers believed graphic organizers were beneficial for students when organizing chapters and reviewing for tests. On the other hand, one participating teacher criticized graphic organizers because they were difficult to assess (Barry). According to the Alliance for Excellent Education Research (Biancarosa & Snow, 2004), the use of instructional strategies such as graphic organizers that present math content in a visually alternative way to increase comprehension have proven to greatly enhance student performance—for all students regardless of ability level.
Research by Brennan and Dunlap (1985) demonstrates that students struggle with reading mathematical materials, and that the reading skills required to read math texts are generally one to three years above the textbook’s targeted population. Baer and Nourie (1993) suggest that because of the text difficulty, there needs to be changes in the way teachers teach including making accommodations for students to ensure that all students have an opportunity to be successful in class. To provide these adaptations for students, Baxendell (2003) has demonstrated through research that graphic organizers are effective and can be used in an inclusive classroom. Based on his research and practice, Baxendell has identified three main standards for teachers to follow to ensure student success when using graphic organizers: consistency, coherence, and creativity.

First, Baxendell (2003) states that students’ organizational skills and content retention improve when they use graphic organizers in a consistent manner. Teachers need to create and consistently use the same set of graphic organizers repeatedly so that students become familiar with the format and expectations of the teacher (Baxendell). For example, when discussing the sequence of events, the teacher should always use the same flow-chart format so that students become accustomed to the style and can focus on content versus instructional procedures. Likewise, Baxendell believes that when beginning a new chapter of the textbook, the teacher should use the same brainstorming web each time so that he/she is not wasting valuable instructional time teaching the strategy and is instead concentrating on the students’ responses. Therefore, Baxendell has found that students “are more likely to internalize and reapply, or generalize, the skills associated with given graphic organizers because of consistent application” (pp. 47-48).
Baxendell (2003) believes the chief objective of graphic organizers is to make abstract concepts and relationships clear. Therefore, to maximize the effectiveness of graphic organizers, according to Baxendell, relationships shown in graphic organizers must be obvious and easily understandable. Baxendell focuses on three key concepts when discussing graphic organizers: the graphic organizer needs to be clearly labeled, contain a limited number of concepts, and have very few illustrations, pictures, or drawings that may distract the student. Finally, when creating graphic organizers, teachers must remember to make them appealing to the students, because, according to Baxendell, students are more likely to retain the information in a graphic organizer if it is presented in a visually pleasing manner.

Throughout research and practice, Baxendell (2003) identified two graphic organizers that are specifically applicable to the math classroom. First, Baxendell describes how the implementation of flow-charts can be beneficial in math when solving word problems that involve multiple steps or calculations that require a specific sequence. For example, Baxendell’s research involved making sequence charts for organizing the steps needed to compare fractions with unlike denominators, change mixed numbers into improper fractions, and vice versa. Baxendell also believes the compare-and-contrast diagram is particularly useful in a math class. According to Baxendell, a Venn diagram can be used when finding the common multiples between two or more numbers and also when comparing units of measurement.

Ives and Hoy (2003) also investigated the use of graphic organizers in a math classroom as a means of integrating literacy into the content area. Similar to Baxendell (2003), Ives and Hoy believe that the primary purpose of using graphic organizers to learn mathematics is to recognize and learn the patterns that connect numbers, expressions and equations. Ives and Hoy believe graphic organizers should be an integral part of good instruction.
KWL

Ogle originated a strategy that helps students to assess their own learning and forces them to see how much they really have learned called the KWL strategy (Glazer & Ogle, 1994). Ogle (1986) believes that the KWL method is most effective with nonfiction texts, but it can be integrated into any grade level or content area. Many teachers are incorporating Ogle’s KWL into their classroom. Barry (2002) found that out of 123 content area teachers surveyed, 52% were incorporating the KWL strategy in their classroom. Fisher and Frey (2004) believe that the KWL is useful and flexible enough to use when introducing a new unit. Similarly, Cantrell (1997) predicts that by using the KWL concept in middle grades classrooms, students will become more engaged with the text, practice metacognition while reading, and ask questions that teachers and students can investigate as a class outside their textbook.

The KWL method involves the use of a three-column chart given individually to students or presented to the whole class on the chalkboard or overhead. Blachowicz and Ogle (2001) believe that by the teacher writing in this chart on the board or overhead, students who struggle with reading or writing skills will experience decreased anxiety, since the spotlight will be off of them. First, Ogle (1986) suggests that before reading the textbook, the students discuss what they know about the new topic and record all of their ideas in the first column (K-What I Know). In this step, “the teacher’s role is not to correct or evaluate, but to encourage and stimulate students to think broadly about what they bring to the study” (Blachowicz & Ogle, p. 108). Next, students write or suggest any questions they may have under the second column (W- What Do I Want to Learn?), which deals with anything the student wonders or inquires about the new topic (Ogle). Finally, after reading the required material, students fill in the third column with everything that they learned from the reading (L- What I Learned). Ogle believes that at this stage, every student
should have the opportunity to have his/her questions answered and discussed, since “this is what reading is all about!” (p. 567). With the KWL, the teacher is sending the message that reading and learning is not just about what an author thinks and chooses to write about, but more importantly it is about being active readers and challenging an author’s choices (Ogle).

According to Ogle (1986), both students and teachers have responded enthusiastically to the use of the KWL. Teachers informally evaluated their students’ attitudes toward the KWL, and all responses were positive (Ogle). Furthermore, principals were concerned about the amount of time that this strategy could consume if done right, but teachers overwhelmingly responded with “if we want the student to learn the content, then it isn’t time consuming at all; other strategies too often leave no evidence of learning” (p. 569). Another method used to research the KWL effectiveness was simply worksheet comparisons. In other words, teachers compared worksheets completed by students at the beginning of the year to worksheets completed at the end (after KWL implementation), and they found that students displayed an increased ability to incorporate their background knowledge and experiences to write (Ogle). Finally, Ogle also found proof of KWL effectiveness through videotape analysis. Teachers were asked to videotape their students at different points in the year to evaluate not only student progress but also teacher effectiveness. The results were all positive—“the number of students participating generally shows real gains over time; the quality of their thinking improves; and the involvement in and enthusiasm for reading nonfiction goes from lukewarm to really keen” (p. 570). Overall, according to Ogle, frequent implementation will lead to students’ independent internalization of this necessary reading process.
Note-taking

Adolescents are confronted with a multitude of content area texts, and according to Barton, Heidema, and Jordan (2002), mathematics textbooks are arguably one of the most difficult to read. Therefore, Fisher and Frey (2004) talked with a group of teachers to find out what strategies they use to accommodate the technical mathematical vocabulary, formulas, and procedures presented by the textbook. They found that note-taking was a staple in each of the teacher’s classrooms and that some believed teaching note-taking skills was necessary, while others did not see the necessity of taking class time to do so. However, Burke (2002) noted:

Taking notes is an essential skill, one that has many other subskills embedded within it.

Taking good notes trains students not only to pay attention but what to pay attention to. It teaches them to evaluate the importance of information and the relationship between different pieces of information as they read textbooks and articles. It also teaches them to organize that information into some format that serves their purpose. (p. 21)

Burke (2002) believes that if teachers are providing their students with the notes, rather than teaching them how to take notes themselves, they are doing a disservice to the students. However, a misconception may be that note-taking involves students writing page after page on lined paper. Fisher and Frey (2004) present alternative models for taking notes for mathematics students; these alternatives allow the students to condense and summarize information a variety of formats.

While Barry (2002) found that 74% of content area teachers were using note-taking strategies as teaching strategies, Bretzing, Kulhavy, and Caterino (1987) researched the effectiveness of taking notes and the significance of teaching note-taking skills to middle grades students prior to implementation. This study was conducted on 42 seventh-grade students
attending junior high school (Bretzing et al.). Seventh graders were chosen because it was predicted that once students reach junior high, they are required to listen to lectures, take notes, and then regurgitate the information on a test, which is not a common procedure in the primary grades. The study involved three separate classrooms: One class was told that note-taking is an important skill and was provided with a short training session on note-taking; one class was told that note-taking is an important skill but received no specific training, and the final class received no information or training about note-taking (Bretzing et al.). After listening to a lecture, the students completed a multiple-choice test on the material presented. Results indicated that the two groups who took notes remembered significantly more material than those who just listened. After examining the relationship between the notes and the test items, the researchers found that there was an 82% chance that an item had been written in notes if it was correct on the test. Likewise, if a student incorrectly answered a question on the test, Bretzing et al. found that there was a 65% chance that the student did not have that information in his/her notes. In addition, Bretzing et al. reported that his results indicated that typically higher achieving students did not demonstrate a greater ability to effectively use notes. Therefore, they conclude that taking notes is equally constructive for all ability levels.

Anders and Guzetti (1996) believe, “notetaking and summarizing are strategies that contribute to a student’s ability to consolidate, synthesize, and integrate new information” (p. 34). Therefore, based on their research, Bretzing et al. (1987) agree and strongly encourage middle grades teachers to incorporate note-taking strategies in their classroom; however, they point out that organized note-taking training did not increase performance levels over those students who have never specifically been trained to take notes. Fisher, Frey, and Williams (2002) report that note-taking strategies lead to deeper student engagement and reflection.
**Question-Answer Relationship (QAR)**

When students incorrectly or struggle answering questions either orally or in writing, as teachers, many times we jump to conclusions and assume that it is because the student only skimmed, read too quickly, or did not read at all. However, the exact opposite may be true according to Raphael (1982). The student may have read as carefully as he/she knows how, but unfortunately, that student may have never received instruction in “how to analyze a question in order to find the correct answer” (p. 186). Therefore, Raphael originated the Question-Answer Relationship (QAR) strategy that teaches students to evaluate and identify the type of question that is being asked to more easily find and answer the question.

McIntosh and Draper (1995) believe that as middle school students encounter mathematics books, they find that they lack the skills for effective reading. Therefore, they confirmed through their research that it is now essential for reading and math teachers to collaborate to help adolescents read their math textbooks. One way in which math teachers are attempting to make this connection is through the Question-Answer Relationship (QAR) strategy. McIntosh and Draper note that QAR is unique because it is a strategy that categorizes questions by considering the reader’s background knowledge and the text versus only taking the text into account. Therefore, QAR is a much needed strategy to apply in the middle grades math classroom if teachers are to get the greatest potential out of their students (McIntosh & Draper, 1996). According to Anders and Guzzetti (1996), many who complain about the questions that appear in a textbook do so because they (a) are not sufficiently related to the text, (b) do not encourage students to think and (c) appear to be designed to check whether or not students have read the material rather than whether or not they understood what they read.
QAR provides a framework for students to follow when answering questions, and it is also a beneficial tool for teachers to use when developing questions (Fisher & Frey, 2004). “The instructional power of QAR lies in the explicit instruction of identifying what type of question is being asked, and therefore what resources are required to answer the question” (Fisher & Frey, p. 72).

McIntosh and Draper (1995) and Raphael (1982) provide the QAR categories and definitions that they taught to their mathematics students to achieve success: First, some questions can be answered by simply finding exact words in one sentence in the text. The answer is “Right There.” However, some questions may have answers in the textbook, but one must “Think and Search” for the answer. In McIntosh’s and Draper’s investigation, if a math problem was just like an example in the text, except with different numbers, they considered this a Think and Search QAR. Furthermore, to answer yet another question, the reader must use information from the author combined with prior knowledge. These type of questions are labeled as “Author and Me QARs” by McIntosh and Draper. Finally, the reader may be able to answer a question without even looking at the text. These types of questions are categorized as “On My Own,” since a student must strictly use prior knowledge to correctly answer this question. McIntosh and Draper provided an “On My Own” example: “Negative numbers appear on television in many situations. What real situation might each number represent? (a) -5.2 in stock market averages, (b) -9 in rocket launches, and (c) -3 in golf” (p. 123). Likewise, McIntosh and Draper suggested having students draw pictures or make tables and graphs to practice the “On My Own” QAR category in the math classroom.

Unfortunately, McIntosh and Draper (1995) found that simply knowing the definitions for the types of question-answer relationships is not enough for students. Teachers need to model
and teach students how to identify which type of question-answer relationship is needed, how to use that information to help them answer textbook, and how to recognize the proper amount of contemplation and searching needed when answering questions (McIntosh & Draper). Using examples from the mathematics textbook with the question-answer relationship explanation, followed by guided practice using the textbook is necessary when attempting to integrate this strategy in a middle grades math classroom, according to McIntosh and Draper.

McIntosh and Draper (1995) taught the Question-Answer Relationship strategy in a middle school math classroom that had 75-minute class periods. According to the authors, one idea they stressed throughout the QAR unit was that the ability to answer questions and solve mathematics problems requires varying levels of book/brain involvement. To visually display this concept to the students, McIntosh and Draper provided the students with a graphic aid to describe to students that their mathematics work may be easy, hard, or somewhere in the middle, and the QAR strategy can lead them through each of the levels.

Overall, McIntosh and Draper (1996) believe that learning to read mathematics and having the proper attitude is part of learning to communicate mathematically. Furthermore, “many students do not exhibit a reading-to-learn attitude; they appear to be operating under the old notions that mathematics textbooks are repositories for problems and that their teacher is the resource for how to solve those problems” (McIntosh & Draper, p. 5). Therefore, they recommend the use of the Question-Answer Relationship in mathematics classrooms to help students become actively involved in and responsible for their own learning of mathematics. Barry (2002) concluded that 41% of content area teachers were incorporating the QAR strategy into their classroom, which means that almost a majority of teachers are aware of and using the QAR strategy. Raphael (1982) suggests four main points for teachers to remember when
implementing his QAR strategy: “give immediate feedback, progress from shorter to longer
texts, guide students from group to independent activities, and provide transition from the easier
task of recognizing an answer to the more difficult task of creating a response from more than
one source of information” (p. 27).

*Vocabulary Activities*

When students delve into their math textbook, they are often encountering the language of
a professional mathematician. Filled with foreign, technical terminology, the textbook can be
overwhelming for any student, regardless of his/her ability level. Barton, Heidema, and Jordan
(2002) point out that asking students to look up terms in a dictionary and memorize their
definitions doesn’t really help students develop an understanding of the new concepts.
Consequently, “until the mathematics teacher realizes that the students cannot read many of the
words found in the mathematics text, the child will not be successful in mathematics” (Brennan
& Dunlap, 1985, p. 155). Fortunately, Barry (2002) reported that 62% of surveyed content area
teachers were incorporating vocabulary activities in their classrooms.

Not only does understanding of words aid students’ command over math material, but it
also helps increase their comprehension and oral reading fluency (Bromley, 2003). Bromley
reports that “70 to 80 percent of comprehension is related to vocabulary knowledge, and as much
as 80 percent of fluency is connected to vocabulary knowledge” (p. 29). Blachowicz and Fisher
(2004) agree that developing a strong vocabulary promotes reading comprehension and enables
active participation in our society.

Blachowicz and Fisher (2004) discuss and describe four principles to follow when
attempting to develop students’ vocabulary and improve their reading across the curriculum.
First, they believe that teachers should allow students to play with and manipulate words in a fun
atmosphere, because when learning words is fun, students become intrigued by words and see them as useful items. Secondly, providing specific instructional strategies to expand particular vocabulary will aid students’ classroom performance. Blachowicz and Fisher suggest finding ways to connect the new words to students’ background knowledge to increase and strengthen mastery. For example, they recommend that students physically act out the word and create “synonym sets” that will provide opportunities for students to connect the words to previously learned information. Next, Blachowicz and Fisher recommend that teachers integrate strategies that will lead to students’ independence. For example, focusing on structural analysis (learning word parts, such as Greek and Latin roots) can help students learn new words while reading (Blachowicz & Fisher). By teaching students common prefixes, suffixes, and root words, teachers are providing students with skills that they can apply to all future reading material—inside and outside the classroom walls. For example, the prefixes penta-, hexa, and octa- are all used in the geometry textbook, but they are also seen in everyday newspapers and street signs. Finally, proposing that teachers integrate a wide variety of reading material into the classroom, not just textbooks, Blachowicz and Fisher present the idea of building lifelong readers.

Similarly, Vacca (2004) agrees that students miss the experience of connecting words with concepts if vocabulary is isolated in weekly word lists and tests. Therefore, he describes several strategies to incorporate vocabulary instruction in the content area classroom that emphasize how words are related to one another and that require kids to investigate and think on a higher level, rather than simply memorize definitions. First, as a means of manipulating words, Vacca recommends the use of words sorts, which involves placing words written on index cards into teacher-directed (closed sort) or student-determined categories (open sort). According to Vacca, the discussions that occur with word sorts will increase students’ comprehension and foster
retention. Likewise, Fisher and Frey (2004) agree with Vacca when they state, “word sorts can provide students with a way to arrange and rearrange words in ways that mimic the critical thinking processes they use in applying known words to comprehending new text. Readers try a variety of related words until they discover the one meaning that supports their ability to understand a passage” (p. 133).

Concept circles can be incorporated into the content area classroom to enhance and teach vocabulary, according to Vacca (2004). Concept circles help students understand the relationships among several vocabulary terms, again connecting their prior knowledge to new information (Vacca). According to Vacca, there are three main ways in which to present concept circles to students. First, by putting four related words in each quadrant of the circle, students will be required to determine the common factor between them all. For example, a concept circle with the words square, rectangle, rhombus, and kite has the commonality that all of the shapes have four sides.

Vacca (2004) also suggests creating a concept circle with one blank quadrant so that the students would be required to fill in the empty space with a vocabulary term associated with the three given terms. Finally, by providing all four words with one unrelated to the others, the students would be required to pick out the word that does not fit, and then identify the concept relationship. Vacca claims that students’ interests beyond the classroom are developed by using words sorts, graphic organizers, and concept circles and these graphic organizers are ideal for teaching math vocabulary because they show the interconnectedness of words and concepts in different contexts.

Because authors of mathematics texts do not always follow the principles of writing that students learn in language arts, graphics that combine verbal and visual word associations are
ideal for enhancing students’ technical vocabulary (Barton, Heidema, & Jordan, 2002).

Similarly, McIntosh and Draper (1996) believe that the new textbooks contain running text explanation, longer word problems, and numerical problems with verbal explanations and/or questions to be aligned with new standards. Students are expected to be able to read, comprehend, and answer questions all related to mathematical vocabulary.

Summary

Teachers’ attitudes toward integrating literacy into the math classroom and their awareness of the possible strategies and research-based recommendations has been an issue for decades. Research has shown that our middle grades students need special attention, because unfortunately, not all students can effectively read after third grade as expected. Without structured reading classes in middle schools and junior highs, adolescents are not receiving the proper reading instruction needed to succeed. Therefore, while math teachers must teach formulas, algorithms, and computation due to standards, they must also teach their students how to read technical vocabulary and extensive required texts to reach acceptable levels of success. This chapter discusses previous research on teachers’ attitudes toward literacy integration into the content area and identifies and describes seven research-based recommended literacy strategies to use in a middle grades math classroom: Directed Reading-Thinking Activity, journals and/or learning logs, graphic organizers, KWL, notetaking, Question-Answer Relationships, and vocabulary activities.
CHAPTER III. METHODS AND PROCEDURES

The purpose of this study was to answer the four part research question: (a) What are the attitudes of math teachers in northwest Ohio’s seventh grade classrooms towards integrating reading into their instruction? (b) What types of tools and strategies do seventh grade math teachers provide to integrate reading into their math instruction? (c) What are the teachers’ perceptions of the effectiveness of selected tools and strategies? and (d) What correlation lies between the teachers’ attitudes towards literacy integration into math instruction and the frequency with which they actually do so? This chapter serves as an overview of the nature of the investigation. More specifically this chapter describes the research design, population being studied, instrumentation, and data collection and analysis procedures.

Methods

Research Design

A survey design was utilized to collect and analyze data. The survey was mailed to all northwest Ohio seventh grade math teachers in public schools. The survey was reviewed by a statistical analysis expert and declared fair and appropriate before being sent out. A pilot study was not conducted prior to this study.

Participants

Participants included all responding math teachers of seventh grade students in northwest Ohio public school systems. For this study, the Ohio Department of Education was consulted to determine the sixteen counties in the northwestern part of the state. The counties included in the study were Allen, Defiance, Fulton, Hancock, Hardin, Henry, Lucas, Ottawa, Paulding, Putnam, Sandusky, Seneca, Van Wert, Williams, Wood, and Wyandot. The public schools within northwest Ohio were found on the Ohio Department of Education website.
A cover letter describing the research project and procedures for the teacher to follow was sent to all seventh grade math teachers in northwest Ohio public schools. The participant who completed the survey was then directed to return it in the self-addressed stamped envelope provided.

**Instrumentation**

A survey (see Appendix A) was developed for this study to address the four part research question: (a) What are the attitudes of math teachers in northwest Ohio’s seventh grade math classrooms towards integrating reading into their instruction? (b) What types of tools and strategies do seventh grade math teachers provide to integrate reading into their math instruction? (c) What are the teachers’ perceptions of the effectiveness of selected tools and strategies? and (d) What correlation lies between the teachers’ attitudes towards literacy integration into math instruction and the frequency with which they actually do so?

The first section of the survey asked teachers to identify demographic information, such as the school and county that they teach for. Teachers were also asked to declare their licensure area (K-3, K-8, 4-9, or 7-12), and their current teaching position(s) (math, language arts, social studies, and/or science). The first part of the research question that asks about the attitudes of math teachers towards incorporating literacy into their classroom was addressed by the participant responding to fifteen different statements originally written by Vaughn (1977) and adapted for this study (see Appendix A). The teachers were asked to respond using a seven-point Likert scale in which 1 = strongly disagree, 2 = disagree, 3 = tend to disagree, 4 = neutral, 5 = tend to agree, 6 = agree, and 7 = strongly agree. No time limit was imposed on the teachers as they responded to the items.
The second part of the research question that asks what types of tools and strategies are used was measured using a four-point Likert scale where 1 = never, 2 = rarely (once or twice during the academic year), 3 = occasionally (two or more times during a semester), and 4 = regularly (two or more times during a quarter). Participants were asked to circle the number corresponding to the frequency with which they integrate the math-reading strategies provided on the list. The strategies contained on the list were chosen based on previous research (Burke, 2002; Burns & Silbey, 2001; Ivie, 1998; Ogle, 1986; Raphael, 1982; Stauffer, 1969). The strategies included were: directed reading-thinking activity, journals and learning logs, graphic organizers, KWL, notetaking, question-answer relationships, and vocabulary activities.

The third part of the research question regarding the teachers’ perceptions of the effectiveness of selected tools and strategies was also addressed using a Likert scale where 1 = not effective, 2 = effective, and 3 = very effective. The participants were asked to circle the number corresponding to their belief on the strategy’s effectiveness if they have ever used it. An “other” category was included in the list of strategies for teachers to insert a strategy they use and find particularly beneficial and effective.

Procedures

Once the survey was deemed appropriate for use, all necessary forms were sent to the Human Subjects Board at Bowling Green State University. Once approval was received to execute this study with the targeted subjects, information regarding all middle schools and junior highs in northwest Ohio that contain seventh grade students was obtained from the Ohio Department of Education (ODE) website. Labels were created for mailings to all necessary schools based on the addresses gathered from the ODE website.
A cover letter was written to the seventh grade math teachers to fully inform them of the study for which they are being asked to participate. The letter was mailed with the surveys to each participating school. A self-addressed stamped envelope was also included for the teachers to return the surveys in a timely manner. Once the cover letter, survey, and self-addressed envelope were stuffed in the envelope, the label with the northwest Ohio school on it was affixed, and the packet was sent.

Data Collection

In an attempt to receive all data back in time to fully interpret, the surveys were sent out by March 1, 2005. The cover letter described all details to the teachers regarding timelines. If the teacher wished to participate in the study, he/she was asked to fill out and return the survey by March 15, 2005, using the self-addressed stamped envelope. The questionnaire was anonymously completed; therefore, there were no follow-up procedures for participants. Upon receipt of the surveys, the quantitative information gathered from all research questions was entered into a comprehensive statistical system. The data was then analyzed to find any common themes among the participants.

Data Analysis

To analyze all quantitative data, a comprehensive statistical program was used. All survey questions dealing with attitudes of teachers were developed based on Vaughn’s (1977) Scale to Measure Attitudes toward Teaching Reading in Content Classrooms. Using the seven-point Likert scale Vaughn suggests, data based on positive items (1, 2, 4, 6, 8, 10, 12, 13, and 15) and negative items (3, 5, 7, 9, 11, and 14) were separated and analyzed. Quantitative data from research question (2) were also entered into a comprehensive statistical program to find frequencies and percentages of strategies used by seventh grade math teachers to integrate
literacy into their content area. Bar graphs representing frequencies and preferences of teachers were created upon analysis of all data. Furthermore, quantitative data regarding the level of effectiveness that teachers have found in the literacy strategies they have implemented were also collected and analyzed. Finally, data sets regarding the attitudes of teachers and the frequency with which strategies are used were compared and analyzed to determine any correlations. The ultimate goal of analyzing all quantitative data was to determine the most predominate and effective strategies used by northwest Ohio seventh grade math teachers to integrate literacy into their classroom.

Summary

The main goal of this study was to compile data that answers the four main research questions. More specifically, this study determined the attitudes of northwest Ohio seventh grade math teachers on integrating literacy into their content area. The collected data also described the most prevalent and effective strategies and tools that the teachers are using to implement this new idea of all teachers being reading teachers regardless of content area. The survey was developed based on the four research questions and collected quantitative data. The number of teachers who chose to participate influenced the final data interpretation.
CHAPTER IV. DATA ANALYSIS AND DISCUSSION OF RESULTS

This study was designed to survey northwest Ohio seventh grade math teachers to determine their attitudes towards integrating reading into their instruction and to identify the tools and strategies they are using to do so. This study also explored the teachers’ perceptions of the effectiveness of the strategies. Of the 143 surveys that were mailed to junior highs and middle schools throughout the sixteen northwest Ohio counties, 34% were returned. All data collected were quantitative and were entered into the SPSS statistics program. This chapter summarizes the results from all surveys returned, according to the four research questions.

Data Analysis

Research Question: One

What are the attitudes of math teachers in northwest Ohio’s seventh grade math classrooms towards integrating reading into their instruction? Survey questions 1-15 were answered using a seven-point Likert scale with 1 = strongly disagree and 7 = strongly agree. Out of the fifteen items, nine were positively stated (1, 2, 4, 6, 8, 10, 12, 13, and 15), while six were negative (3, 5, 7, 9, 11, and 14). Therefore, a negative response to a negative question indicates the participant tended to agree with the statement; however, a positive response to a negative question means that the participant tends to disagree. To analyze frequency and descriptive statistical analysis, the order of the negative question responses were reversed to parallel the positive question responses. In other words, all high scores would now indicate a positive attitude (see Appendix B).

Results from survey questions 1-15 ranged from a mean response of 6.67 (strongly agree) to the item 14 that stated, “reading instruction in the middle grades (6-8) is a waste of time” to a mean response of 2.55 (tend to disagree) to item 3 which stated, “the primary responsibility of a
math teacher should be to impart subject matter knowledge” (see Figure 1). The abovementioned results are a direct result of the 71.4% participants that strongly agreed with item 14, while 0% responded with anything lower than tend to agree. Furthermore, 28.6% of participants strongly disagreed that math teachers are solely responsible for math material, while only 2% strongly agreed with this statement.

In addition, item four stated that “few students can learn all they need to know about how to read in six years of schooling,” which produced the greatest standard deviation (1.93), indicating this particular statement evoked the widest range of responses. In other words, 10.4% of participants strongly agreed with this statement, while 16.7% strongly disagreed. In addition, 14.6% were neutral. However, 31.3% responded that they agree; therefore, the majority believe that most students do not know all they need to know about reading after six years of schooling.

The sum of the overall attitudes resulted in a mean of 5.06, which indicates that northwest Ohio seventh grade math teachers tend to agree with the notion that all teachers are reading teachers regardless of content area. Overall, they feel positively about integrating literacy into their seventh grade math classroom.

*Research Question: Two*

What types of tools and strategies do seventh grade math teachers provide to integrate reading into their math instruction? This research question was addressed through survey questions 16-22, which utilized a four-point scale (1 = never, 2 = rarely/use once or twice during the academic year, 3 = occasionally/use two or more times during a semester, and 4 = regularly/use two or more times during a quarter). The criteria for the four-point scale was created by the research committee in an attempt to increase participant honesty, and to eliminate
Figure 1

Mean Responses of Survey Questions 1-15
the notion that using a particular strategy daily is “good.” Frequency and descriptive statistical analyses were conducted to address this question.

The results reveal that the most predominately used literacy strategy in the surveyed classrooms is notetaking with 75% of participants incorporating this technique two or more times during a quarter and 93.8% of participants using notetaking at least two or more times during a semester (see Table 1). In addition, all responding participants claim to use notetaking at least once or twice during the academic year. The second most used strategy was Question-Answer Relationships with 69.6% of participants claiming to integrate this strategy two or more times during a quarter. Furthermore, the third strategy most often used in a seventh grade math classroom is vocabulary activities with 45.8% using this strategy two or more times during a quarter. On the other hand, results indicated that journals and/or learning logs were least likely to be used in a math classroom with 35.4% of participants claiming to never utilize this strategy. Close behind was the KWL strategy, where 35.3% of participants never use this strategy. The third least used strategy was graphic organizers, with 17% of participants claiming to never integrate this strategy (see Figure 2).

Research Question: Three

What are the teachers’ perceptions of the effectiveness of selected tools and strategies? This question was also addressed through survey questions 16-23; however, the effectiveness was measured using a three-point Likert scale, where 1 = not effective, 2 = effective, and 3 = very effective. Frequency and descriptive statistics were conducted.

Results from items 16-22 indicated that the most effective literacy strategy integrated into seventh grade math classrooms as perceived by the participants is Question-Answer Relationships with 48.9% of participants deeming this strategy very effective. Notetaking
Table 1

Frequencies of Literacy Strategy Integration

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>DESCRIPTION</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Directed Reading-Thinking Activities</td>
<td>2.76</td>
<td>1.02</td>
<td>10.9</td>
<td>32.6</td>
<td>26.1</td>
<td>30.4</td>
</tr>
<tr>
<td>17</td>
<td>Journals and/or Learning Logs</td>
<td>2.5</td>
<td>1.26</td>
<td>35.4</td>
<td>8.3</td>
<td>27.1</td>
<td>29.2</td>
</tr>
<tr>
<td>18</td>
<td>Graphic Organizers</td>
<td>2.77</td>
<td>1.07</td>
<td>17</td>
<td>19.1</td>
<td>34</td>
<td>29.8</td>
</tr>
<tr>
<td>19</td>
<td>KWL</td>
<td>2.24</td>
<td>1.1</td>
<td>35.3</td>
<td>20.6</td>
<td>29.4</td>
<td>14.7</td>
</tr>
<tr>
<td>20</td>
<td>Notetaking</td>
<td>3.69</td>
<td>0.59</td>
<td>0</td>
<td>6.3</td>
<td>18.8</td>
<td>75</td>
</tr>
<tr>
<td>21</td>
<td>Question-Answer Relationships</td>
<td>3.67</td>
<td>0.52</td>
<td>0</td>
<td>2.2</td>
<td>28.3</td>
<td>69.6</td>
</tr>
<tr>
<td>22</td>
<td>Vocabulary Activities</td>
<td>3.23</td>
<td>0.86</td>
<td>4.2</td>
<td>14.6</td>
<td>35.4</td>
<td>45.8</td>
</tr>
</tbody>
</table>
Figure 2

How Often Seventh Grade Math Teachers Are Integrating Literacy

![Bar chart showing literacy strategies and their integration frequency]

- DR-TA: Journals/Learning Logs
- Graphic Organizers: KWL
- Notetaking
- QAR: Vocabulary Activities

Legend:
- Never
- Rarely
- Occasionally
- Regularly
(47.9%) is the second most effective literacy strategy, and vocabulary activities (34%) is the third most effective. On the other hand, responding teachers indicated that the KWL strategy is the least effective with 22.7% of participants declaring that it is not effective. In addition, 19% and 13.9% of participants believe that Directed Reading-Thinking Activities and journals and/or learning logs, respectively, are also not effective (see Table 2).

Overall, when taking a closer look at the descriptive statistics, results indicate that the majority of responding teachers believe all specified strategies are effective when integrated into a seventh grade math classroom. Calculated mean responses range from 2 for Directed Reading-Thinking Activities and KWL to a 2.47 for Question-Answer Relationships. Further supporting the abovementioned notion, participants responding with either effective or very effective to the given strategies ranged from 97.8% for Directed Reading-Thinking Activities to 77.2% for KWL. Therefore, overall, the majority of responding seventh grade math teachers in northwest Ohio believe that Directed Reading-Thinking Activities (80.9%), journals and/or learning logs (86.1%), graphic organizers (92.5%), KWL (77.2%), Question-Answer Relationships (97.8%), vocabulary activities (95.7%) are effective in their classrooms (see Figure 3).

Item 23 on the survey asked for any other literacy strategies that the seventh grade math teachers integrate and find effective. Six teachers offered suggestions that they used two or more times during a quarter, and they rated them as very effective. The following are the additional literacy strategies suggested by responding participants: Reading Workshop, short response questions, short answer, practice proficiency questions, anticipatory set, student designed short response and extended response questions, and long answer responses. Four of the seven additional strategies offered include writing; therefore, the assumption can be made that these
Table 2

**Literacy Strategy Effectiveness in a Seventh Grade Math Classroom**

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>DESCRIPTION</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Directed Reading-Thinking Activities</td>
<td>2.00</td>
<td>0.63</td>
<td>19</td>
<td>61.9</td>
<td>19</td>
</tr>
<tr>
<td>17</td>
<td>Journals and/or Learning Logs</td>
<td>2.08</td>
<td>0.6</td>
<td>13.9</td>
<td>63.9</td>
<td>22.2</td>
</tr>
<tr>
<td>18</td>
<td>Graphic Organizers</td>
<td>2.25</td>
<td>0.59</td>
<td>7.5</td>
<td>60</td>
<td>32.5</td>
</tr>
<tr>
<td>19</td>
<td>KWL</td>
<td>2.00</td>
<td>0.69</td>
<td>22.7</td>
<td>54.5</td>
<td>22.7</td>
</tr>
<tr>
<td>20</td>
<td>Notetaking</td>
<td>2.40</td>
<td>0.64</td>
<td>8.3</td>
<td>43.8</td>
<td>47.9</td>
</tr>
<tr>
<td>21</td>
<td>Question-Answer Relationships</td>
<td>2.47</td>
<td>0.55</td>
<td>2.2</td>
<td>48.9</td>
<td>48.9</td>
</tr>
<tr>
<td>22</td>
<td>Vocabulary Activities</td>
<td>2.30</td>
<td>0.55</td>
<td>4.3</td>
<td>61.7</td>
<td>34</td>
</tr>
</tbody>
</table>
Figure 3

Literacy Strategy Effectiveness in a Seventh Grade Math Classroom

![Chart showing literacy strategy effectiveness](chart.png)
seventh grade math teachers also support and feel positively about teaching students proper writing in the math classroom.

*Research Question: Four*

What correlation lies between the teachers’ attitudes towards literacy integration into math instruction and the frequency with which they actually do so? The results for this part of the research question were collected by comparing the quantitative data from survey questions 1-15 and the frequencies from 16-22. The Pearson correlation was computed to determine what type of relationship exists between math teachers’ attitudes towards literacy integration and the frequency with which they do so. The correlation is significant at the 0.05 level for this two-tailed test. Based on the p-values that were calculated, the results prove a significant correlation between teachers’ attitudes and their use of Directed Reading-Thinking Activities (0.012) and journals and/or learning logs (0.002). On the other hand, results denote an insignificant correlation between teachers’ attitudes and their use of graphic organizers (0.078), KWL (0.593), notetaking (0.708), Question-Answer Relationships (0.787), and vocabulary activities (0.051). Overall, the results indicate a significant correlation (0.005) between teachers’ attitudes toward literacy integration and amount of times that they actually do utilize the given strategies (see Table 3).

**Discussion of Results**

The results from survey questions 1-15 were compiled to address the first part of the research question which asked, “What are the attitudes of math teachers in northwest Ohio’s seventh grade math classrooms towards integrating reading into their instruction?” Based on this study’s findings, seventh grade math teachers agree that reading instruction in the middle grades (6-8) is a waste of time. However, contradicting the latter statement, the majority also believe
Table 3

Correlation of Use Frequency with Reading Attitudes

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>DESCRIPTION</th>
<th>r</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Directed Reading-Thinking Activities</td>
<td>0.366</td>
<td>0.012</td>
</tr>
<tr>
<td>17</td>
<td>Journals and/or Learning Logs</td>
<td>0.444</td>
<td>0.002</td>
</tr>
<tr>
<td>18</td>
<td>Graphic Organizers</td>
<td>0.259</td>
<td>0.078</td>
</tr>
<tr>
<td>19</td>
<td>KWL</td>
<td>0.095</td>
<td>0.593</td>
</tr>
<tr>
<td>20</td>
<td>Notetaking</td>
<td>0.055</td>
<td>0.708</td>
</tr>
<tr>
<td>21</td>
<td>Question-Answer Relationships</td>
<td>0.041</td>
<td>0.787</td>
</tr>
<tr>
<td>22</td>
<td>Vocabulary Activities</td>
<td>0.283</td>
<td>0.051</td>
</tr>
<tr>
<td>16-22</td>
<td>OVERALL</td>
<td>0.395</td>
<td>0.005</td>
</tr>
</tbody>
</table>
that most students do not know all they need to know about reading after six years of schooling. Therefore, if students entering the middle grades are still not fully equipped with all necessary literacy skills, then why is reading instruction a waste of time? In addition, the majority of participants disagree with the statement that the primary responsibility of a math teacher should be to impart subject matter knowledge, which indicates that these math teachers do believe their jobs entail other duties besides strictly teaching mathematical computation. Northwest Ohio seventh grade math teachers tend to agree with the notion that all teachers are reading teachers regardless of content area.

What types of tools and strategies do seventh grade math teachers provide to integrate reading into their math instruction? The large majority (75%) of participants use notetaking regularly (two or more times during a quarter). The second most frequently used strategy was Question-Answer Relationships. On the other hand, journals and/or learning logs and KWL were least often used.

What are the teachers’ perceptions of the effectiveness of selected tools and strategies? Results from items 16-22 indicated that the most effective literacy strategy integrated into seventh grade math classrooms as perceived by the participants is Question-Answer Relationships. Notetaking is the second most effective literacy strategy, and vocabulary activities is the third most effective. On the other hand, participants indicated that the KWL strategy is the least effective. However, overall, when taking a closer look at the descriptive statistics, results indicate that the majority of responding teachers believe all identified strategies are effective when integrated into a seventh grade math classrooms. In addition, Item 23 on the survey asked for any other effective literacy strategies that the participants utilize. Four out of the seven suggestions offered included writing.
What correlation lies between the teachers’ attitudes towards literacy integration into math instruction and the frequency with which they do so? The results for this part of the research question were collected by comparing the quantitative data from survey questions 1-15 and the frequencies from 16-22. Overall, the results indicate a significant correlation between teachers’ attitudes toward literacy integration and amount of times that they actually do utilize the given strategies.

Summary

This chapter summarizes the results of the 49 surveys received from seventh grade math teachers within the sixteen counties of northwest Ohio. The survey was created by a research team and geared towards exploration of a four part research question: (a) What are the attitudes of math teachers in northwest Ohio’s seventh grade classrooms towards integrating reading into their instruction? (b) What types of tools and strategies do seventh grade math teachers provide to integrate reading into their math instruction? (c) What are the teachers’ perceptions of the effectiveness of selected tools and strategies? and (d) What correlation lies between the teachers’ attitudes towards literacy integration into math instruction and the frequency with which they actually do so? Results were compiled using the SPSS statistics program.
CHAPTER V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Students are faced daily with worksheets, textbook assignments, and projects that require a substantial amount of reading and writing in junior high math classrooms. From technical vocabulary to reading story problems, students are faced with literature across the content areas. Therefore, if a student is a struggling reader, these seemingly trivial assignments could quickly become overwhelming and tedious.

However, some teachers still believe that math class is where students learn about the manipulation of numbers and symbols and that teaching students to read is not their responsibility. In addition, with the recent push towards improved test scores and mastery of content standards, teachers find themselves struggling to fit all mathematical computation work in, let alone reading and writing. Therefore, they claim they simply do not have the time to integrate literacy into the math classroom. Furthermore, because academic licenses for middle childhood teachers are designed for two concentrations from any combination of the four main subject areas (math, science, social studies, and reading/language arts), a middle childhood (grades 4-9) teacher may hold concentrations in math and science with no reading background at all. Thus, because teachers may not be prepared or feel qualified to incorporate supplemental literacy strategies, they simply choose not to.

This study focuses on seventh grade math teachers’ attitudes towards the integration of literacy into their classrooms, the tools and strategies with which they choose to do so, and their opinions of the effectiveness of these strategies. A summary and conclusions of this investigation, as well as, recommendations for further research on this topic are presented in chapter five.
Summary

The purpose of this study was to answer the four part research question: (a) What are the attitudes of math teachers in northwest Ohio’s seventh grade classrooms towards integrating reading into their instruction? (b) What types of tools and strategies do seventh grade math teachers provide to integrate reading into their math instruction? (c) What are the teachers’ perceptions of the effectiveness of selected tools and strategies? and (d) What correlation lies between the teachers’ attitudes towards literacy integration into math instruction and the frequency with which they actually do so?

A 23-item survey was designed and mailed to all northwest Ohio seventh grade math teachers in public schools. The strategies contained on the survey were chosen based on previous research (Burke, 2002; Burns & Silbey, 2001; Ivie, 1998; Ogle, 1986; Raphael, 1982; Stauffer, 1969). The strategies included were: directed reading-thinking activity, journals and learning logs, graphic organizers, KWL, notetaking, question-answer relationships, and vocabulary activities.

For this study, the Ohio Department of Education website was consulted to determine the sixteen counties in the northwestern part of the state. The counties included in the study were Allen, Defiance, Fulton, Hancock, Hardin, Henry, Lucas, Ottawa, Paulding, Putnam, Sandusky, Seneca, Van Wert, Williams, Wood, and Wyandot. The public schools within northwest Ohio were found on the Ohio Department of Education website (http://www.ode.state.oh.us).

All data collected were quantitative and were entered into the SPSS statistics program for analysis. Frequency and descriptive statistical analyses were conducted to address the four-part research question.
Conclusions

According to results, northwest Ohio seventh grade math teachers tend to agree with the notion that all teachers are reading teachers regardless of content area. Furthermore, results also indicate that these math teachers believe their jobs entail other duties besides strictly teaching mathematical computation. Therefore, one can conclude that they support the integration of literacy into their math classrooms. However, these findings refute the belief of Donahue (2003) who states, teachers still “see themselves as subject area specialists, with reading relegated to English teachers or reading specialists” (p. 24).

The findings also suggest that math teachers believe taking notes during class constitutes sufficient writing practice. Because note-taking and Question-Answer Relationships were found to be used most frequently, one can conclude that teachers are still resorting to traditional methods of literacy integration, even though they are now being required to take content-area reading courses in teacher preparatory programs, which are intended to teach them contemporary, unique strategies. Therefore, in the field of content-area reading, one can conclude that math teachers are not making any progress, which directly agrees with O’Rourke (1980) when he states, “We have been operating on a false assumption—namely, that knowledge about teaching [reading] in content classrooms would be sufficient to convince teachers to do so” (p. 337). In other words, just because teachers are taught how to integrate reading does not necessarily mean that they will, which has been the same problem for over a half of century (Farrell & Cirrincione, 1984). Hock and Deshler (2003) disagree and believe that by giving added attention to adolescent content area reading strategies and methods during undergraduate programs, teachers will feel more prepared to integrate these strategies and in return will do so effectively.
When taking a closer look at the effectiveness of strategies northwest Ohio seventh grade math teachers are implementing, results indicate that even though teachers may believe that a given strategy is effective, they still do not use it. For example, Item 23 on the survey asked for any other effective literacy strategies that the participants utilize. Because four out of the seven suggestions included writing, the conclusion can be made that seventh grade math teachers also strongly agree with the notion that writing across the content areas is also crucial for success. However, research results indicate that journals and/or learning logs were least often used. Therefore, again, the conclusion can be made that teachers’ beliefs do not always parallel their actions. Farrell and Cirrincione (1984) agree when they state that requiring teachers to take a course in reading methods and altering their philosophy or reading instruction in the classroom are two totally different concepts. Similarly, Gillespie and Rasinski (1989) believe that “positive attitudes do not necessarily guarantee actual or effective reading instruction in the content area classroom” (p. 48). Therefore, based on results, one can conclude that teachers still believe that they do not have sufficient time, preparation, and resources to successfully integrate into their seventh grade math classroom. This conclusion agrees with O’Rourke’s (1980) research that stated teachers believe they are unprepared and unqualified to teach reading in their content area. On the other hand, Farrell and Cirrincione’s research revealed that all teachers believed they were qualified to teach reading.

Overall, the results indicate a significant correlation between teachers’ attitudes toward literacy integration and amount of times that they actually do utilize the given strategies. In other words, one can conclude that teachers who think positively about literacy integration into their math classroom tend to utilize the strategies more often. On the other hand, teachers who feel negatively about reading across the content areas shy away from the strategies and use them less
often. These conclusions agree with O’Rourke’s (1980) research which found math teachers were less positive than other teachers regarding incorporating reading instruction into the content areas, and in return used literacy strategies less frequently than any other teacher. Results from this research also indicate that the more positive a teacher’s attitude is the more likely he/she is to use non-traditional literacy strategies such as journals and/or learning logs or Directed-Reading Thinking Activities. Therefore the conclusion can be made that junior high math teachers who feel negatively towards content area reading tend to resort to traditional strategies (note-taking and question-answer periods); whereas, junior high math teachers who strongly agree with literacy integration are more willing to experiment with alternative strategies.

Recommendations

For Practice

This investigation demonstrates the importance for literacy integration into a middle school math classroom. Therefore, teachers and preservice teachers need to be properly trained and prepared to take on this responsibility, which ultimately falls back on colleges and universities. In other words, regardless of the teacher’s certification, he/she should be required to take an allotted number of credit hours strictly devoted to literacy instruction. Participants of this study tended to agree when asked to respond to the statement “knowing how to teach reading in math should be required for middle childhood certification.” Moreover, teachers currently in the field should consider enrolling in workshops or inservices that concentrate on new and effective literacy strategies to continually stay up-to-date on their instructional strategies.

Furthermore, middle grades math teachers are encouraged to integrate Question-Answer Relationships and notetaking into their curriculum, because based on this study’s findings these are the two most effective literacy strategies. However, there is not one way of taking notes;
therefore, teachers are encouraged to find the notetaking technique that best suits his/her teaching style and his/her students’ learning styles.

*For Further Study*

There is a wide variety of studies similar to this investigation that could be conducted to further analyze this topic. For example, using the same research design as this study, one could conduct research in another part of Ohio and then compare its results to these (northwest Ohio) and draw conclusions based on demographics, socioeconomic status, and facilities available. Moreover, one may be interested in taking this study nationally and again comparing data based on the abovementioned categories.

Furthermore, with standardized testing requirements changing annually, students are being asked to demonstrate mastery of a multitude of literacy skills at every grade level and in every content area. In addition, every state has different requirements. Therefore, again using this same research design, one could collect annual surveys from the same region (northwest Ohio) and then compare data from year to year to explore the pressure that testing requirements have on teacher attitudes and literacy strategy frequency integration. Utilizing this same research design again, researchers may find it beneficial to compare data across states. For example, seventh grade math teachers from southern California may have contrasting beliefs towards literacy integration in the math classroom when compared to this study’s participants of northwest Ohio seventh grade math teachers.

In addition, a more in-depth study could be conducted on any one of the literacy strategies included on this particular survey. For example, there are a variety of notetaking strategies, and one may find it beneficial to study the effectiveness of several particular techniques when used in a math classroom. The category of vocabulary activities is another
category that could easily be broken down for further exploration. Researchers may find it interesting to study specifically which vocabulary activities are being used in a math classroom.

Another recommendation for further research would be to simply follow this same research design with another content area (i.e. science or social studies) and then compare the results from this study. Science teachers may feel differently towards literacy integration into their content areas. Similarly, this research design could again be used with a different grade level. For example, high school and elementary teachers may hold different beliefs towards reading across the content areas as compared to middle school or junior high teachers.

Finally, it is suggested that years of teaching experience be taken into consideration when analyzing results. A teacher with ten years experience may be apt to feel more comfortable taking risks in the classroom with literacy integration, versus a teacher with one to three years experience. On the other hand, new teachers may have had a greater amount of training with the new certifications versus a veteran teacher.

Summary

Based on statistical analysis, this chapter presents the conclusions that have been drawn and suggests recommendations for practice and further research. From cooking to driving, math and reading are two skills performed simultaneously on a daily basis. Therefore, to best prepare students for the rigors of the real world, teachers need to integrate these two subject matters on a daily basis. Whether an above average reader or a struggling reader, all students will benefit from learning how to think, read, and write like a mathematician, and who better to teach these skills than the math teacher.
References


Part I: Please circle all that apply to you:

Licensure Area:  
K-3  K-8  4-9  7-12

Content area(s) you currently teach:  
math  language arts  social studies  science  other_____

Part II: Using the seven-point scale given below, please circle the number that best represents your level of agreement with the following statements.

1 = strongly disagree (SD)  
2 = disagree  
3 = tend to disagree  
4 = neutral (N)  
5 = tend to agree  
6 = agree  
7 = strongly agree (SA)

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SD</td>
<td>N</td>
<td>SA</td>
<td></td>
</tr>
<tr>
<td>1. A math teacher is obliged to help students improve their reading ability.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Technical vocabulary should be introduced to students in math classes before they meet those terms in a reading passage.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The primary responsibility of a math teacher should be to impart subject matter knowledge.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Few students can learn all they need to know about how to read in six years of schooling.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. The sole responsibility for teaching students how to study should lie with reading teachers.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Knowing how to teach reading in math should be required for middle childhood certification.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Only English teachers should be responsible for teaching reading in middle schools.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. A teacher who wants to improve students’ interest in reading should show them that he or she likes to read.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Math teachers should teach math and leave reading instruction to reading teachers.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. A math teacher should be responsible for helping students think on an interpretive level as well as a literal level when they read.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Math teachers should feel a greater responsibility to the content they teach than to any reading instruction they may be able to provide.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Math teachers should help students learn to set purposes for reading.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Every math teachers should teach students how to read material in his or her content specialty.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Reading instruction in the middle grades (6-8) is a waste of time.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Math teachers should be familiar with theoretical concepts of the reading process.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Part III: Please circle how often you incorporate the following literacy strategies into your 7th grade mathematics classroom. Then, please circle the level of effectiveness of only the strategies you have used.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = never</td>
<td>1 = not effective</td>
</tr>
<tr>
<td>2 = rarely (once or twice during the academic year)</td>
<td>2 = effective</td>
</tr>
<tr>
<td>3 = occasionally (2 or more times during a semester)</td>
<td>3 = very effective</td>
</tr>
<tr>
<td>4 = regularly (2 or more times during a quarter)</td>
<td>4 = very effective</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>16. Directed Reading-Thinking Activity</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
</tr>
<tr>
<td>17. Journals and/or learning logs</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
</tr>
<tr>
<td>18. Graphic organizers</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
</tr>
<tr>
<td>19. KWL</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
</tr>
<tr>
<td>20. Notetaking</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
</tr>
<tr>
<td>21. Question-Answer Relationships</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
</tr>
<tr>
<td>22. Vocabulary activities</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
</tr>
<tr>
<td>23. Other ______________________</td>
<td>1 2 3 4</td>
<td>1 2 3</td>
</tr>
</tbody>
</table>
APPENDIX B
ATTITUDES OF SEVENTH GRADE MATH TEACHERS TOWARD LITERACY INTEGRATION
<table>
<thead>
<tr>
<th>ITEM #</th>
<th>DESCRIPTION</th>
<th>M</th>
<th>SD</th>
<th>PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Math teacher must help improve reading.</td>
<td>5.51</td>
<td>1.31</td>
<td>4.1 0  2  6.1  28.6  40.8  18.4</td>
</tr>
<tr>
<td>2</td>
<td>Technical vocabulary should be introduced prior to reading.</td>
<td>5.56</td>
<td>1.38</td>
<td>0  4.2  4.2  14.6  14.6  33.3  29.2</td>
</tr>
<tr>
<td>3</td>
<td>Primary responsibility of math teacher is to impart subject matter knowledge.</td>
<td>2.55</td>
<td>1.46</td>
<td>28.6  24.5  28.6  6.1  8.2  2  2</td>
</tr>
<tr>
<td>4</td>
<td>Students do not know all they need to about reading after six years of schooling.</td>
<td>4.75</td>
<td>1.93</td>
<td>10.4  8.3  4.2  14.6  14.6  31.3  16.7</td>
</tr>
<tr>
<td>5</td>
<td>Reading teachers should be responsible for teaching study skills.</td>
<td>6.29</td>
<td>1.06</td>
<td>2  0  0  2  8.2  36.7  51</td>
</tr>
<tr>
<td>6</td>
<td>Knowing how to teach reading in math should be required for middle childhood certification</td>
<td>4.65</td>
<td>1.42</td>
<td>2  6.1  12.2  22.4  24.5  26.5  6.1</td>
</tr>
<tr>
<td>7</td>
<td>Only English teachers should have to teach reading in middle schools.</td>
<td>5.57</td>
<td>1.34</td>
<td>0  4.1  4.1  10.2  22.4  30.6  28.6</td>
</tr>
<tr>
<td>8</td>
<td>Teachers should show they like to read.</td>
<td>5.8</td>
<td>1.27</td>
<td>2  0  2  10.2  18.4  32.7  34.7</td>
</tr>
<tr>
<td>9</td>
<td>Math teachers should teach math and reading teachers should teach reading.</td>
<td>5.39</td>
<td>1.64</td>
<td>4.1  6.1  4.1  6.1  16.3  38.8  24.5</td>
</tr>
<tr>
<td>10</td>
<td>Math teachers should encourage interpretive and literal level thinking while reading.</td>
<td>5.9</td>
<td>0.99</td>
<td>0  2.1  0  4.2  20.8  45.8  27.1</td>
</tr>
<tr>
<td>11</td>
<td>In math, the subject matter should come first, then reading instruction.</td>
<td>2.96</td>
<td>1.47</td>
<td>14.3  30.6  26.5  10.2  10.2  8.2  0</td>
</tr>
<tr>
<td>12</td>
<td>Math teachers should help students set purposes for reading.</td>
<td>4.9</td>
<td>1.34</td>
<td>2.1  6.3  6.3  10.4  41.7  27.1  6.3</td>
</tr>
<tr>
<td>13</td>
<td>Math teachers should teach students how to read math related material.</td>
<td>5.86</td>
<td>0.98</td>
<td>0  0  2  4.1  30.6  32.7  30.6</td>
</tr>
<tr>
<td>14</td>
<td>Reading instruction in 6th-8th grade is a waste of time.</td>
<td>6.67</td>
<td>0.56</td>
<td>0  0  0  0  4.1  24.5  71.4</td>
</tr>
<tr>
<td>15</td>
<td>Math teachers should be familiar with theoretical concepts of the reading process.</td>
<td>5.12</td>
<td>1.2</td>
<td>0  6.1  0  16.3  42.9  22.4  12.2</td>
</tr>
</tbody>
</table>