A CONTENT ANALYSIS OF THE WRITING ASSIGNMENTS CONTAINED
IN THE FOUR BASAL MATHEMATICS TEXTBOOK SERIES
ADOPTED BY THE STATE OF TEXAS

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

Barbara Bando Irvin, B.S., M.Ed.
Denton, Texas
May, 1993
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The purpose of this study was to identify and compare specific writing assignments provided in the four basal mathematics textbook series, grades six through eight, adopted by the state of Texas in 1990. The student and teachers' editions by each publisher were analyzed (1) for the total number and types of writing assignments provided, (2) to compare how the writing assignments compared with the four purposes of writing mandated in the *English Language Arts Framework, Kindergarten through Grade 12* for the state of Texas, (3) to compare how the writing assignments compared with the recommendations for communication opportunities stated in the National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards for School Mathematics* for grades five through eight, and (4) to compare the number and types of writing assignments among the four publishers.

The total number of writing assignments varied among publishers ranging from 151 to 316 in the student editions and from 147 to 523 in the teacher's editions. The findings of this study indicate that from 80 to 98 percent of the writing assignments in the student editions and from 72 to 96 percent of the writing assignments in the teacher's editions corresponded to the Informative purpose of writing. Very few writing assignments were provided corresponding to the Literary, Expressive, and Persuasive purposes of writing. The writing assignments corresponding to the NCTM recommendations varied among publishers. Writing assignments dealing with modeling mathematical situations ranged from 14 to 66 percent in the student editions and from 24
to 39 percent in the teacher's editions. Writing assignments focusing on understanding and definitions ranged 15 to 61 percent in the student editions and from 31 to 53 percent in the teacher's editions. Writing assignments focusing on interpretation and application ranged from 5 to 29 percent in the student editions and from 10 to 15 percent in the teacher's editions.
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TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. INTRODUCTION ................................................. 1</td>
<td></td>
</tr>
<tr>
<td>Background to the Study</td>
<td></td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td></td>
</tr>
<tr>
<td>Research Questions</td>
<td></td>
</tr>
<tr>
<td>Significance of the Study</td>
<td></td>
</tr>
<tr>
<td>Limitations</td>
<td></td>
</tr>
<tr>
<td>Definition of Terms</td>
<td></td>
</tr>
<tr>
<td>Chapter Bibliography</td>
<td></td>
</tr>
<tr>
<td>II. REVIEW OF RELATED LITERATURE ............................... 14</td>
<td></td>
</tr>
<tr>
<td>Writing to Learn</td>
<td></td>
</tr>
<tr>
<td>Types of Writing</td>
<td></td>
</tr>
<tr>
<td>Writing in the Mathematics Classroom</td>
<td></td>
</tr>
<tr>
<td>Textbooks in American Education</td>
<td></td>
</tr>
<tr>
<td>Textbook Adoptions in Texas</td>
<td></td>
</tr>
<tr>
<td>Chapter Bibliography</td>
<td></td>
</tr>
<tr>
<td>III. METHODOLOGY AND PROCEDURES ............................... 52</td>
<td></td>
</tr>
<tr>
<td>The Methodology</td>
<td></td>
</tr>
<tr>
<td>The Population</td>
<td></td>
</tr>
<tr>
<td>The Sample</td>
<td></td>
</tr>
<tr>
<td>The Research Design</td>
<td></td>
</tr>
<tr>
<td>Collection of the Data</td>
<td></td>
</tr>
<tr>
<td>Procedures for the Analysis of the Data</td>
<td></td>
</tr>
<tr>
<td>Validity and Reliability</td>
<td></td>
</tr>
<tr>
<td>Chapter Bibliography</td>
<td></td>
</tr>
</tbody>
</table>
IV. PRESENTATION AND ANALYSES OF DATA 71

Dimensions for Reporting the Data
Frequency and Types of Writing Assignments
Writing Assignments Which Correspond to the Four Purposes of Writing
Writing Assignments Which Correspond to the NCTM Standards
Comparison of Writing Assignments Among Publishers

V. SUMMARY, IMPLICATIONS AND RECOMMENDATIONS 103

Summary
Summary of Data Findings
Implications
Recommendations
Chapter Bibliography

APPENDICES 114

BIBLIOGRAPHY 142
**LIST OF TABLES**

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Frequency and Types of Writing Assignments</td>
<td>74</td>
</tr>
<tr>
<td>II. Frequency and Types of Writing Assignments</td>
<td>75</td>
</tr>
<tr>
<td>III. Frequency and Types of Writing Assignments</td>
<td>76</td>
</tr>
<tr>
<td>IV. Frequency and Types of Writing Assignments</td>
<td>77</td>
</tr>
<tr>
<td>V. Writing Assignments Which Correspond to the Four Purposes of Writing</td>
<td>79</td>
</tr>
<tr>
<td>VI. Writing Assignments Which Correspond to the Four Purposes of Writing</td>
<td>80</td>
</tr>
<tr>
<td>VII. Writing Assignments Which Correspond to the Four Purposes of Writing</td>
<td>81</td>
</tr>
<tr>
<td>VIII. Writing Assignments Which Correspond to the Four Purposes of Writing</td>
<td>82</td>
</tr>
<tr>
<td>IX. Writing Assignments Which Correspond to the NCTM Standards</td>
<td>84</td>
</tr>
<tr>
<td>X. Writing Assignments Which Correspond to the NCTM Standards</td>
<td>85</td>
</tr>
<tr>
<td>XI. Writing Assignments Which Correspond to the NCTM Standards</td>
<td>87</td>
</tr>
<tr>
<td>XII. Writing Assignments Which Correspond to the NCTM Standards</td>
<td>88</td>
</tr>
<tr>
<td>Table</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>XIII. A Comparison of the Number and Types of Writing Assignments</td>
<td>91</td>
</tr>
<tr>
<td>among Publishers.</td>
<td></td>
</tr>
<tr>
<td>XIV. A Comparison of the Number of Writing Assignments</td>
<td>95</td>
</tr>
<tr>
<td>Corresponding to the Four Purposes of Writing among Publishers</td>
<td></td>
</tr>
<tr>
<td>XV. A Comparison of the Number of Writing Assignments</td>
<td>100</td>
</tr>
<tr>
<td>Corresponding to the NCTM Standards among Publishers</td>
<td></td>
</tr>
</tbody>
</table>
LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A Comparison of the Number of Types of Writing Assignments among Publishers</td>
<td>92</td>
</tr>
<tr>
<td>2</td>
<td>A Comparison of the Percentage of Types of Writing Assignments among Publishers</td>
<td>93</td>
</tr>
<tr>
<td>3</td>
<td>A Comparison of the Number of Writing Assignments Corresponding to the Four Purposes of Writing among Publishers</td>
<td>96</td>
</tr>
<tr>
<td>4</td>
<td>A Comparison of the Percentage of Writing Assignments Corresponding to the Four Purposes of Writing among Publishers</td>
<td>97</td>
</tr>
<tr>
<td>5</td>
<td>A Comparison of the Number of Writing Assignments Corresponding to the NCTM Standards among Publishers</td>
<td>101</td>
</tr>
<tr>
<td>6</td>
<td>A Comparison of the Percentage of Writing Assignments Corresponding to the NCTM Standards among Publishers</td>
<td>102</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

Background to the Study

Writing to show learning has been part of the curriculum for many years in that teachers have routinely asked students for written evidence of what they have mastered (Gere, 1985). In the mid-1970s, the Writing Across the Curriculum movement originated at American colleges and universities in response to a perceived deficiency in student writing and thinking skills. This movement to treat writing more seriously in all disciplines caught on nationwide because it simultaneously addressed problematic issues in education such as literacy, critical thinking, improved writing and active learning (Fulwiler & Young, 1982). More recently, Writing to Learn has replaced the Writing Across the Curriculum movement because it suggests a powerful role language plays in the production, as well as the presentation, of knowledge. Writing to Learn is about language that is forming meaning. It is about writing that is done regularly in and out of class to help students acquire a personal ownership of ideas in lectures and textbooks. The writing-to-learn movement is fundamentally about using words to acquire concepts (Connolly, 1989). The interest in using writing as a way of learning stemmed initially from two areas of research. The first area of research concerned the composing process derived from several detailed studies of how skilled and unskilled writers write. An original study by Janet Emig in 1971 and other researchers have determined that skilled writers work through a process that includes several interactive and recursive steps (Glatthorn, 1987). Through various writing activities, students activate their prior knowledge of the topic and then connect and integrate the new incoming information (Konopak, Martin, & Martin, 1987). The second
area of research included investigations of the uses of writing in the classroom. In 1975, Britton and his colleagues examined uses of writing in a variety of subject areas in British secondary schools and discovered that almost all the writing was addressed to the teacher and most of that was to the teacher as examiner. In the United States, Applebee's (1984) study of writing yielded findings similar to Britton's study. Writing activities most often involved calculations, short-answer responses, and "fill-in-the-blank" exercises. The Britton and Applebee studies revealed that writing was not being used extensively as a means of learning (Glatthorn, 1987). Pearce's (1984) study showed that the majority of student writing in content areas appears to be either for purposes of evaluation or of a kind that could be classified as copying, with writing tasks usually consisting of answering essay questions or writing answers to review questions in the class textbook. Relatively few of the content area teachers has their students regularly write about the content in a systematic way that encouraged the development and refinement of concepts. Langer and Applebee's (1987) report on The National Study of Writing in the Secondary School showed that the more content is manipulated [through writing], the more likely it is remembered and understood. When writing-to-learn activities are incorporated into the curriculum content areas, encouraging results have been documented.

According to the 1986 National Assessment of Educational Progress (NAEP), the highest level of performance by any substantial proportion of students reflects only moderately complex skills and understanding. Most students, even at age 17, do not possess the breadth and depth of mathematics proficiency needed for advanced study in secondary mathematics. While average performance has improved since 1978, the gains have been confined primarily to lower-order thinking skills (Dossey, Mullis, Lindquist & Chambers, 1988). Similarly, the levels of writing performance in 1988 appeared to be substantially the same as 1974, with many students continuing to perform at minimal levels
of the NAEP writing assessment tasks, and relatively few performing at adequate or better
Study (1982) reported that the average Japanese student exhibited higher levels of
achievement than the top five percent of American students (McKnight et al, 1987).

The resulting educational deficit reduces our ability to sustain our present
technologically based society and to compete in international arenas. Curricula and
instruction in our schools and colleges are years behind the times. They reflect neither the
increased demand for higher-order thinking skills, nor the greatly expanded uses of the
mathematical sciences, nor what we know about the best way for students to learn
mathematics (National Research Council, 1989).

The same studies also revealed that the student textbook is the predominant
instructional source in American classrooms. In most subjects and in most elementary and
secondary classes, textbooks are responsible for 75 to 90 percent of what students will
learn, which means they play a central role in the education of American students (English,
1980; Young & Reigluth, 1988). In fact, textbook programs have come to constitute a
curriculum, and it seems important for educators to raise some questions about these
programs. Based on research of text and textbooks during 1975 and 1985, Osborn (1985)
states that improving textbook programs used in American schools is an essential step
toward improving American education.

In Texas, the curriculum is comprised of essential elements approved by the Texas
State Board of Education. The essential elements are defined as representing those cores
of knowledge, attitudes, values and skills that must be included in instruction and that each
student must be provided with the opportunity to learn to be an effective and productive
member of society. In a recent report, the Texas Education agency (TEA) clearly
addresses the close relationship between the essential elements and textbooks. The
textbook is seen as the primary source to instruct students in the essential elements. The required connection between the Texas state mandated curriculum and textbooks increases the importance of textbooks in the classroom in the state of Texas (TEA, 1989). Students are held accountable for mastery of these essential elements before they can be promoted or graduated (Schomburg, 1986).

In order to satisfy the legislative requirements that student performance be assessed, Texas instituted the Texas Assessment of Basic Skills (TABS) in 1980, the first statewide assessment program to measure student achievement in reading, writing, and mathematics. The TABS was followed by the Texas Assessment of Minimum Skills (TEAMS) in 1985. The new assessment program of 1990-1995, the Texas Assessment of Academic Skills (TAAS), both extends and expands the TEAMS test placing greater emphasis on a greater set of essential elements and for a different focus. In keeping with the current national trend in education, more stress will be placed on higher-order thinking skills (TEA, 1990).

Writing is uniquely suited to foster higher-order thinking skills (Gere, 1985). Writing is an extremely focused activity which simultaneously involves hand, eye, and brain (Emig, 1977). The work of cognitive psychologists and psycholinguists shows that writing is a highly complex act that demands the analysis and synthesis on many levels of thinking (Graves, 1984).

Writing in the mathematics classroom has recently received increasing attention from educators (Azzolino, 1990). Writing is a useful way to facilitate students' mathematical development. Writing, especially original composition, involves the active manipulation of knowledge, many of the thought process related to creative thinking, and the development of problem-solving strategies (Davison & Pearce, 1988). Writing is particularly useful in helping students develop a deeper understanding of mathematics.
concepts and skills. However, it is a communication skill that has been used too infrequently in mathematics (NCTM, 1989).

The basal mathematics textbook can be a source for teachers in planning and implementing writing activities in the mathematics classroom. It is widely known that the content of textbooks makes a difference (Altbach, 1991). Textbooks have a powerful influence on what students learn. Begle's (1973) data from the National Longitudinal Study of Mathematical Achievement cites evidence that students learn what is in the text and do not learn topics not covered in the book. Over 75 percent of the teachers in a survey sponsored by the National Advisory Committee on Mathematics Education reported using a single textbook predominantly in the classroom, and 53 percent of the teachers reported that they followed the texts closely (Porter, 1981).
Statement of the Problem

The problem of this study was to identify and compare specific writing assignments provided in the four basal mathematics textbook series, grades six through eight, adopted by the state of Texas in 1990 and to describe the relationship to the mathematics and writing requirements included in the assessment objectives and curriculum framework for the state of Texas and the National Council of Teachers of Mathematics.

Research Questions

The following research questions were addressed in this study:

1. How many and what types of specific writing assignments are provided in the student editions and in the teacher's editions of the four basal mathematics textbook series adopted by the state of Texas for grades six through eight?

2. How do the writing assignments compare with the purposes of discourse mandated in the *English Language Arts Framework, Kindergarten through Grade 12* for the state of Texas?

3. How do the writing assignments compare with the recommendations for communication opportunities stated in the National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards for School Mathematics* for grades five through eight?

4. How do the basal mathematics textbooks series compare with each other with regard to the number and types of writing assignments provided in the student editions and in the teacher's editions of the four basal mathematics textbook series?
Significance of the Study

The purpose of this study was to identify and compare specific writing assignments provided in the four basal mathematics textbook series, grades six through eight, adopted by the state of Texas in 1990. Each of these writing assignments were categorized with relation to the purposes of discourse mandated by the state of Texas' *English Language Arts Framework*. Texas educators have chosen the noted rhetorician James Kinneavy's theory and terminology as a basis of the English language arts curriculum. Kinneavy provides a definitive classification that approaches reality by distinguishing the purpose of a piece of discourse from its structure or form (TEA, 1988).

Writing is a process of communication. However, not all forms of written communication are the same nor should all written communication occur in the same way. Individuals write to accomplish a purpose. The purpose or aim of any discourse is the central feature of that communication whether the communication is occurring between one person, between two people, or within large groups. The four major purposes of language use identified in the Texas *English Language Arts Framework, Kindergarten through Grade 12* are informative, persuasive, literary, and expressive.

The identification and correlation of the specific writing assignments and the purposes of writing stated in the state of Texas' framework of essential elements in this study will assist teachers in planning an integrated mathematics/language arts curriculum. By integrating mathematics and language arts objectives more closely, students will have the opportunity to employ the purposes of writing in a mathematics lesson and to draw upon the vast number of mathematical topics to write about in an English language arts lesson. An integrated mathematics/language arts program can afford students the opportunity to focus on better thinking and learning as they write to learn while at the same time produce better products as they write across the curriculum. This study will
also provide relevant information that will allow consultants from school districts and regional service centers to develop supportive mathematics/language arts lessons and to provide integrated mathematics/language arts in-service training to intermediate level elementary teachers and especially departmentalized middle school/junior high school teachers. The results of this study will also provide relevant information for the writing of future basal mathematics textbooks which support an integrated approach to the teaching of mathematics and writing.

Limitations

The results of this study were directly applicable only for the state of Texas, since the categories of the writing tasks are correlated to the Texas English Language Arts Framework and the Writing Objectives of the Texas Assessment of Academic Skills.

The categories of writing assignments were categorized in terms of purpose of language in this study although forms (modes of organization) of language and audience are an integral part of written communication.
Definition of Terms

For the purpose of this study, the following terms have a specific meaning and are defined as they relate to this study.

1. Writing Assignment: A written phrase, sentence, paragraph or essay to contain "composition" attributes. For example, the writing task for "Write to explain how you solved the problem." requires a student to think and compose a response. In mathematics, instructions such as "Write the number." or "Write as a fraction." do not connote "composition" type of writing:
[Refer to Appendix A for more examples.]

2. Four Purposes of Writing (TEA, 1988 & 1990):
   a. Informative: Informative use of language primarily explores questions, provides information, and produces verifiable evidence for given questions. It is subject matter centered. (Discourse theorists use different terms to refer to the informative purpose: referential, transactional, expository. Each may have a special nuance, but all refer to the purpose of providing information.) The writer selects facts so that information can be conveyed. Examples include:
      Report          Proposing a solution to a problem
      Summary         Proving a point by arguing from accepted premises
      News article    Proving a point by generalizing from particulars
   b. Persuasive: Persuasive use of language attempts to change the thinking of individuals or groups. The sender of the message usually has determined that a change in the thinking and/or attitude of the receiver is necessary or desirable. Persuasive discourse is receiver oriented. The writer presents reasons in support of a point of view with the intention of influencing a particular audience. Examples include:
      Advertisement   Editorial      Slogan      Political speech
c. **Literary**: Literary use of language is intended to provide pleasure to both sender and receiver. Literary discourse is signal centered, that is, it focuses on the piece of discourse as a work of art whose medium is language. Examples include:

- Short story
- Drama
- Ballad, folk song
- Limerick
- Poem
- Joke, riddle
- TV/radio show
- Video, movie

d. **Expressive**: Expressive use of language is writer oriented and is an attempt to clarify what he or she thinks and feels as well as to provide an outlet for those thoughts and feelings. Examples include:

- Journal
- Learning Log
- Diary

[Refer to Appendix B for more examples.]
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CHAPTER II

REVIEW OF RELATED LITERATURE

This study was concerned with the correlation of the kinds (purposes) of writing activities and the writing activities found in four basal mathematics textbook series. Therefore, the review of the literature includes the following related areas of research: writing to learn, types of writing, writing in the mathematics classroom, textbooks in American education, and textbook adoptions in Texas. The literature concerning each topic is discussed as it pertains to the purposes of the study.

Writing to Learn

"I write to find out what I am thinking about." — Edward Albee

Writing is central to teaching and learning in American schools. Teachers assign it, and students spend 44 percent of their classroom time doing it. However, only three percent is actual composing, where writers put together a sufficient number of sentences to form paragraphs (Fulwiler, 1982). Writing to show learning has been part of the curriculum for many years. Teachers have routinely asked students for written evidence of what they have mastered. While this kind of writing has been helpful to those who must evaluate students, there is some question of how writing to show learning has helped students (Gere, 1985).

Writing-across-the-curriculum programs originated in the mid-1970s at American colleges and universities as a response to a perceived deficiency in student writing and thinking skills. The movement to treat writing more seriously in all disciplines caught on nationwide because it simultaneously addressed a number of problematic issues of
education: literacy, critical thinking, improved writing and active learning (Fulwiler & Young, 1982).

Writing to learn differs from writing across the curriculum. Although writing to learn, like writing across the curriculum, emphasizes writing in all disciplines, its goal is different. Writing across the curriculum aims to improve the quality of writing, while writing to learn focuses on better thinking and learning (Gere, 1985). Writing to learn is based on a growing body of research into the writing process that suggests that writing can be a powerful strategy for learning content. The student who participates in a writing-to-learn program is likely to learn more content, understand it better, and retain it longer. As a bonus, writing skills are also likely to improve with use (Myers, 1984).

Writing is one extremely valuable tool of learning, of finding out what one knows and thinks, as well as showing what one knows. Writing is a way to explore and question, as well as to gain control and exhibit knowledge of subject area. Writing engages the imagination, intellect and emotions and encourages articulation of those attitudes, skills and values necessary for effective learning in most disciplines. It is a unique learning activity because it allows the student to capture thoughts and data for future reference, contemplations and synthesis (Draper, 1982). Furthermore, writing is self-paced and review oriented, for it produces a more-or-less permanent artifact that encourages students to reprocess their thoughts by re-reading and re-examining their conceptions (Bell & Bell, 1985).

Janet Emig (1977) has made an international reputation studying the composing processes of student writers. She contends that writing is uniquely suitable to providing multiple approaches that promote learning. First, the writing processes information on three levels: enactive—the hand which moves the pen across the page engages in motor functioning, iconic—the eye that reads what is being written activates sensory functioning,
and symbolic—the mind which shapes and refines the message that is being written
concerns the deeper intellectual and analytical processes. What is striking about the
writing process is that, by its very nature, all three ways of dealing with actuality are
simultaneously deployed.

Cognitive psychologists point out that higher cognitive functions, such as analysis
and synthesis, seem to develop most fully only with the support system of verbal language
—particularly, it seems, of written language. Cognitive psychologists such as Piaget and
Bruner have provided some insight into the relationship between writing and thinking.
Their work illustrates that verbalizing is an integral part of thinking and that such
verbalizing takes place on several levels, from subvocal to finished writing.

In his book *Six Psychological Studies* (1967), Piaget has presented a seminal
interpretation of language as an activity on mind. The last stage of cognitive growth, the
period of "formal operations," reveals the child's enhanced ability to deal not just with
concrete elements of reality, but with abstract verbal issues and complex logical problems.
The child begins to deal with the possible as well as the real, and the past and the future as
well as the present. "Language is indispensable to the elaboration of thought" in this
period. Piaget proposed that knowledge is highly organized, that learning involves
assimilation of new experience to one's previous knowledge, and that intellectual
development is not a passive incorporation of information but an active construction on
the part of the learner.

Jerome Bruner contends that language is "at the center of the stage" in intellectual
development. He maintains that language is an "instrument of thought" because the syntax
of language organizes human experiences into "hierarchical categories" which underlie all
human experience. By this, Bruner means that language expresses the mind's drive to
categorize experience, and provides a method by which thought can deal with experience.
Bruner reaffirms Piaget's principle that language enables the developing mind to objectify experience by abstracting from it and communicating about it. Like Piaget, Bruner insists on language's crucial ability to making learning possible (Foster, 1983).

Verbalization at the more conscious levels, especially writing, helps people to operate at the higher levels of abstraction (Griffin, 1982). The Russian psychologist Lev Vygotsky tells us in *Thought and Language* (1962) that the connection between language and thinking is vital and organic. "The relation between thought and word," he maintains, "is a living process, thought is born through words. A word devoid of thought is a dead thing, and a thought embodied in words becomes a shadow."

Frank Smith (1982) states that writing cannot be separated from thought. Writing is one of the most effective methods of putting our theory of the world to work. He states that writing helps us to discover what we think and that the writing process puts our thinking to work. Smith indicates that composition and comprehension cannot be separated since thinking is involved.

As the study of cognitive or thinking process, problem solving explores the wide array of mental procedures people use to process information in order to achieve their goals. The real problem the student is working on is not just getting ideas, but verbalizing them. The goal is to get thinking down in words, phrases, sentences--fragments of writing. "Until you can express what's in the mind in words, it can be said you really don't know it" (Flower & Hayes, 1977, p. 454). Articulating ideas and intentions to someone else--getting the right words on paper--draws on a staggering array of mental gymnastics, from simply generating language to highly sophisticated concept formation. Students who are required to write must do considerable thinking and organizing of their thoughts before they write, thus crystallizing in their minds the concepts studied (Johnson, 1983).
According to Emig, the act of writing allows us to manipulate thought in unique ways, because writing makes our thoughts visible and concrete and allows us to interact with and modify them. Writing one word, one sentence, one paragraph suggests still other words, other sentences and other paragraphs. The writing progresses as an act of discovery and, furthermore, that no other thinking process helps us develop a given train of thought as thoroughly. When we speak, we compose. When we write, we compose even better because, as Emig describes, we can manipulate our compositions on paper in addition to holding them in our heads. We can review them, revise them and rewrite them, because they are now visible and concrete. Writing is important because it generates understanding and communication (Young and Fulwiler, 1986).

Asking for the student's answer in writing should be an important pedagogical decision, not simply a trade-off in time. To compose something is a more demanding task—coordinating knowledge with both logic and rhetoric—for the student than simply deciding (or guessing at) something. Asking students for a piece of writing involves students more profoundly in the learning process; they must demonstrate not only "knowledge" but also the ability to organize and explain that knowledge (Fulwiler & Jones, 1982).

Writing is thinking made visible. Yet, for much of this century teachers of writing ignored the vital connection between writing and thinking and focused instead on writing as the transcription of letters and punctuation marks rather than on writing as the composition of ideas (Maimon, Nodine, & O'Connor, 1989).

The nature of writing makes learning inevitable. Writing is not grammar, not punctuation, not spelling. Writing is composing, and composing is a sustained activity of discovering and stating relationships among bits of information. These relationships evolve as one writes, by means of continually grouping pieces of information into clusters, and
regrouping them with more information into new clusters. The activity of sorting and relating occurs in an uneven continuum, enabling the writer to learn about any subject by writing about it. The evolving awareness of the implications of a subject is a function of the writer realizing the ways in which pieces of information about that subject can be connected (Van Norstrand, 1979).

When content area teachers incorporate writing in all areas of curriculum, students benefit in three ways: (1) they have a source for better understanding content; (2) they practice a technique which aids retention; and (3) they begin to write better. In creating a context for learning, teachers create a "space" within which connections among ideas can take shape and be manipulated (Sorenson, 1991). Students should be given opportunities to use writing to get course materials "right with themselves" (Britton, 1975), to create their own "webs of meaning" (Vygotsky, 1962).

Writing is important for several reasons. Graves (1984) who has studied the writing processes of children for many years, offers the following summary: (1) Writing is most important as a contribution to the development of a person, no matter what the person's background or talents. (2) Writing contributes to intelligence. The work of psycholinguistics and cognitive psychologists shows that writing is a highly complex act that demands the analysis and synthesis of many levels of thinking; (3) Writing develops initiative. In writing, the learner must provide the right relationship between sounds and letters, the order of letters and their form on the page and the topic of the writing, information, questions, answers, order. (4) Writing develops courage. Writers leave their shelter of anonymity and offer to public scrutiny their interior language, feelings and thoughts. (5) Writing also contributes to reading because writing is the making of reading. And, (6) writing is active, it involves the learner; and doing is important.
Murray (1987) points out that writing is the most disciplined form of thinking. It allows us to be precise, to stand back and examine what we have thought, to see what our words really mean, to see it stand up to our critical eye, make sense, and understood by someone else. Gere (1985) describes the value of writing as a thinking tool: by forcing a slowdown in thought processes, it frees the brain to play around with ideas and make new discoveries more fully to integrate knowledge.

Writing tends to encourage students to be more precise than verbal expression (Geeslin, 1987). It demands an internal monologue on the ideas under consideration. Writing constantly requires new descriptive phrases, connectives to form one idea to the next, decisions on inclusions and omissions, rank ordering of competing thoughts, and so on (Fulwiler & Young, 1982). Writing, in fact, is similar to having a debate with oneself (Fennell & Ammon, 1985).

Writing corresponds to learning in several ways. First of all, learning is multifaceted, as is writing, which uses eye, hand, and mind. Secondly, learning profits from self-provided feedback—the kind available in writing, where the product takes gradual shape before the writer's eyes and is then available for review and reflection. Third, learning serves an analytical function, as does writing, which organizes individual facts, images, and symbols into sentences, paragraphs, and essays. And finally, learning is engaged, committed, and self-rhythmed, as the best writing is (Emig, 1977).

Writing is truly individualized instruction. In its expressive form, writing allows every student to explore, discover, connect, translate, and personalize knowledge. Most critically, this processing in the classroom goes on in all students simultaneously. Rather than listening to a few students' verbal answers, all students are engaged at once in writing. What more could a teacher want: individualized instruction on the group level (Fulwiler & Young, 1982).
The interest in using writing as a way of learning stemmed initially from two interesting research thrusts. One such thrust was research into the composing process, derived from several detailed studies of how skilled and unskilled writers write. Building upon an original study by Janet Emig (1971), numerous researchers have determined that skilled writers in general work through a process that includes several interactive and recursive steps: Prewriting, drafting, revising, editing, and publishing (Glatthorn, 1987). The most obvious consequence of Emig's work is that many teachers now give special attention to the writing process in their classes and are developing strategies to nurture it. The shift from product to process is the simple most important change in composition pedagogy in the last two decades (Freisinger, 1982). Careful prewriting is necessary to focus the students' attention on a topic. Through various writing activities, the students activate their prior knowledge of the topic by writing a preliminary draft, and then connect and integrate the new incoming information through repeated reorganization (Konopak, Martin, & Martin, 1987).

The second area of research included investigations of the uses of writing in the classroom. Britton and his colleagues (1975), in examining the uses of writing in a variety of subject areas in British secondary schools, discovered that almost all the writing was addressed to the teacher and most of that was to the teacher as an examiner.

The summary of findings of the study and of the in-depth studies of the SCRE Writing Across the Curriculum project in Scotland (Spencer, 1983) revealed that teachers regarded writing as an important skill needed either for developing students' clarity and logic as thinkers, for self-expression, and for functioning effectively in society. They also recognize some relationships between language and learning and between writing and learning. Most teachers, however, think of writing primarily as a way of communicating information to the learner or of showing the teacher what has been understood or recalled.
Accordingly, the most frequent purposes of written work are to store information for revision, to reinforce memorization, and to allow the teacher to assess knowledge of understanding. Guidance given to students on written work consisted mainly of brief advice explaining what to do in tasks which do not make a heavy demand on writing abilities. Among teachers of subjects other than English, there was no coherent theory of learning in relation to writing, no general realization of what is important in it or how best to develop it. Most students (62 to 84 percent) in ten subject areas did copied or dictated writing. There was little demand in most subjects for continuous "own words" writing and almost no demand for "extended own words" writing. Even in English, 70 percent of the students did not write more than one page of continuous writing in any one task.

Applebee’s (1984) study of writing in schools in the United States yielded similar findings to those of the British study. Writing activities most often involved calculations, short-answer responses, and "fill-in-the-blank" exercises. Almost all writing reflected the informational uses of writing; very little required students to use their imaginations. Overall, analytical writing tasks were more prevalent, but summary writing tasks were important in the social sciences, and report writing in the science classes. Almost all writing, from 87 percent to 99.5 percent in all subjects, was addressed to the teacher as an examiner; students rarely played a role as audiences for their classmate's writing. Teachers allowed an average of three minutes for prewriting, and only 29 percent of the teachers surveyed required students to revise. The Britton and the Applebee studies provided evidence that writing was not being used extensively as a means of learning (Glatthorn, 1987). Pearce's (1984) study, whose purpose was to determine to what extent high school content teachers infuse writing in the classroom, showed that the majority of student writing in content areas appears to be either for purposes of evaluation or of a kind that could be classified as copying, with two most frequently assigned writing activities being
the answering of essay questions and writing answers to review questions in the class textbook. Relatively few of the content area teachers had their students regularly write about the content in a systematic way that encouraged the development and refinement of concepts. The lack of original student writing for purposes other than review questions or evaluation would appear to be by omission as opposed to being by design.

However, when writing-to-learn activities are incorporated into the curriculum content areas, encouraging results have been documented. Langer and Applebee's (1987) report on The National Study of Writing in the Secondary School showed that the more that content is manipulated [through writing], the more likely it is to be remembered and understood. The findings of Konopak, Martin, and Martin (1987), using a guided writing procedure, showed that the writing group was better able to synthesize information acquired from all its activity sources and produce higher level ideas on the final writing than a control group and a nonwriting treatment group.

To help teachers use writing more effectively in the classroom, Yates (1987) offers these general conclusions: (1) Writing is tied to the other language acts. That is, writing is reinforced by talking, listening, and reading. (2) Writing is learned holistically. Like talking, writing is learned by working on whole problems rather than on isolated skills. Holistic learning involves creative problem solving, repetition, hypothesis formation, testing and error-making. (3) Writing is a process. All writers move through stages, from conceiving an idea to completing a final draft; and often they must go through these stages several times to rewrite and clarify ideas. And, (4) writing is communication. Like speech, writing carries from one person to another, has a distinct purpose and audience, and is based on meaning.
Types of Writing

Britton (1975) acknowledges different kinds of language use by distinguishing the transactional, poetic, and expressive functions of language. Transactional language is language for an audience. Its primary aim is to convey information clearly to other people. It is the language of newspapers, technical reports, and schools. It is writing that informs, instructs, and generally communicates to others; it's "writing to get things done." Poetic language is the language of art. It is used to create verbal objects, and as such is as much an aesthetic medium for a writer as clay or paint would be for a sculptor or painter. Expressive language is language close to the self. It reveals as much about the writer as it does the topic. It is informal, personal, self-expressive, talky, tentative, speculative, exploratory; writing to oneself--diaries, journals, letters, first drafts. The composing process is indebted to Britton's stress on the relationship between the expressive and the transactional modes, particularly his claim that success with the latter grows out of involvement with the former. In Britton's study, 63 percent of the students did transactional writing, 18 percent did poetic writing, and only 5.5 percent did expressive writing.

The National Study of Writing in the Secondary School, supported for 3 1/2 years by grants from the National Institute of Education, categorized three main categories of functions of writing: informational, personal, and imaginative in order to better understand the role that writing plays in academic learning and also to identify particular ways that writing can be used more effectively in high school classrooms. Informational writing uses language to convey information, advise, instruct or persuade. It can be used to record facts, explain ideas, exchange opinions, transact business. Personal writing uses language close to the self and it mostly unstructured. Imaginative writing uses language as a medium; to make a construct, an arrangement, a pattern. The categories of this study
strongly paralleled Britton's transactional, expressive, and poetic categories of writing. One result of the study showed that different kinds of writing activities lead students to focus on different kinds of information, to think about that information in different ways, and in turn to take quantitatively and qualitatively different kinds of knowledge away from their writing experiences (Applebee, 1984; Langer & Applebee, 1987).

According to noted rhetorician James Kinneavy (1971), "aim" is the crucial determinant of discourse. "Purpose in discourse is all important. The aim of a discourse determines everything else in the process of discourse." He defines "aim in discourse" as that "aim which is embodied in the text itself--given the qualifications of situation and culture." Kinneavy's purpose is to categorize all aspects of "an oral or written situation using the "communication triangle" that breaks down into encoder (sender), decoder (receiver), signal (language), and reality (subject matter). Kinneavy provides a definitive classification of the purpose of a piece of discourse as referential, persuasive, literary, or expressive. The referential classification is further subdivided into scientific, informative, and exploratory. He also distinguishes purpose from its structure or form (description, narration, classification, evaluation). Kinneavy's theory of discourse is not the only classification of oral and written language. However, at the state level, Texas educators have chosen Kinneavy's theory and terminology (informative, persuasive, literary, expressive purposes) as a basis for the English language arts curriculum (TEA, 1988). Britton's "transactional" writing shares some of the features of Kinneavy's "informative" and "persuasive" writing, Britton's "poetic" function is very similar to Kinneavy's "literary" aim, and their joint use of the "expressive" category reveal similar purposes (Foster, 1983).

The National Assessment of Educational Progress (NAEP) survey data indicates that student achievement improved between 1971 and 1980, and has remained level since
1980. However, according to Anrig and LaPointe (1989), there is little solace in the writing achievement of students. The Nation's Report Card assesses three kinds of student writing at age 17: Informative: Only 25 percent of 17-year-olds can write an adequate analytic paper from given information. Persuasive: Only 20 percent of them can write a persuasive letter to the principal. Imaginative: Only 28 percent of them can write an adequate essay in this area.

Writing in the Mathematics Classroom

The traditional view has been that students learn to write in English classes and to compute in mathematics classes and "never the twain shall meet." Certainly little thought has been given to the idea that teachers of various subjects, especially mathematics, are to seek to have students engage in writing activities as part of their study of that area (Davison & Pearce, 1988a). The teachers who are the most difficult to convince of the worth of writing as a normal part of their curriculum are mathematics teachers. The idea is so foreign to the majority of mathematics teachers at every level that even the mere suggestion is often met with derisive looks, rolled eyes, and a shaking head. The reason for this lack of enthusiasm or downright refusal regarding writing in mathematics class has to do with the way that it is typically presented to mathematics teachers. All too often they are given the impression that they must teach writing along with mathematics. The thought that they must add something else to their already overwhelming curriculum is unbearable (McIntosh, 1991). In recent years, this position has been changing, and different authors have recommended increased writing about mathematics by students as a useful and valuable aspect of mathematics instruction (Azzolino, 1990). Using a writing-to-learn approach does not mean changing course content but rather incorporating writing strategies into existing courses. (Gere, 1985).
James Moffett (1968) in *Teaching the Universe of Discourse* said "To compose is to comprehend," and so to have a student write about an idea in a subject field is to have a student understand the idea. He also proposes that English, like mathematics, is a symbol system, and "when a student 'learns' one of these systems, he learns how to operate it," and therefore the student should use his time manipulating the system "in every realistic way it can be used" rather than studying it as an object.

Writing and content are inseparable. Research on transfer suggests that basic skills are generally tied to the context in which they are learned and practiced. The technical vocabulary, procedural and substantive concepts and generalizations, and data unique to a subject or discipline influence considerably how one writes as well as what one writes (Beyer & Brostoff, 1979).

The *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989) identifies learning to communicate mathematically as an important goal. Communication in and about mathematics serves many functions. It helps to (1) enhance understanding, (2) establish some shared understanding, (3) empower students as learners, (4) promote a comfortable learning environment, and (5) assist the teacher in gaining insight into the students' thinking so as to guide the direction of instruction (Rowan, Mumme, & Shepard, 1990).

Mathematics can be thought of as a language that must be meaningful if students are to communicate mathematically and apply mathematics productively. Communication plays an important role in helping children construct links between their informal, intuitive notions and the abstract language and symbolism of mathematics; it also plays a key role in helping children make important connections among physical, pictorial, graphic, symbolic, verbal, and mental representations of mathematical ideas (NCTM, 1989).
Communication involves the ability to read and write mathematics and to interpret meanings and ideas. Writing and talking about their thinking clarifies students' ideas and gives the teacher valuable information from which to make instructional decisions. Emphasizing communication in a mathematics classroom helps shift the classroom environment in which students are totally dependent on the teacher to one in which students assume more responsibility for validating their own thinking (NCTM, 1989).

In mathematics, students think about numbers and relationships but not necessarily about words and phrases. The author of the mathematics textbook draws both together. The mathematics teacher searches for words to teach the mathematical processes. Although students must confront the verbal explanations of the author and the teacher, they seldom verbalize their own mathematical work. Once students begin to construct verbal patterns, through writing, they will more easily recognize the logic of similar writings in textbooks and classroom materials (Venne, 1989). Written communication is important, and as students get used to writing, they grow to appreciate it as part of doing mathematics (Rowan, Mumme, & Shepard, 1990).

Skill in writing may be important to success in a mathematics-related career but is often overlooked. Consider the need for clear and concise manuals to accompany computer hardware and software, or the need to interpret and communicate the results of statistical analysis in understandable language (Abel & Abel, 1988). The need for more writing in mathematics is evident when practicing scientists in research-and-development corporations report that over 30 percent of their time is spent writing (Mett, 1987).

Based on his own research, Geeslin (1987) concludes that writing about mathematics can be useful both as a diagnostic tool for the teacher and as learning device for the student. Geeslin also found that students have nearly correct notions concerning the mathematics concepts, but many indicate important misconceptions not revealed by
achievement tests. Furthermore, he states that written explanations of mathematical concepts have several advantages over discussion: all students can participate simultaneously, writing tends to encourage the student to be more precise than verbal expression, and written work of this type may improve technical writing skills, which seems to be declining.

Having students engage in writing tasks in a mathematics context has several benefits. Not only will the opportunity to practice writing improve a students' ability in written expression, by using writing to practice mathematical tasks will also assist students in comprehending mathematics concepts and improve their ability to communicate mathematically. The inclusion of writing activities potentially has additional value when the kinds of activities are varied and writing is treated as an attempt at communication. In such an environment writing can become a personal and rewarding activity for students. Given that many students view mathematics as a stringent program of rules, facts, and figures, writing activities can involve students in useful and enjoyable mathematical activities. These, in turn, can encourage students to become more proficient in mathematics (Davison & Pearce, 1988a).

Problem solving is common ground for all the disciplines and fundamental to all human activities. A writer is a problem solver of a particular kind. Writers' "solutions" will be determined by how they frame their problems, the goals they set for themselves, and the means or plans they adopt it for achieving these goals (Berkenkotter, 1982).

The relationship between writing and problem solving has been examined in the research of Flower and Hayes (1977). They are among a number of researchers who have studied the cognitive processes of experts and novices thinking aloud on tape as they solved problems in mathematics, physics, chess playing, and composing [music]. All the researchers share with Britton the view that writing involves highly complex cognitive
processes. Geeslin (1987) suggests that students write step-by-step explanations of their problem solving. This technique helps students become more autonomous learners.

Bell and Bell's (1985) study in a ninth grade general math class was to determine the effectiveness of integrating writing and mathematical problem solving. This study was based on the premise that there are similarities between problem-solving skills involved in expository writing and problem-solving skills involved in solving mathematics problems. The study determined that students who completed writing assignments on mathematics problems were better problem solvers than students in control groups, supporting the contention that expository writing is an effective, practical, and innovative tool for problem solving. Focusing on the writing process—discovering a topic, deciding what one needs to say about it, organizing and structuring content, writing a draft, and then revising and editing the finished product—underscores a fundamental "problem solving" factor involved in expository writing that parallels the one which is found in the corresponding mathematical process—defining the unknown, determining what information one already knows, design a strategy or plan for solving the problem, reaching a conclusion, and checking the results. The two procedures are strikingly similar and both require critical decision-making from the students engaged in them. A basic premise of the study, one which separates this plan from other research on the subject, is that the writing component of the math unit must be perceived as an integral element of the teaching process, not as merely an enrichment exercise.

In Carton's (1990) research project, students in any level of mathematics working in a cooperative, active setting, developed their own understanding of mathematical concepts through the collaborative writing of word problems. In so doing, they saw mathematics from the inside out, as creators rather than mimickers; they were "doers" of mathematics, reflecting on and clarifying their own thinking about mathematical ideas in
specific situations. This theory concurs with Davidson's (1977) language approach to story problems. A student can be expected to have greater success at analyzing a story problem if the student has first had experiences at writing a similar story problem. By writing their own story problems, students combine reading, critical thinking, and the collection and organization of data (Fennell & Ammon, 1985). Problem writing does more than engage students in writing and learning—it has a far-reaching impact. As students take ownership for the work they create, they begin to take more pride in the quality of their work and achieve a higher level of self-esteem (McGhee, 1991).

In another collaborative mathematics writing study conducted by LeGere (1991), the following conclusions were noted: the classroom environment was less threatening, lessening anxiety to interfere with learning; students were more involved in the learning process; and students used higher level thinking skills because the tasks required them.

Christine Sobray Evans conducted a study in 1984 to determine whether elementary school students could use writing to help them learn mathematics. CTBS scores were taken in the fall to compare two fifth grade classes (22 students in test group, 23 students in control group) to obtain a profile in each class for computation and total math ability. The data used in Evans' study were figures of only those students who took the CTBS tests in September and were present for both pretests and posttests in the given topic. Three types of writing were used in the study with fifth graders working on units of multiplication and geometry. The unit on multiplication would provide information on using writing with computation; the unit on geometry would provide information how writing works in an area in which most students have no previous background and one that has a heavy vocabulary load. The first type of writing focused on explanations—writing to describe "how to do" something. Writing to an uninformed third party forced students to be more specific than writing to the teacher. The second type of writing dealt
with definitions. The vocabulary used in mathematics textbooks is extremely precise. Good students could memorize the definitions, but often did not understand them. Poor students could not even do that. Writing their own definitions, which lacked precision, at least gave the students the chance to describe something new in their own familiar terms. As a mathematics teacher, Evans could immediately discover who understood the concepts that were taught and, more importantly, who did not. The third form of writing was "troubleshooting." Students had to specifically explain errors on homework or quizzes before turning in their papers. Evans and her colleague, a fellow fifth grade teacher, decided to use the publisher's pretest and posttest of the district-adopted mathematics textbook for each unit and supplementary practice. The only difference in the teaching approach was that Evans' class would incorporate writing during class time and her colleague would not. The statistical results of the study revealed the following:

<table>
<thead>
<tr>
<th>Multiplication Unit</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Geometry Unit</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Group</td>
<td>41%</td>
<td>77%</td>
<td>Test Group</td>
<td>17%</td>
<td>70%</td>
</tr>
<tr>
<td>Control Group</td>
<td>54%</td>
<td>76%</td>
<td>Control Group</td>
<td>23.5%</td>
<td>60.3%</td>
</tr>
</tbody>
</table>

On the unit on multiplication, Evans' test group edged out the control group with an average of 77 to 76 percent, even though the control group's pretest scores were higher due to the fact that it contained a cluster of six gifted students. On the unit on geometry, the results were quite dramatic. Although the control group's pretest scores were higher, the test group average on the posttest scores were 70 percent as compared to the control group's average score of 60.3 percent. The results also showed that students with the lowest pretest scores in the test group made the most gains, and thus showing that writing gives teachers one more tool to help the less capable students to grow and learn.

Linn's (1987) study, whose purpose was to determine the effects of journal writing on the thinking skills of high school geometry students, supported the idea that writing can
enhance a student's metacognitive capacities. Each student becomes actively involved in
his or her own learning process. Writing forced the students to synthesize information and
become aware of what they did and did not know. They recognized their individual
learning style and strengths and began to take advantage of these strengths. The journals
also served as a diagnostic tool for the teacher, opened lines of communication between
teacher and students, and personalized the learning environment. Strackbein and Tillman
(1987) contend that journal writing is one of the best beginning points for daily writing.
It can be thought of as a rough draft where one works out an idea. A mathematics
professor at George Mason University documented that students who kept journals scored
15 percent higher on tests than students who did not keep journals (Mett, 1987). Watson
(1980) also reports that students who kept journals showed improvement in problem
solving, study habits, and grades. Nahrgang and Peterson (1986), using journals in their
classroom studies, concurred that journals clearly indicated that students used them to
think about solving problems associated with mathematical concepts and that students
viewed journals as a worthwhile inclusion in mathematics classes.

In an exploratory investigation in Louisiana, Miller and England (1989) wished to
ascertain what influence the use of regular writing in algebra classes would have on
students' skills in algebra and their attitude toward algebra. Some of the things they
learned as a result of using four categories of writing prompts in algebra classes was that
students are able to quote rules and properties but they did not know how to apply them.
Students seemed to write more if the prompt told them to address their comments to
someone. Writing at the beginning of class seemed to put the students in a "frame of
mind" for algebra class. For many students, regular writing assignments appeared to
provide a comfortable, familiar, routine—sometimes whether they put themselves into the
writing in meaningful ways or not. Students' writings improved in quantity and quality over time, and students seemed to enjoy the "fun" writings and the "free" writings.

Writing seems to free mathematics students of the idea that math is a collection of right answers owned by the teacher—a body of knowledge that she will dispense in chunks and that they will have to swallow and digest. That's how most nonmathematicians perceive it (Zinsser, 1988).

Davison and Pearce (1988b) explored various ways that teachers use writing in mathematics instruction. The results of their investigations have suggested that the use of writing activities is sporadic in junior high school mathematics classes. However, a pattern of writing activities has emerged. In particular, it appears that writing activities used in mathematics classrooms can be classified into five categories: direct use of language (copying and recording information); linguistic translation (translation of mathematical symbols into written language); summarizing (paraphrasing or summarizing materials from the textbook or some other source, keep a journal); applied use of language (apply a mathematical idea to a problem context—make up story problems); and creative use of language (explore and convey information that is not specifically being studied in mathematics).

By incorporating writing in the mathematics curriculum, teachers wonder "Does the integration of writing decrease valuable time needed for the actual instruction of mathematics?" Ganguli (1989) addressed this question in a study that investigated the effectiveness of integrating writing instruction in a developmental mathematics course as a means of improving student performance. It was found that while adding writing instruction did reduce slightly the amount of time available for mathematics instruction, student performance was also better. Secondary teachers who participated in the action research study by Miller and England (1987) found that allowing students to write for five
minutes on four out of every five instructional days did not interfere with covering the prescribed curriculum over one academic year. In fact, they thought that in some ways the writing helped them to cover the material in a more effective manner.

Textbooks in American Education

The textbook is one of the world's ubiquitous instructional devices. Textbooks for instruction in reading and writing have been found that date from early Greek, Roman, and Chinese civilizations. A famous early textbook, the *Orbis Pictus* of John Amos Comenius, was first published in 1648. It was a reading primer and contained wood-cut illustrations of subjects taken from real life. It was, thus, one of the earliest illustrated textbooks. Examples of famous early American textbooks include *Webster's Elementary Spelling Book* published in 1793 and *McGuffey's Eclectic Readers* published in 1836 (Flanagan, 1981). For many people in the United States, the basal reader was the first and most important textbook of their daily lives in schools. Among the most influential of these texts were the famous (or infamous, depending on your point of view) "Dick and Jane readers" (Apple & Christain-Smith, 1991).

Webster defines the textbook as a manual of instruction; as containing the "principles of a subject used as a basis of instruction" (Muther, 1985). That is, the textbook is a book used as a standard work of the formal study of a particular subject. Textbooks are the foundation of much of our intellectual life; they are the basic books in every subject (Cole & Sticht, 1981). Most textbooks are designed by publishers to provide base instruction in a given subject. Generally, publishers expect teachers to judiciously select topics, units, or activities and support them with other sources (Muther, 1985).
Implied in the terms "series" and "basal" is the assumption that at each level a graded sequence of textbooks will aid students in building concepts, acquiring skills, and gaining a store of information that will serve as the basis for developing more sophisticated skills and concepts at succeeding levels. Textbook programs at least represent a basic resource to ensure that pupils have access to reasonably good quality content and skills instruction that meet most generally accepted curriculum goals in most districts (Woodward, Elliott, & Nagel, 1986). Investigators at the Institute for Research on Teaching offer evidence that, at the very least, textbooks are important exercise sources (Flanders, 1987).

Several features serve to distinguish textbooks from other printed forms. They are designed to present the basic principles as aspects of a given subject for use as the basis of instruction. Textbooks can sometimes be considered as an entire course of study in print. As such, they have the following features: (1) They contain a summary of selected topics or body of knowledge, often in simplified form. (2) Their content is presented in a highly organized structured fashion. (3) They are designed primarily for the purpose of instruction in a given topic. And, (4) they may incorporate learning activities or suggestions for further study (Flanagan, 1981).

Textbooks are generally considered to have the following instructional advantages: (1) Because they are organized, they provide a means of organizing instruction. (2) Because they are organized and because they stress the most important aspects of a topic, they can serve as a teacher's guide. (3) Because they pull together materials presented elsewhere, they can condense relevant information into a single, compact, economical form. And, (4) because they contain suggestions for further learning activities, they can help to individualize instruction (Flanagan, 1981).
Good textbooks are more than attractive transmitters of information; they relate to students' lives, help students summarize and ask pertinent questions, use graphics judiciously to augment content, present concepts in a logical manner, and use appropriate vocabulary (Osborn, Jones, & Stein, 1985).

The textbook represents a critical element in the connection between students and the school system. The teacher's instructional role becomes critical. The teachers organize their instruction around the content presented in the adopted textbooks and design their instruction so that some amount of the material becomes the agenda for the school year. In this classroom context, teachers seldom openly challenge and reject the adopted textbook (Wong & Loveless, 1991).

Four factors influence the development and use of textbooks: (1) textbooks are designed to respond to the requirements of the school; (2) certain recent changes in textbooks and instructional materials relate changes in the ways in which textbooks are selected; (3) the increased structure in instructional materials is traceable not only to expressed customer requirements but to new development technologies being applied by educational publishers; and (4) changes in textbooks and instructional materials are clearly related to funds available for school expenditures (Squire, 1981). Textbooks are the least expensive, most reliable means of transmitting knowledge and providing coherence to the curriculum. Unlike computers, they are never "down" and do not require much expertise to use (Altbach, 1991). And, "despite the growing use of computers, textbooks remain the foundation for as much as 90 percent of classroom learning," noted the 1988 Paramount Corporate Report (Sewall & Cannon, 1991). Textbooks are more potent forces in what and how teachers teach and in what and how children learn than we are ready to admit. Textbooks select for study a content, an emphasis, a method of instruction and learning, and a level of difficulty (Chall, 1981).
Few aspects of schooling currently have been subject to more intense scrutiny and criticism than the textbook. Perhaps one of the most graphic descriptions is provided by A. Graham Down (1988) of the Council for Basic Education:

Textbooks for better or worse, dominate what students learn. They set the curriculum, and often the facts learned, in most subjects. For many students, textbooks are their first and sometimes only early exposure to books and reading. The public regards textbooks as authoritative, accurate, and necessary. And teachers rely on them to organize lessons and structure subject matter.

Young's field research found that whether a teacher is a veteran or teaching a subject for the first time, teachers tend to expect students to gain skills and understandings, not just information, from the textbook (Young & Reigeluth, 1988).

In most subjects, and in most elementary and secondary classes, about 80 percent of the knowledge to which students are exposed comes from a textbook. The original meaning and intent of the textbook was to provide a compendium of basic knowledge and not intended to be the sole instructional tool. However, the school textbook becomes the exclusive reading matter for a course for a whole year. Too often, the textbook is the teacher's lesson plan. Consequently, the textbook becomes excessively and monopolistically important, and the choice of textbook takes on the seriousness of a political decision (English, 1980). Today the textbook has become a total program. EPIE Institute's national survey shows reliance on the textbook from 70 to 95 percent on classroom time, depending on the subject and study, with students spending up to 70 percent of their instructional time directly involved with workbook, dittos, and other seatwork activities (Durkin, 1983, Muther, 1985). And, as much as 95 percent of classroom instruction can be attributed to classroom materials according to a study by the Educational Products Information Exchange Institute in 1983 (Graves, 1983).
Teacher's editions play a central role in a textbook series. They explain how to present materials and run the class. Teacher's editions contain explicit suggestions, ideas for class activities, and strategies for students who need more help or additional challenge (NEA, 1989). In Durkin's (1984) observational study of elementary teachers to learn about what parts of manuals teachers use and why as well as to find out why manual recommendations had been used, altered, skipped, showed that 93 percent of the teachers who used a manual assigned all the written practice referred to in skill development sections. A large percentage of the teachers sampled by Rosecky, 90 percent used the basal guidebooks [teacher's manuals] most of the time or all of the time. This coincides with Durkin's observation that teachers do use guidebooks frequently.

Mathematics books, second only to the basal readers which comprise at least 40 percent of elementary level textbook purchases, constitute about 25 percent of elementary textbook purchases in the United States. Mathematics instruction in American classrooms is clearly textbook driven. The textbook largely determines what is taught as well as what strategies are used in teaching it. According to reasons given by teachers for using various instructional strategies and representation of mathematical content, inclusion in the textbook did not always guarantee that a strategy or content representation would be used in the classroom. However, exclusion from the textbook made it virtually certain that the strategy or representation would not be used (McKnight et al, 1987). Begle's (1973) data from the National Longitudinal Study of Mathematical Achievement concurs with McKnight's findings—students learn what is in the text and do not learn topics not covered in the book. The evidence indicates that most student learning is directed by the textbook rather than the teacher. Also, from this same study Porter (1981) cites that "student achievement, to a substantial extent, mirrors the content treated in the textbook—students learn what they have been taught rather than something else." According to the NAEP
survey reported in *The Mathematics Report Card*, mathematics instruction in 1986, as in previous years, continues to be dominated by teacher explanations, chalkboard presentations, and reliance on textbooks and workbooks. Seventy-seven percent of the seventh graders and 76 percent of the eleventh graders used textbooks on a daily basis in mathematics (Dossey, Mullis, Lindquist, & Chambers, 1988). Over 75 percent of the teachers in a survey sponsored by the National Advisory Committee on Mathematics Education reported using a single textbook predominately in the classroom, and 53 percent of the teachers reported they followed the texts closely (Porter, 1981). The overall picture is that to a great extent the textbook defines the content of the mathematics that is taught in U. S. schools (Flanders, 1987). Playing such a central role in the dispensation of knowledge, the content of textbooks becomes a critical issue (Keith, 1991).

Changes in the educational climate, the textbook-evaluation process, and the marketplace have led to vast improvements in published materials. Authors and editors study curricula from all over the country to match as many state mandates as possible. Publishers today engage in formative and summative research, pilot studies and learner verification. They research educational trends, curricular requirements and pedagogical advances from all over the nation. Teacher support materials are more varied and thorough than ever. The day of teacher's editions that were simply the student's text with on-page annotations is past. Now oversized teacher's editions include complete lesson plans in side columns opposite the student's page, provide activities for varying ability levels, give full answers to questions, and introduce all the other accompanying resources, such as activity sheets, bulletin board ideas, and tests (Graham, 1986). We have come to believe that improving textbook programs used in American schools is an essential step toward improving American education (Osborn, Jones, & Stein, 1985). Textbooks are now seen to be an important excellence movement (Altbach, Kelly, Petrie, & Weis, 1991).
In assessing instructional materials, selection committees must consider a variety of criteria, including the relationship of content and instructional approach to the standards of appropriate subject matter organizations and the relationship of content and instructional approach to research in the appropriate subject matter field (NEA, 1989). The vast majority of textbooks that are regularly used in the United States have been reviewed and selected by textbook adoption committees (Farr & Tully, 1985). The adoption of new textbooks is the central method of spread of new curriculum (Cole & Sticht, 1991).

The textbook system in the United States was designed at the turn of the century to deal with turn-of-the-century issues—cost control, corruption, and consolidation of state curricular authority. Twenty-two, now generally called "adoption states," enacted legislation requiring a centralized textbook adoption system (NEA, 1989). Although no two states conduct the adoption process in a like fashion, their intentions are clear: choosing books at the state level provides curriculum uniformity, quality of textbooks, establishment of a minimum and standard course of study throughout the state, periodic review of textbooks, and cost controls (Apple, 1991; Farr & Tully, 1985; Marshall, 1991b). These books will be the standard printed curriculum for public school teachers and school students over the next five to ten years (Sewall & Cannon, 1991).

Texas represents the largest instructional materials market in the United States with a school population exceeding three million students. Should reformers earmark the Texas system as fertile ground for change, they would first do well to understand how the state's textbook selection and adoption system functions (Marshall, 1991b).
Textbook Adoptions in Texas

Texas deserves special attention because of the large quantity of books it adopts annually. The educational governance structure of Texas, like most states, consists of a State Department of Education (in Texas, the Texas Education Agency, a Chief State Officer (in Texas, the Commissioner of Education), and an elected or appointed State Board of Education (in Texas, appointed). This structure permits a variety of tasks, most of which are routine and regulatory in nature. Selecting textbooks in Texas is one such task (Marshall, 1991a).

In Texas, the influence of state guidelines are pervasive and highly dominant (Marshall, 1991b). A number of curriculum changes are adopted that will profoundly affect textbook content. Most notable is the requirement that essential elements be developed for each area of the well-balanced curriculum, and that students be held accountable for mastery of these elements before they can be promoted or graduated (Schomburg, 1986). The essential elements are defined as representing those core areas of knowledge, attitudes, values, and skills that must be included in instruction and that each student must be provided an opportunity to learn to be an effective and productive member of society. Districts are urged to expand and add to the essential elements, but they may not delete any (TEA, 1991). The TEA (1989a) clearly addresses the close relationship between the essential elements and textbooks. The textbook is seen as the primary means to instruct students in the essential elements. Each year the State Board of Education issues its textbook proclamation calling for bids from textbook publishers. The essential elements and consensus generated from statewide curriculum review are the basis for development of the annual proclamation. The required connection between Texas state mandated curriculum and textbooks increases the importance of the textbooks in the classroom.
When the textbooks coming up for adoption are determined, a Proclamation is written specifying selection criteria. These include the legislative mandates and essential elements for each subject area. This Proclamation serves as the most powerful tool in determining textbook content. Proclamation 66 and the revised essential elements for mathematics, grades 1-8, take a step toward improving the curriculum along some of the lines recommended by various research reports and national recommendations, especially the National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards for School Mathematics* (1989). The mathematics curriculum review committee and the Agency have tried to be sensitive to a balance between changes expected of teachers and improvements necessary to help students learn mathematics more effectively. One of the major changes includes emphasizing the importance of communication in mathematics (TEA, 1989b). For the English language arts curriculum, educators have chosen Kinneavy's theory and terminology as a basis (TEA, 1988). According to data provided by the State Textbook Committee members in Texas, the three most prominent textbook evaluation criteria were ranked as organization and presentation of content, adherence to the proclamation, and pedagogical strength (Marshall, 199b).

In Texas, the textbook selection and adoption system consists of three decision-making stages: (1) review and selection by the State Textbook Committee; (2) review by Texas Education Agency personnel; and (3) review and adoption by the State Board of Education (Marshall, 1991a). Professional educators make initial decisions, the Commissioner of Education and his staff have the power to alter or overturn those decisions, and the State Board of Education holds the power to alter or overturn those of the Commissioner (Schomburg, 1986). In Texas, the State Board of Education approves a list of no fewer than two and no more than five textbooks from which local districts may make their K through 12 selections (Wong & Loveless, 1991).
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CHAPTER III

METHODOLOGY AND PROCEDURES

The Methodology

Since content represents the means through which one person or group communicates with another, it is important for communications research to be described with accuracy and interpreted with insight. A scientific method that has been developed for describing various facets of communication content in summary fashion is content analysis (Berelson, 1952). The research method selected for this study, content analysis, was employed to identify and categorize specific writing assignments in the four basal mathematics textbook series.

Potentially, content analysis is one of the most important research techniques in the social sciences. It seeks to understand data not as a collection of physical events but as a symbolic phenomena and to approach their analysis unobtrusively. With unobtrusive measures, the producer of media materials is unaware of materials being analyzed, and there is little danger that the act of measurement will itself serve as a force for change in behavior or elicit role-playing that confounds the data (Nachmias & Nachmias, 1981).

Educational material, long the focus of attention by social scientists, became recognized as a rich source of data both to make inferences about processes of reading and to understand larger political, attitudinal, and value trends to be found in its textbooks (Krippendorff, 1980). One of the two main uses of content analysis by educators has been the measurement of "readability" of printed materials and textbook analysis (Berelson, 1952). Content analysis can be a valuable tool for obtaining certain types of information useful in identifying or solving educational problems. This information can be directly
applied to the revision of course content or the development of new programs (Borg & Gall, 1979).

Empirical inquiries into communications content date back to studies in theology in the late 1600s when the Church was worried about the spread of nonreligious matters through newspapers. Probably the first well-documented case of quantitative analysis of printed materials occurred in eighteenth-century Sweden involving a collection of 90 hymns of unknown authorship. Outstanding in this case was the fact that good scholars who participated in this controversy focused on the question of whether the songs were in fact carriers of dangerous ideas. Words in religious hymns were counted by Swedish authorities and dissidents to prove or disprove heresy. (Krippendorff, 1980; Rosengren, 1981).

The turn of the century brought a visible increase in the mass production of newsprint in the United States. Journalism schools emerged, leading a demand for ethical standards and for empirical inquiries into the phenomenon of the newspaper. These demands were met by what was then called quantitative newspaper analysis. Almost exclusively, such early studies employed straight subject-matter categories (e.g., politics, labor, crime, etc.). Probably the first analysis of this kind, published in 1893, asked the question: "Do newspapers now give the news?" The author showed how religious, scientific, and literary matters had dropped out of leading New York newspapers between 1881 and 1893 in favor of gossip, sports, and scandals (Berelson, 1952; Krippendorff, 1980).

During the 1930s, there was an increasing interest in propaganda and public opinion and the emergence of radio as a great mass medium of communication. Also during this period, the professional interest in adult education promoted several researches into the readability of materials (Berelson, 1952).
Content analysis received a major impetus for its probably first large-scale application during World War II, since it was believed in the United States to be possible by systematic analysis of German texts and official documents to detect plans, thoughts, attitudes, and internal conflicts of the Nazis (Philliber, Schwab, & Sloss, 1980). World War II did for content analysis what World War I did for I.Q. testing (Carney, 1972).

After World War II, content analysis spread to numerous disciplines. When other mass media become prominent, this approach—measuring volumes of print in subject-matter categories—became extended initially to radio and later to movies and television. Content analysis of this kind continues today and is applied to a wide variety of content such as textbooks, comic strips, speeches, and advertising (Krippendorff, 1980).

Major development occurred in the fifties and sixties regarding content analysis. Berelson’s *Content Analysis in Communication Research* (1952) on the technique brought it widespread attention, and enabled systematic, focused analysis to proceed (Carney, 1972). It also contributed to the use of content analysis by other disciplines by giving the first integrated picture of content analysis. Content analysis was used in psychology to analyze verbal records to discover motivational, psychological, or personality characteristics. Anthropologists used content analysis techniques to analyze myths, folktales, and riddles. Historians had always looked for more systematic ways to analyze large bodies of available historical documents and came to appreciate content analysis as a suitable technique (Krippendorff, 1980).

The need for systematic and objective determination of various types of communication significance led to the rise of content analysis as a distinct field of communication research (Gerber, Holsti, Krippendorff, Paisley, & Stone, 1978). Content analysis has evolved into a scientific method that promises to yield inferences from essentially verbal, symbolic, or communicative data (Krippendorff, 1980). With the
development of more sophisticated computer software and artificial intelligence, content analysis will continue to evolve into a prominent research design.

Berelson (1952) listed four distinguishing characteristics of content analysis: (1) it applies only to the syntactic and semantic aspects of language; (2) it must be objective; (3) it must be systematic; and (4) it must be quantitative. From these characteristics, he wrote the following definition: "Content analysis is a research technique for the objective, systematic, and quantitative description of the manifest content of communication" (p. 18). "Manifest" content refers to the surface meaning of the text.

Paisley offered this definition in 1964: "Content analysis is a phase of information-processing in which communication content is transformed, through objective and systematic application of categorization rules, into data that can be summarized and compared" (Holsti, 1969).

Krippendorff (1980) defined content analysis as "a research technique for making replicable and valid inferences from data to their content" (p. 21). For a research project to be replicable, it must be clear which data will be analyzed, how the data will be defined, and from what population it will be drawn.

Definitions of content analysis have tended to change over time with developments in techniques and with application of the tool itself to new problems and types of materials. However, the requirements of objectivity, system, and generality prevail.

Objectivity stipulates that each step in the research process must be carried out on the basis of explicitly formulated rules and procedures. One test of objectivity is: can other analysts, following identical procedures with the same data, arrive at similar conclusions?

Systematic means that the inclusion and exclusion of content or categories is done according to consistently applied rules. All aspects of the question must be investigated uniformly, throughout all parts of a defined body of text. Generality requires that the
findings must have theoretical relevance; that is, content analysis must be undertaken for some theoretical reason. Purely descriptive information about the content, unrelated to other attributes of documents or to the characteristics of the sender or recipient of the message, is of little value. All content analysis is concerned with the comparison being dictated by the investigator's theory. In general, content analysis is the application of scientific methods to documentary evidence (Holsti, 1969).

A content analysis design requires several steps to assure its objectivity. These steps include data-making (unitization, sampling, and recording), data reduction, inference, and analysis. Krippendorff (1980) describes datum as a unit of information that is recorded in a durable medium, distinguishable from other data, analyzable from other data, analyzable by explicit techniques, and relevant to a particular problem. Unitizing, sampling, and recording are somewhat interrelated. Unitizing involves the identification of the specific unit or category to be analyzed. It can be done during the recording phase of a content analysis.

According to Budd (1967), no content analysis is better than its categories, for a system or set of categories is, in essence, a conceptual scheme. Where categories are in fact variables, they are linked to the problem and the theories on which the research is based. Furthermore, categories differentiate and describe the content being investigated and form a crucial link between the actual counting or measuring and the larger fields of theory and concept. These categories are not mere labels, but compartments with explicitly defined boundaries into which material is grouped for analysis. Categories must accurately fit the needs of the study so that they answer the questions originally asked, be exhaustive, and be mutually exclusive. By having categories that are exhaustive means that all relevant items in the sample under study must be capable of being placed in a category. Mutual exclusiveness stipulates that no content datum can be placed in more than a single
cell. In other words, operational definitions of the investigator's variables must be precise and unambiguous (Budd, Thorp, & Donohew, 1967; Holsti, 1969).

Data reduction simply means shaping the form of available data into one required by the analytical technique. It may be statistical, algebraic, or it may mean omitting irrelevant details. Inference is the raison d'être for any content analysis. It "consumes" all the knowledge a content analyst may have about the way data are related to their context and this knowledge will be strengthened with inferential success. Analysis concerns the processes of identification and representation of patterns that are noteworthy, statistically significant, or otherwise accounting for or descriptive of the content analysis results (Krippendorff, 1980).

There are two basic units of measurement involved in content analysis—the recording (or coding) unit and the context unit. The recording unit is the smallest segment of content counted and scored in content analysis. They are separately described and can therefore be regarded as the separately analyzable parts of a sampling unit; that is, they provide the basis for analysis. The distinctions among the recording units are achieved as a result of a descriptive effort. The most common recording units are a word, a theme or assertion, a paragraph, an item, a character, group, or object, and space or time. The context unit is the body of material surrounding the recording unit. By defining a larger context unit for each recording unit, the researcher recognizes and makes explicit the fact that symbols codetermine their interpretation and they derive their meanings in part from the immediate environment in which they occur. (Budd, Thorp, & Donohew, 1967; Holsti, 1969; Krippendorff, 1980).

In this study, the specific writing assignments were the recording (or coding) units; and the student editions and the teacher's editions of the four basal mathematics textbook series were the context units. The writing assignments were categorized and
compared according to the categories specified by the purposes mandated in the *English Language Arts Framework, Kindergarten through Grade 12* for the state of Texas using Kinneavy's four basic categories—informative, persuasive, literary, expressive. They correlate closely with Britton's categories—transactional, poetic, expressive. According to Krippendorff (1980), the researcher who relies on existing conceptualizations has more of a chance to contribute to knowledge. It also allows the researcher to rely on well-developed constructs. By relating the study to a theoretical background, two forms of bias are avoided: it has to be explicitly shown how the theory involved is relevant and standards as well as categories are determined not by the research but by outsiders' findings (Carney, 1972).

**The Population**

The state of Texas adopted four basal mathematics textbook series for grades one through eight and one integrated mathematics textbook series for grades seven and eight in 1990. The integrated mathematics textbook series was not included in this study. The four basal mathematics textbook series for grades six through eight, from which each individual school district can select, were the population of this study. The four basal mathematics textbook series include:

*Addison-Wesley Mathematics* (Addison-Wesley Publishing Company, ©1991),

*Exploring Mathematics* (Scott, Foresman and Company, ©1991),


Note: All four publishers of these basal mathematics textbook series have produced "Texas Editions" for the Texas adoption to ensure correlation to the Texas Essential Elements and the Texas Assessment of Academic Skills.
The Sample

This study considered the four adopted basal mathematics textbook series for grades six through eight. Each of the four publisher's student editions were examined for identification of writing assignments and the teaching suggestions in each of the four teacher's editions were also examined for writing assignments for a total of 12 student editions and 12 teacher's editions.

The Research Design

Since the goals of this study were to identify and compare specific writing assignments in the four adopted basal mathematics textbooks series, grades six through eight, adopted by the state of Texas in 1990, a quantitative method was most appropriate. The research method content analysis was selected for this study.

A content analysis design requires the establishment of categories for the coding process. Three coding criteria lists were used: (1) Categories of Writing Assignments Considered to be "Non-composition" Types of Writing Tasks, (2) Coding List of Writing Assignments Corresponding to the Four Purposes of Writing, and (3) Coding List of Writing Assignments Corresponding to the Six NCTM Recommendations in Standard 2: Mathematics as Communication.

The Categories of Writing Assignments Considered to be "Non-composition" Types of Writing Tasks list was used to guide the investigator in categorizing types of writing assignments with regard to its problem title. This coding list was devised to help the investigator locate all possible writing assignments in both the student editions and the teacher's editions of the basal mathematics textbook series. Upon preliminary investigation of the textbooks, the investigator discovered that some writing assignments were properly labeled as writing assignments while other writing assignments were found under various
problem titles or were labeled as writing assignments but were non-composition types of tasks. Three types of "writing" problems were coded W→W, P→W, and W→NOT and defined as follows: The code W→W was used to stand for a problem whose title did include the word "writing" and would lead to a written composition task. For example, in the problem "Writing Activity: Have students write about what kind of shopper he or she is and why," the title of the problem contains the word writing and the suggested activity leads to a composition type of writing activity. The code P→W was used to stand for a problem whose title did not include the word "writing" but lead to a written composition task. For example, in the problem "Explore Math: Write a generalization about the coordinates of lines that are parallel to the x-axis," the title of the problem did not contain the word "writing" but the task required written composition. The code W→NOT was used to stand for a problem whose title included the word "writing" but did not lead to a written composition task. For example, in the problem "Write About Math: How many different ways can you write 64 using exponents," the title included the word "writing" but the task required the use of numerals and operation symbols. The list of suggested "non-composition" type writing tasks can found in Appendix A.

The Four Purposes of Writing Coding List was used to guide the investigator in categorizing the writing assignments in the basal mathematics textbook series with reference to the English Language Arts Framework, Kindergarten through Grade 12 for the state of Texas. The four purposes of writing include Informative, Expressive, Persuasive, and Literary. Suggested writing assignments that were unable to be categorized as composition-type writing assignments or those that relied heavily on the use of mathematical symbolism were categorized as "none." The list of suggested writing tasks for the four purposes of writing can be found in Appendix B.
The NCTM Communication Recommendations Coding List was used to guide the investigator in categorizing the writing assignments in the basal mathematics series with reference to the National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards for School Mathematics* for grades five through eight. The six recommendations of NCTM's Standard 2: Mathematics as Communication were subcategorized into specific writing tasks which correlate closely to the four purposes of writing. Subcategories 1, 3, and 4 correlate with the Informative purpose of writing; subcategory 2 correlates to the Expressive purpose of writing; subcategory 5 correlates to the Persuasive purpose of writing; and subcategory 6 correlates to writing (recording) tasks requiring the use of mathematical symbolism or "non-composition" writing tasks. This list can be found in Appendix C.

Collection of the Data

The instrument used to collect the raw data consisted of a data sheet with four columns to indicate the location and categorization the specific writing assignments. Using an instrument with four columns enabled the investigator to locate each writing assignment and then to code it into three categories. The four columns consisted of the following: Column 1: **PAGE/PROBLEM #/PROBLEM TITLE/WRITING ASSIGNMENT** to record the page number, problem number, problem title and writing assignment. Column 2: **PROBLEM TITLE -> ASSIGN** was used to show whether the problem title corresponded to the content of the assignment using the codes W->W, P->W, and W->NOT to correspond to the coding list criteria of Categories of Writing Assignments Considered to be "Non-composition" Types of Writing Tasks. Column 3: **ENGLISH LANGUAGE ARTS FOUR PURPOSES OF WRITING** was used to categorize the writing assignment as Informative, Literary, Expressive, Persuasive or none according to the Coding List of Writing...
Assignments Corresponding to the Four Purposes of Writing. Column 4: NCTM Standards, 1-6 for Standard #2 was used to categorize the writing assignments from 1 through 6 following the Coding List of Writing Assignments Corresponding to the Six NCTM Recommendations in Standard 2: Mathematics as Communication. The information in columns 2, 3, and 4 were used to find the total number and of types of assignments also as to provide a summary of the writing assignments. The instrument used for collecting the data can be found in Appendix D.

Procedures for the Analysis of the Data

To answer the first research question — How many and what types of specific writing assignments are provided in the student editions and the teacher's editions of the four basal mathematics textbook series adopted by the state of Texas for grades six through eight? -- the specific writing assignments coded as W→W, P→W, and W→NOT were tallied for each edition. The total number of writing assignments as well as the subtotals for each category by publisher can be found in Tables I-IV.

To answer the second research question — How do the writing assignments compare with the purposes of discourse mandated in the English Language Arts Framework, Kindergarten through Grade 12 for the state of Texas? -- the specific writing assignments were tallied for each of the four basal mathematics textbook publishers to include how many and what percent of the writing assignments that were categorized as Informative, Literary, Expressive, and Persuasive. The category of "none" was also used to accommodate the problems where the problem title included the word "writing" but did not lead to a written composition task. This information can be found in Tables V-VIII by publisher.
To answer the third research question -- How do the writing assignments compare with the recommendations for communication opportunities stated in the National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards for School Mathematics* for grades five through eight? -- a summary of the analysis of the totals of the six NCTM categories of writing for each of the four basal mathematics textbook publishers included how many and what percent of the writing assignments were coded as Category 1 to model situations (informative or literary), Category 2 to reflect on or clarify thinking (expressive), Category 3 to develop understanding, including definitions (informative), Category 4 to interpret or evaluate ideas (informative), Category 5 to make conjectures or convincing arguments (persuasive), and Category 6 to appreciate mathematical notation for its role (non-composition task). This information can be found in Tables IX-XII by publisher.

To answer the fourth research question -- How do the basal mathematics textbooks series compare with each other with regard to the number and types of writing assignments provided in the student editions and in the teacher's editions of the four basal mathematics textbook series? -- Tables XIII - XV compare, by publisher, the data analyzed in the first, second, and third research questions. Bar graphs are also used to illustrate the comparisons among the four publishers. Figures 1, 3, and 5 show the number of writing assignments of each publishing company by grade level and edition; Figures 2, 4, and 6 show the percentage of writing assignments of each publisher by grade level and edition.
Validity and Reliability

The requirements for content categories that they be exhaustive and mutually exclusive are especially crucial to validity and reliability. *Validity* is the degree to which a measure actually measures what is intended to measure (Borg & Gall, 1979). Content validity (also called *face validity*) is often assumed by the content analyst. This method of validation presumes that a measure self-evidently measures what it is supposed to if the categories are rigidly defined and the coding has a high degree of reliability. (Budd, Thorp, & Donohew, 1967) In most content analyses the problem of validity is no problem at all. Most of the time, careful definition of categories and judicious and alternative selection of indicators will take care of the matter (Berelson, 1952).

*Reliability* is a measure of the replicability of the research result. By definition, content analysis must be objective. The analyst's subjectivity must be minimized in the effort to obtain an objective description of the communication content. The necessity to achieve objectivity, or near objectivity, for content analysis raises the problem of reliability. Reliability is higher under these conditions: the simpler the categories and the unit, the more experienced and better trained the recorders (coders), and the more precise and complete the set of coding rules. In previous content analyses, only about 15 to 20 percent of the studies report reliability of the analysis contained in them, and the reports on reliability which do appear are uniformly high (Berelson, 1952). *Category reliability* depends upon the analyst's ability to formulate categories "for which the empirical evidence is clear enough so that competent judges will agree to a sufficiently high degree on which items of a certain population belong in the category and which do not" (Holsti, 1969). To test reliability, interrater reliability coefficients are most often used. Interrater reliability involves the degree of similarity between the results of two or more judges (coders) rating the same thing at the same time (Krippendorff, 1980).
To determine interrater reliability of the coding of the writing assignments, a total of ten mathematics teachers and mathematics curriculum coordinators participated in the study as raters to code a selected sample of ten writing assignments from the student and teacher's editions of four mathematics basal textbook series adopted by the state of Texas. The criteria for selecting the raters included classroom teaching experience, especially in mathematics, and whether they had a grasp for distinguishing non-composition writing assignments from composition-type writing assignments. Interviews with the raters were used to determine adequate qualifications for participation in this study. The raters were selected corresponding to the grade levels, six through eight, of the content to be analyzed in that they consisted of experienced upper elementary teachers and a middle school mathematics teacher as well as district curriculum coordinators with teaching experience in the field of mathematics. Nine of the raters held Masters degrees and one held a doctorate. There was a fifth grade teacher, a sixth grade teacher, an eighth grade mathematics teacher, two high school department chairpersons, and five district curriculum coordinators. The years of classroom teaching experience of all the raters ranged from 8 to 27 years. The years of non-classroom education-related experience of the five coordinators ranged from 7 to 18 years. Three raters were male, seven raters were female. Six of the raters were between 40 to 49 years of age, three raters were between 50 to 59 years of age, and one rater was in her thirties. Training of the raters was provided in the Rater Response Form. (The complete Rater Response Form can be found in Appendix E.) Since three of the four questions in this study were concerned with the number and type of writing assignments in the four basal mathematics textbooks, the coding of the selected ten writing assignments was done in three sections: (1) Writing Assignment Title vs. Writing Assignment Content, (2) Writing Assignments Corresponding to the Four Purposes of Writing, and (3) Writing Assignments Corresponding to the NCTM
Recommendations. For each section of the Rater Response Form, a simple explanation of the section was given at the top of the instruction page, a sample of three to six writing assignments were provided with answers, and a list of appropriate suggested writing tasks. The instruction page for each section of the Rater Response Form was modeled similarly to an instruction page for a standardized assessment instrument. The investigator also did a walk-through with each rater of each instruction page for each section of the Rater Response Form to clarify the instructions as well as to determine whether the anticipated rater could distinguish between composition and non-composition types of writing assignments. The raters then completed the coding of the ten selected writing assignments for each of the three sections on their own time and sent the Rater Response Form back to the investigator. All the raters who participated in the study returned the forms along with a sheet of demographic information regarding their educational and professional background.

To determine the interrater reliability, the investigator calculated the reliability coefficient by using the investigator's coding results for ten selected writing assignments and the results of the ten raters. The following coefficient of reliability (C.R.) was used to show the ratio of coding agreements to the total number of coding decisions between two coders, the investigator and one of the ten raters at a time (Holsti, 1969: 140):

\[
C.R. = \frac{2M}{N_1 + N_2}
\]

In this coefficient of reliability (C.R.) formula, \( M \) is the number of coding decisions on which two coders are in agreement, and \( N_1 \) and \( N_2 \) refer to the number of coding decisions made by coders 1 and 2, respectively. For example, if ten writing selections from the basal mathematics series were to be given to the coders, each coder would be expected to make ten decisions \( (N_1 = N_2 = 10, N_1 + N_2 = 20) \). If, after coding ten selections, coder 2 agrees
with eight decisions \( (M = 8) \) of coder 1, the coding reliability between coders 1 and 2 would be 0.8.

\[
C.R. = \frac{2 \times 8}{10 + 10} = \frac{16}{20} = 0.8
\]

When perfect agreement exists between raters, C.R. = 1. When maximum disagreement exists, C.R. = 0.

In this investigation, the investigator was designated coder 1 and the other ten coders as coders 2 through 11. The chart used to record the data of the raters can be found in Appendix F.

A composite reliability coefficient was also computed by the following formula, in which \( N \) denotes the number of coders (Holsti, 1969: 137):

\[
\text{Composite reliability} = \frac{N \text{ (average inter-coder agreement)}}{1 + [(N - 1) \text{ (average inter-coder agreement)}]} 
\]

The Rater Response Form consisted of three sections to correspond to the type of data that needed to be coded in order to relate to the first three research questions of this study which were to find (1) how many and what types of writing assignments are provided in the student editions and the teacher's editions of the four basal mathematics textbook series adopted by the state of Texas for grades six through eight, (2) how do the writing assignments compare with the four purposes of discourse mandated in the English Language Arts Framework, Kindergarten through Grade 12 for the state of Texas, and (3) how do the writing assignments compare with the recommendations for communication opportunities stated in the National Council of Teachers of Mathematics' Curriculum and Evaluation Standards for School Mathematics for grades five through eight.
For Section 1: Writing Assignment Title vs. Writing Assignment Content, the interrater coefficient of reliability ranged from 0.8 to 1.0 with a composite reliability of 0.997. For items 2-8 and 10, there was 100% agreement with the investigator. Items 1 and 9 were the only two items that showed agreements of 90% and 80%, respectively, with the investigator.

For Section 2: Writing Assignments Corresponding to the Four Purposes of Writing, the interrater coefficient of reliability ranged from 0.7 to 1.0 with a composite reliability of 0.995. For items 3, 4, 5, 8, and 9, there was 100% agreement with the investigator. The remaining items showed an agreement of 90% each with the investigator.

For Section 3: Writing Assignments Corresponding to the NCTM Recommendations, the interrater coefficient of reliability ranged from 0.6 to 1.0 with a composite reliability of 0.983. Most of the discrepancies were shown for items that were coded as 1, 3, or 4. These three coding categories were refinements (or subcategories) of the Informative purpose of writing found in Section 2.

With composite reliability coefficients of 0.997, 0.995, and 0.983 on the Rater Response Form's Sections 1 through 3, respectively, the ten raters exhibited a high degree of consistency and reliability with the investigator coding the writing assignments into the appropriate categories.
CHAPTER BIBLIOGRAPHY


CHAPTER IV

PRESENTATION AND ANALYSES OF DATA

The state of Texas adopted four basal mathematics textbook series for grades one through eight and one integrated mathematics textbook series for grades seven and eight in 1990. However, only the four basal mathematics textbook series *Addison-Wesley Mathematics* published by Addison-Wesley and Company, *Mathematics in Action* published by Macmillan/McGraw-Hill School Publishing Company, *Exploring Mathematics* published by Scott, Foresman and Company, and *MATHEMATICS: Exploring Our World* published by Silver Burdett Ginn, for grades six through eight, were considered for this study. The student editions and teacher's editions for each grade level six through eight were examined for identification and categorization of writing assignments for a total of twelve student editions and twelve teacher's editions used in this study.

Since the purpose of this study was to identify and compare specific writing assignments provided in the four basal mathematics textbook series, grade six through eight, adopted by the state of Texas in 1990, the research method content analysis was selected to describe various facets of communication content in summary fashion.

Dimensions for Reporting the Data

To collect the data for this study, the student editions and the teacher's editions from the four publishers for grades six through eight were examined for identification of writing assignments. To answer the first research question, the number and types of specific writing assignments for each student and teacher's edition by publisher can be found in Tables I through IV. To answer the second research question, the writing
assignments which correspond to the four purposes of writing for each student and teacher's edition by publisher can be found in Tables V through VIII. To answer the third research question, the writing assignments which correspond to the NCTM Standards for each student and teacher's edition by publisher can be found in Tables IX through XII. And, to answer the fourth research question, Tables XIII through XV compare, by publisher, the data presented in Tables I through XII regarding the categories of specific writing assignments. Bar graphs were also used to illustrate the comparison of statistical data among the four publishers. Figures 1, 3, and 5 show the number of writing assignments of each publishing company by grade level and edition for the frequency and types of writing assignments, writing assignments which correspond to the four purposes of writing, and writing assignments which correspond to the NCTM Standards, respectively. Figures 2, 4, and 6 show the percentage of writing assignments of each publisher by grade level and edition for the frequency and types of writing assignments, writing assignments which correspond to the four purposes of writing, and writing assignments which correspond to the NCTM Standards, respectively.

Frequency and Types of Writing Assignments

Addison-Wesley Publishing Company

In the *Addison-Wesley Mathematics* basal mathematics textbook series published by Addison-Wesley Publishing Company, a total of 679 writing assignments were identified in the student and teacher's editions for grades six through eight (see Table I). Of that total, 156 writing assignments were located in the student editions and 523 writing assignments were located in the teaching suggestions of the teacher's editions. The investigator found that in this basal mathematics textbook series it was more difficult to
identify the writing assignments in the student editions than in the teacher's editions in that a total of 124, or 79 percent of the 156, writing assignments in the student editions did not have the word "writing" in the problem title (i.e., coded P→W). Of the remaining 32 problems that did contain the word "writing" in the problem title (i.e., coded W→W or W→not), only 26 of them, or 17 percent of the 156 problems, required composition-type writing tasks. The problems indicating writing assignments in the seventh and eighth grade levels of the student editions were more accurately labeled than the sixth grade student edition in that these two grade levels did not contain any problems coded as "W→not."

Specific writing assignments were somewhat easier to locate in the teacher's editions in that two-thirds or 67 percent (261 of 523 writing assignments) were labeled with the word "writing" in the problem title (i.e., coded W→W or W→not). However, about 17 percent of these labeled writing assignments required non-composition writing tasks.

Overall, there were more than three times as many suggested writing assignments in the teaching suggestions of the teacher's editions (N = 523) than the student editions (N = 156). When comparing each grade level of each edition, there were more than three times as many suggested writing assignments in the teacher's edition (N = 173) than in the student edition (N = 53) for grade 6, more than twice as many suggested writing assignments in the teacher's edition (N = 169) than the student edition (N = 75) in grade 7, and more than six times as many suggested writing assignments in the teacher's edition (N = 181) than the student edition (N = 28) in grade 8. Refer to Table I.
### TABLE I

**FREQUENCY AND TYPES OF WRITING ASSIGNMENTS**

Addison-Wesley Publishing Company

<table>
<thead>
<tr>
<th></th>
<th>W→W</th>
<th>W→NOT</th>
<th>P→W</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE* 6</td>
<td>11</td>
<td>6</td>
<td>36</td>
<td>53</td>
</tr>
<tr>
<td>SE 7</td>
<td>6</td>
<td>0</td>
<td>69</td>
<td>75</td>
</tr>
<tr>
<td>SE 8</td>
<td>9</td>
<td>0</td>
<td>19</td>
<td>28</td>
</tr>
<tr>
<td><strong>SE Subtotals</strong></td>
<td><strong>26</strong></td>
<td><strong>6</strong></td>
<td><strong>124</strong></td>
<td><strong>156</strong></td>
</tr>
<tr>
<td>TE* 6</td>
<td>87</td>
<td>30</td>
<td>56</td>
<td>173</td>
</tr>
<tr>
<td>TE 7</td>
<td>72</td>
<td>30</td>
<td>67</td>
<td>169</td>
</tr>
<tr>
<td>TE 8</td>
<td>102</td>
<td>31</td>
<td>48</td>
<td>181</td>
</tr>
<tr>
<td><strong>TE Subtotals</strong></td>
<td><strong>261</strong></td>
<td><strong>91</strong></td>
<td><strong>171</strong></td>
<td><strong>523</strong></td>
</tr>
<tr>
<td><strong>SE/TE Total</strong></td>
<td><strong>287</strong></td>
<td><strong>97</strong></td>
<td><strong>295</strong></td>
<td><strong>679</strong></td>
</tr>
</tbody>
</table>


Macmillan/McGraw-Hill School Publishing Company

In the *Mathematics in Action* basal mathematics textbooks series published by Macmillan/McGraw-Hill Publishing Company, a total of 506 writing assignments were identified in the student and teacher's editions for grades six through eight. Of that total, 316 writing assignments were located in the student editions and 190 writing assignments were located in the teacher's editions. When examining the four basal mathematics textbook series for writing assignments, the investigator experienced finding the location of specific writing assignments in this series more easily than the other three. In fact, 249 of the 316 writing assignments (or 79 percent) were labeled appropriately with the word "writing" in the problem title (i.e., coded W→W). The remaining 67 writing assignments were located under other problem titles (i.e., coded P→W), and none of the labeled writing assignments were non-composition type writing tasks (i.e., coded W→not). The labeling of writing assignments was almost as consistent in the teacher's editions as in the
student editions in that 77 percent of the problems contained the word "writing" (i.e., coded W→W or W→not). However, 30 of these problems required non-composition writing tasks. Only 44 of the 190 writing assignments, or 23 percent, were located under problem titles not containing the word "writing" (i.e., coded P→W). Refer to Table II.

Table II

<table>
<thead>
<tr>
<th>FREQUENCY AND TYPES OF WRITING ASSIGNMENTS</th>
<th>Macmillan/McGraw-Hill School Publishing Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>W→W</td>
<td>W→NOT</td>
</tr>
<tr>
<td>SE 6</td>
<td>79 81%</td>
</tr>
<tr>
<td>SE 7</td>
<td>92 77%</td>
</tr>
<tr>
<td>SE 8</td>
<td>78 80%</td>
</tr>
<tr>
<td>SE Subtotal</td>
<td>249 79%</td>
</tr>
<tr>
<td>TE 6</td>
<td>47 72%</td>
</tr>
<tr>
<td>TE 7</td>
<td>32 54%</td>
</tr>
<tr>
<td>TE 8</td>
<td>37 56%</td>
</tr>
<tr>
<td>TE Subtotal</td>
<td>116 61%</td>
</tr>
<tr>
<td>SE/TE Total</td>
<td>365 72%</td>
</tr>
</tbody>
</table>

Comparing the number of writing assignments presented in the student editions to the number of writing assignments in the teacher's editions, there were about one and one-half times as many writing assignments in the student editions for grades six and eight and twice as many writing assignments in the student edition for grade seven than in the teacher's editions for the respective grade levels.

Scott, Foresman and Company

In the Exploring Mathematics basal mathematics textbook series published by Scott, Foresman and Company, a total of 318 writing assignments were identified in the student and teacher's editions for grade six through eight, of which 171 writing assign-
ments were located in the student editions and 147 writing assignments were located in the teacher's editions. Refer to Table III.

### TABLE III

**FREQUENCY AND TYPES OF WRITING ASSIGNMENTS**
Scott, Foresman and Company

<table>
<thead>
<tr>
<th></th>
<th>W→W</th>
<th>W→not</th>
<th>P→W</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE 6</td>
<td>34</td>
<td>10</td>
<td>7</td>
<td>51</td>
</tr>
<tr>
<td>SE 7</td>
<td>33</td>
<td>14</td>
<td>6</td>
<td>53</td>
</tr>
<tr>
<td>SE 8</td>
<td>31</td>
<td>8</td>
<td>28</td>
<td>67</td>
</tr>
<tr>
<td>SE Subtotal</td>
<td>98</td>
<td>32</td>
<td>41</td>
<td>171</td>
</tr>
<tr>
<td>TE 6</td>
<td>20</td>
<td>0</td>
<td>19</td>
<td>39</td>
</tr>
<tr>
<td>TE 7</td>
<td>15</td>
<td>0</td>
<td>37</td>
<td>52</td>
</tr>
<tr>
<td>TE 8</td>
<td>21</td>
<td>0</td>
<td>35</td>
<td>56</td>
</tr>
<tr>
<td>TE Subtotal</td>
<td>56</td>
<td>0</td>
<td>91</td>
<td>147</td>
</tr>
<tr>
<td>SE/TE Total</td>
<td>154</td>
<td>32</td>
<td>132</td>
<td>318</td>
</tr>
</tbody>
</table>

The writing assignments were easier to locate in the student editions in that 130, or 76 percent, of the 171 problems contained the word "writing" in the problem title as opposed to only 56, or 38 percent, of the 147 problems in the teacher's editions that contained the word "writing" in the problem title (i.e., coded W→W or W→not).

Although there were no writing assignments coded as "W→not" in the teacher's editions, nearly two-thirds (62 percent) of the writing assignments were located in problems whose problem titles did not contain the word "writing" (i.e., coded P→W). Two student editions in this series had the highest percentage of labeled writing assignments that were non-composition tasks (i.e., coded W→not) with 10 assignments, or 20 percent, in grade 6, and 14 assignments, or 26 percent, in grade 7.
Silver Burdett Ginn

In the *MATHEMATICS: Exploring Your World* basal mathematics textbooks series published by Silver Burdett Ginn, a total of 359 writing assignments were identified in the student and teacher's editions in grades six through eight. In this series the problem titles were the least descriptive with regard to indicating any type of writing activity in that all 151 writing assignments in the student editions were located under problem titles that did not contain the word "writing" (i.e., coded P→W) and 166, or 80 percent, of the writing assignments found in the teacher's editions did not contain the word "writing" in the problem title. Only 41, or 20 percent, of the writing assignments were actually labeled as a writing assignment in the teacher's editions (i.e., coded W→W). Refer to Table IV.

<table>
<thead>
<tr>
<th></th>
<th>W→W</th>
<th>W→Not</th>
<th>P→W</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE 6</td>
<td>0</td>
<td>0%</td>
<td>52</td>
<td>100%</td>
</tr>
<tr>
<td>SE 7</td>
<td>0</td>
<td>0%</td>
<td>51</td>
<td>100%</td>
</tr>
<tr>
<td>SE 8</td>
<td>0</td>
<td>0%</td>
<td>48</td>
<td>100%</td>
</tr>
<tr>
<td>SE Subtotal</td>
<td>0</td>
<td>0%</td>
<td>151</td>
<td>100%</td>
</tr>
<tr>
<td>TE 6</td>
<td>14</td>
<td>18%</td>
<td>62</td>
<td>82%</td>
</tr>
<tr>
<td>TE 7</td>
<td>14</td>
<td>21%</td>
<td>52</td>
<td>79%</td>
</tr>
<tr>
<td>TE 8</td>
<td>13</td>
<td>19.5%</td>
<td>52</td>
<td>79%</td>
</tr>
<tr>
<td>TE Subtotal</td>
<td>41</td>
<td>20%</td>
<td>166</td>
<td>80%</td>
</tr>
<tr>
<td>SE/TE Total</td>
<td>41</td>
<td>11.4%</td>
<td>317</td>
<td>88.3%</td>
</tr>
</tbody>
</table>
Writing Assignments Which Correspond to the Four Purposes of Writing

Each writing assignment that was identified in the student and teacher's editions in the four basal mathematics textbook series for grades six through eight was categorized as Informative, Literary, Expressive or Persuasive as defined by the four purposes of discourse mandated in the *English Language Arts Framework, Kindergarten through Grade 12* for the state of Texas. Suggested writing assignments labeled with the word "writing" in the problem title but required non-composition writing tasks (i.e., coded W→not) were categorized as "none."

Addison-Wesley Publishing Company

A total of 679 writing assignments located in the Addison-Wesley Publishing Company's student and teacher's editions, grades six through eight, were categorized into the four purposes of writing. In the student editions 134, or 86 percent, of the writing assignments were categorized as Informative. The remaining 14 percent of the writing assignments included six Expressive, 10 Persuasive, and six "none." There were no Literary writing assignments contained in the student editions.

In the teacher's editions, 72 percent, or 378, of writing assignments were categorized as Informative, 17 percent categorized as "none," 16 percent categorized as Persuasive, six percent categorized as Expressive, and only one percent categorized as Literary. Refer to Table V.
A total of 506 writing assignments were identified in the student and teacher's editions, grades six through eight, in the Macmillan/McGraw-Hill Publishing Company's basal mathematics series. Of the 316 writing assignments found in the student editions, 310, or 98 percent, were categorized as Informative. There were only three Literary, two Persuasive, and one Expressive writing assignments categorized in the remaining two percent of the writing assignments in the student editions.

In the teacher's editions, 146, or 77 percent, of the writing assignments were categorized as Informative, seven were Expressive, five were Persuasive, and only two were Literary. Thirty of the writing assignments, or 16 percent, were categorized as "none" in the teacher's editions. Refer to Table VI.
Three hundred eighteen writing assignments were identified in the Scott, Foresman and Company basal mathematics textbook series for grades six through eight. Eighty percent, or 136, of the writing assignments were categorized as Informative. Of the remaining 35 writing assignments, 32 were categorized as "none" and three were categorized as Expressive. There were no Literary nor Persuasive writing assignments in the student editions. The teacher's editions contained writing assignments in only two categories: 141 writing assignments, or 96 percent, were Informative and six writing assignments were Expressive. Refer to Table VII.
TABLE VII

WRITING ASSIGNMENTS WHICH CORRESPOND TO THE FOUR PURPOSES OF WRITING
Scott, Foresman and Company

<table>
<thead>
<tr>
<th></th>
<th>INFORMATIVE</th>
<th>LITERARY</th>
<th>EXPRESSIVE</th>
<th>PERSUASIVE</th>
<th>NONE</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE 6</td>
<td>41 80%</td>
<td>0 0%</td>
<td>0 0%</td>
<td>0 0%</td>
<td>10</td>
<td>20%</td>
</tr>
<tr>
<td>SE 7</td>
<td>39 74%</td>
<td>0 0%</td>
<td>0 0%</td>
<td>0 0%</td>
<td>14</td>
<td>26%</td>
</tr>
<tr>
<td>SE 8</td>
<td>56 84%</td>
<td>0 0%</td>
<td>3 4%</td>
<td>0 0%</td>
<td>8</td>
<td>12%</td>
</tr>
<tr>
<td>SE</td>
<td>136 80%</td>
<td>0 0%</td>
<td>3 2%</td>
<td>0 0%</td>
<td>32</td>
<td>19%</td>
</tr>
<tr>
<td>TE 6</td>
<td>36 92%</td>
<td>0 0%</td>
<td>3 8%</td>
<td>0 0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>TE 7</td>
<td>51 98%</td>
<td>0 0%</td>
<td>1 2%</td>
<td>0 0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>TE 8</td>
<td>54 96%</td>
<td>0 0%</td>
<td>2 4%</td>
<td>0 0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>TE</td>
<td>141 96%</td>
<td>0 0%</td>
<td>6 4%</td>
<td>0 0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>SE/TE</td>
<td>277 87%</td>
<td>0 0%</td>
<td>9 3%</td>
<td>0 0%</td>
<td>32</td>
<td>10%</td>
</tr>
</tbody>
</table>

Silver Burdett Ginn

Silver Burdett Ginn's basal mathematics textbook series contained a total of 359 writing assignments in the student and teacher's editions for grades six through eight. Eighty-nine percent of the writing assignments were categorized as Informative in the student editions with two percent each Literary and Expressive, and five percent Persuasive. The teacher's editions also contained 89 percent of its writing assignments categorized as Informative. Four percent each were Literary and Persuasive, and only two percent were Expressive. Only one assignment was categorized as "none" from the total of 359 writing assignments for the student and teacher's editions. Refer to Table VIII.
Writing Assignments Which Correspond to the NCTM Standards

The writing assignments identified in the four basal mathematics textbook series, grades six through eight, were also coded into six categories following the recommendations of Standard 2: Mathematics as Communication of the National Council of Teachers of Mathematics' Curriculum and Evaluation Standards for School Mathematics. These six categories correlate closely to the four purposes of writing in that Categories 1, 3, and 4 correspond to the Informative purpose of writing. More specifically, Categories 1, 3, and 4 are subcategories of the Informative purpose of writing. Category 1 deals with writing assignments that model mathematical situations such as writing a story problem, an adventure story, a haiku poem, a limerick, a riddle, a rhyme, a short story, or a tall tale. Category 3 deals with developing understanding of mathematical concepts and skills by writing explanations, definitions, an analysis, comparisons, conclusions, a diagnosis,
generalizations, set of guidelines, procedures, rules, summaries, and step-by-step instructions. Category 4 deals with interpreting and evaluating mathematical ideas which includes writing tasks to show applications and program designs, more specifically, writing plans, documenting projects, making lists, showing examples, and conducting surveys. Category 2 corresponds to the Expressive purpose of writing to explain one's own thinking, keeping a journal, or writing an opinion or reaction. Category 5 corresponds to the Persuasive purpose of writing which entails writing convincing arguments, advertisements, slogans, predictions, and conjectures. Category 6 deals with non-composition types of writing tasks in which mathematical symbolism is preferred. The analysis of data for Tables IX through XII focuses on writing assignments corresponding to the NCTM Standards. In particular, Categories 1, 3, and 4 are analyzed in greater detail due to the fact that they are subcategories of the Informative purpose of writing. The other NCTM categories (Expressive, Persuasive, and "none" corresponding to Categories 2, 5, and 6) have already been shown in the previous section discussing the four purposes of writing and are simply noted again in this analysis of the data.

Addison-Wesley Publishing Company

Of the 156 writing assignments located in the student editions, grades six through eight, in the Addison-Wesley Publishing Company basal mathematics textbook series, 134 of them, or 86 percent, were categorized as Informative. These Informative writing assignments have been subcategorized in the following way: 66 were Category 1 which deal with modeling mathematical situations, 23 were Category 3 which focus on definitions and explanations, and 45 were Category 4 which require interpretation and evaluation of mathematical ideas. Modeling mathematical situations, usually by writing word problems, seems to dominate the Informative purpose of writing in these student
editions. Very small percentages of 4 and 6 percent of the writing assignments were in Categories 2, 5, and 6.

The teacher's editions of the Addison-Wesley Publishing Company's basal mathematics textbook series, grades six through eight, contained 523 suggested writing activities of which nearly three-fourths of them were found to be Informative types of writing. Of these 523 writing assignments, 123 of them (24 percent) were Category 1 writing tasks, 208 of them (40 percent) were Category 3 writing tasks, and 52 of them (10 percent) were Category 4 writing tasks. The remaining writing suggestions included 91 writing tasks (17 percent) in Category 6, 33 of the assignments (6 percent) in Category 2 (Expressive) and only 16 of the assignments (3 percent) in Category 5 (Persuasive).

Unlike the student editions, more Category 3 writing tasks dealing with explanations and definitions were suggested in the teacher's editions. Refer to Table IX.

### Table IX

**Writing Assignments Which Correspond to the NCTM Standards**

<table>
<thead>
<tr>
<th></th>
<th>1*</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE 6</td>
<td>14</td>
<td>26%</td>
<td>1</td>
<td>2%</td>
<td>3</td>
<td>6%</td>
<td>26</td>
</tr>
<tr>
<td>SE 7</td>
<td>41</td>
<td>55%</td>
<td>3</td>
<td>4%</td>
<td>14</td>
<td>18%</td>
<td>12</td>
</tr>
<tr>
<td>SE 8</td>
<td>11</td>
<td>39%</td>
<td>2</td>
<td>7%</td>
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<td>7</td>
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<tr>
<td>SE</td>
<td>66</td>
<td>42%</td>
<td>6</td>
<td>4%</td>
<td>23</td>
<td>15%</td>
<td>45</td>
</tr>
<tr>
<td>TE 6</td>
<td>41</td>
<td>24%</td>
<td>15</td>
<td>9%</td>
<td>58</td>
<td>35%</td>
<td>20</td>
</tr>
<tr>
<td>TE 7</td>
<td>46</td>
<td>27%</td>
<td>9</td>
<td>5%</td>
<td>65</td>
<td>38%</td>
<td>16</td>
</tr>
<tr>
<td>TE 8</td>
<td>36</td>
<td>20%</td>
<td>9</td>
<td>5%</td>
<td>85</td>
<td>47%</td>
<td>16</td>
</tr>
<tr>
<td>TE</td>
<td>123</td>
<td>24%</td>
<td>33</td>
<td>6%</td>
<td>208</td>
<td>40%</td>
<td>52</td>
</tr>
<tr>
<td>SE/TE</td>
<td>189</td>
<td>28%</td>
<td>39</td>
<td>6%</td>
<td>231</td>
<td>34%</td>
<td>97</td>
</tr>
</tbody>
</table>

* NCTM Category 1 models mathematical situations, Category 2 reflects on or clarifies thinking (Expressive), Category 3 develops understanding and includes definitions, Category 4 deals with interpretation and evaluation of ideas, Category 5 includes conjectures and convincing arguments (Persuasive), and Category 6 appreciates mathematical notion and its role (non-composition).
The Informative purpose of writing dominated the type of writing assignments presented in the student editions of Macmillan/McGraw-Hill's basal mathematics textbook series, grades six through eight, with an overwhelming 98 percent, or 310 out of 316 writing assignments, as shown earlier in Table VI. Of these 310 writing activities as shown in Table X, 208 assignments or 66 percent were in Category 1, 62 assignments or 20 percent were in Category 3, and 43 assignments or 14 percent were in Category 4. Only one writing assignment was in Category 2 (Expressive) and two writing assignments in Category 5 (Persuasive). There were no Category 6 writing assignments in the student editions. The Informative type of writing tasks of Category 1, modeling mathematical situations, was identified most often.

### Table X

<table>
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</tr>
<tr>
<td><strong>SE 7</strong></td>
<td>76</td>
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<td>0%</td>
<td>29</td>
<td>24%</td>
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<td>1%</td>
<td>1%</td>
<td>16</td>
<td>16%</td>
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<td>5</td>
</tr>
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<td>3%</td>
<td>5%</td>
<td>12</td>
<td>20%</td>
<td>13</td>
</tr>
<tr>
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<td>0%</td>
<td>0%</td>
<td>29</td>
<td>44%</td>
<td>3</td>
</tr>
<tr>
<td><strong>TE</strong></td>
<td>72</td>
<td>38%</td>
<td>4%</td>
<td>2%</td>
<td>58</td>
<td>31%</td>
<td>21</td>
</tr>
<tr>
<td><strong>SE/TE</strong></td>
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<td>0.1%</td>
<td>120</td>
<td>24%</td>
<td>64</td>
</tr>
</tbody>
</table>

* NCTM Category 1 models mathematical situations. Category 2 reflects on or clarifies thinking (Expressive). Category 3 develops understanding and includes definitions. Category 4 deals with interpretation and evaluation of ideas. Category 5 includes conjectures and convincing arguments (Persuasive), and Category 6 appreciates mathematical notion and its role (rote).
Of the 190 writing assignments that were suggested in the teacher's editions of 
Macmillan/McGraw-Hill's basal mathematics textbook series, grades six through eight, 90 
percent were classified as Informative as shown earlier in Table VI. However, unlike the 
predominance of Category 1 writing tasks in the student editions, Categories 1 and 3 were 
more evenly distributed with 38 percent and 31 percent of the writing assignments in each, 
respectively, in that more writing suggestions were given in the teacher's edition dealing 
with explanations and definitions than in the student editions. Categories 2, 4, 5, and 6 
contained 4, 21, 5, and 30 writing assignments, respectively.

Scott, Foresman and Company

The student editions of the Scott, Foresman and Company basal mathematics 
textbook series, grades six through eight, contained 171 writing assignments. Table XI 
shows that the majority of the writing assignments (61 percent) were in Category 3 
dealing with explanations and definitions. Nearly one-fifth (19 percent) were in Category 6 
which required writing tasks involving mathematical symbolism rather than composition 
types of writing. Twenty-four writing assignments were in Category 1. Of the remaining 
11 writing assignments, there were eight writing suggestions in Category 4 (Informative: 
interpretation and evaluation), only three suggested writing tasks for Category 2 
(Expressive) and no writing suggestions in Category 5 (Persuasive).

In the teacher's editions of the Scott, Foresman and Company basal mathematics 
textbook series, 96 percent of the total 147 writing assignments dealt with Informative 
types of writing and distributed this way: 53 percent in Category 3 (explanations and 
definitions), 28 percent in Category 1 (modeling mathematical situations) and 15 percent 
in Category 4 (interpretation and evaluation). The remaining four percent of the writing
assignments were in Category 2 (Expressive). There were no writing tasks suggested in Categories 5 and 6.

### Table XI

<table>
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<td>1</td>
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<td>5</td>
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<td>2%</td>
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<td>61%</td>
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<tr>
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<tr>
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<td>3%</td>
<td>182</td>
<td>57%</td>
<td>30</td>
<td>9%</td>
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</tbody>
</table>

* NCTM Category 1 models mathematical situations, Category 2 reflects on or clarifies thinking (Expressive), Category 3 develops understanding and includes definitions, Category 4 deals with interpretation and evaluation of ideas, Category 5 includes conjectures and convincing arguments (Persuasive), and Category 6 appreciates mathematical notion and its role (non-composition).

Silver Burdett Ginn

Silver Burdett Ginn's basal mathematics textbook series for grades six through eight contained a total of 359 writing assignments. Of the 151 writing assignments found in the student editions, Table XII shows that 44 percent were in Category 1, 32 percent in Category 3, and 16 percent in Category 4 for a total of 88 percent of the problems being classified as Informative (see Table VII). Only four writing assignments were in Category 2 and eight writing assignments were in Category 5 dealing with expressive and persuasive types of writing, respectively. There were no writing assignments in Category 6.
Of the 208 writing assignments in the teacher’s editions, 39 percent were in Category 1, 40 percent were in Category 3, and 14 percent in Category 4. Only five writing assignments were in Category 2 and eight writing assignments were in Category 5 dealing with expressive and persuasive types of writing, respectively. There was only one writing assignment in Category 6. In both the student and teacher's editions, suggestions for writing tasks focusing on modeling mathematical situations and explanations and definitions were most prevalent.

<table>
<thead>
<tr>
<th>Table XII</th>
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<td>Writing Assignments Which Correspond to the NCTM Standards</td>
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<tr>
<td>TE</td>
</tr>
<tr>
<td>SE/TE</td>
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</tbody>
</table>

* NCTM Category 1 models mathematical situations, Category 2 reflects on or clarifies thinking (Expressive), Category 3 develops understanding and includes definitions, Category 4 deals with interpretation and evaluation of ideas, Category 5 includes conjectures and convincing arguments (Persuasive), and Category 6 appreciates mathematical notion and its role (non-composition).
Comparison of Writing Assignments
Among Publishers

The analysis of data in this section focuses on comparing the four publishers of the basal mathematics textbook series, grades six through eight, regarding the frequency and types of writing assignments, writing assignments which correspond to the four purposes of writing, and writing assignments which correspond to the NCTM recommendations. The statistical information displayed in Tables XII through XV and Figures 1 through 6 is a compilation of the statistical information previously displayed in Tables I through XII so that the comparison among the publishers may be presented graphically as well as through discussion of the data.

Frequency and Types of Writing Assignments

Compiling the statistical data displayed earlier in Tables I through IV dealing with the frequency and types of writing assignments contained in each of the four basal mathematics textbook series, grades six through eight, into Table XIII and then graphically in Figures 1 and 2, provides a comparison among the four publishers.

The Addison-Wesley Mathematics series, grades six through eight, contained the most writing assignments in the student and teacher's for a combined total of 679 as compared to a combined total of writing assignments Macmillan/McGraw-Hill had with 506 (see Figure 1). Scott, Foresman and Company and Silver Burdett Ginn followed with 318 and 359 writing assignments, respectively. Addison-Wesley also had the most writing tasks suggested in the teacher's editions than the other three publishers for a total of 523. Macmillan/McGraw-Hill had twice as many writing assignments in the student edition with 316 as compared to the other three publishers with 156, 171, and 151 assignments each.

Macmillan/McGraw-Hill's writing assignments were labeled as writing assignments (i.e., W→W) more often with 79 percent in the student edition and 61 percent in the teacher's edition than the other three publishers. Silver Burdett was least descriptive with
its writing assignment problem titles in that all 151 of the writing assignments in the
student editions were located under a problem title that did not contain the word "writing"
(i.e., P→W) and only 20 percent of the suggested writing activities in the teacher's
editions were appropriately labeled as writing assignments (i.e., W→W) as illustrated in
Figure 2. In the student editions, Scott, Foresman and Company incorrectly labeled almost
20 percent of its writing assignments as composition tasks when in fact they were non-
composition tasks (i.e., W→not). Addison-Wesley and Macmillan/McGraw-Hill labeled
17 percent and 16 percent of the writing assignments as composition type writing tasks
when they were actually non-composition tasks. Silver Burdett Ginn, in both the student
and teacher's editions, was most consistent for not labeling non-composition tasks as
composition type writing tasks.


| Table XIII |

**FREQUENCY AND TYPES OF WRITING ASSIGNMENTS**

**COMPARISON AMONG PUBLISHERS**

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<th>P→W</th>
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<td>181</td>
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<td>18</td>
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FIGURE 1

FREQUENCY AND TYPES OF WRITING ASSIGNMENTS
COMPARISON AMONG PUBLISHERS BY NUMBER

Addison-Wesley
Macmillan/McGraw-Hill
Scott, Foresman & Co.
Silver Burdett Ginn

PUBLISHER
FIGURE 2

FREQUENCY AND TYPES OF WRITING ASSIGNMENTS
COMPARISON AMONG PUBLISHERS BY PERCENT

- W→W
- P→W
- W→NOT

Addison-Wesley
Macmillan/McGraw-Hill
Scott, Foresman & Co.
Silver Burdett Glen

PUBLISHER
Writing Assignments Which Correspond to the Four Purposes of Writing

The data from Tables V through VIII were compiled into Table XIV and Figures 3 and 4 to graphically present the comparison of writing assignments among publishers relating to the four purposes of writing.

All four of the publishers of the basal mathematics textbook series were rather consistent regarding the four purposes of writing. The use of Informative writing was suggested 80 to 98 percent of the time for the writing assignments in the student editions and 72 to 96 percent of the time for the writing assignments in the teacher's editions for grades six through eight. Very few Literary, Expressive, and Persuasive writing assignments were provided in either the student or teacher's editions by all four publishers. In fact, Scott, Foresman and Company did not suggest any Literary or Persuasive writing assignments in their student or teacher's editions. Addison-Wesley had no Literary writing assignments in their student editions.

The category "none" corresponds to all those non-composition writing assignments that were labeled with the word "writing" in the problem title (i.e., W→not). Note: The W→not column in Table XIII and the NONE column in Table XIV have the same totals.
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<th>EXPRESSIVE</th>
<th>PERSUASIVE</th>
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<td>2 7%</td>
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</tr>
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<td>6 4%</td>
<td>10 6%</td>
<td>6 4%</td>
</tr>
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<td>9 5%</td>
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</tr>
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<td>9 5%</td>
<td>3 2%</td>
<td>30 18%</td>
</tr>
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<td>4 2%</td>
<td>31 17%</td>
</tr>
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<td>33 6%</td>
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<td>91 17%</td>
</tr>
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<td>2 0.6%</td>
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<td><strong>Total</strong></td>
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<td>51 78.5%</td>
<td>1 1.5%</td>
<td>1 1.5%</td>
<td>1 1.5%</td>
<td>11 17%</td>
</tr>
<tr>
<td>TE 7</td>
<td>44 75%</td>
<td>1 1.5%</td>
<td>3 5%</td>
<td>3 5%</td>
<td>8 14%</td>
</tr>
<tr>
<td>TE 8</td>
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<td>3 4.5%</td>
<td>0 0%</td>
<td>1 1.5%</td>
<td>11 17%</td>
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<td>4 2%</td>
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FIGURE 3

WRITING ASSIGNMENTS WHICH CORRESPOND TO THE FOUR PURPOSES OF WRITING
COMPARISON AMONG PUBLISHERS BY NUMBER

- INFORMATIVE
- LITERARY
- EXPRESSIVE
- PERSUASIVE
- NONE
FIGURE 4

WRITING ASSIGNMENTS WHICH CORRESPOND TO THE FOUR PURPOSES OF WRITING
COMPARISON AMONG PUBLISHERS
BY PERCENT

<table>
<thead>
<tr>
<th>Publisher</th>
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<th>Expressive</th>
<th>Literary</th>
<th>Persuasive</th>
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<td>Macmillan/McGraw-Hill</td>
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<tr>
<td>Scott, Foresman &amp; Co.</td>
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<tr>
<td>Silver Burdett &amp; glu</td>
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</tbody>
</table>

Addison-Wesley, Macmillan/McGraw-Hill, Scott, Foresman & Co., Silver Burdett & glu
Writing Assignments Which Correspond
to the NCTM Standards

To compare the writing assignments which correspond to the NCTM Standards among publishers, the data in Tables IX through XII were compiled into Table XV and Figures 5 and 6.

Although the publishers of all four of the basal mathematics textbook series for grades six through eight were relatively consistent in providing anywhere from 72 to 98 percent Informative writing assignments in their student and teacher's editions, they differed with regard to the types of Informative writing that was provided. By analyzing the categories of writing activities related to the NCTM Standards, the Informative purpose of writing can be subcategorized into writing dealing with modeling mathematical situations (Category 1), explanations and definitions (Category 3), and interpretation and evaluation of mathematics ideas (Category 4). The other three categories related to the NCTM Standards Categories 2, 5, and 6 deal with Expressive, Persuasive, and non-composition writing activities, respectively.

In the student editions for grades six through eight, Macmillan/McGraw-Hill provided more writing assignments in Category 1 than the other three publishers; 66 percent as compared to 42 percent, 14 percent, and 44 percent by Addison-Wesley, Scott, Foresman and Company, and Silver Burdett Ginn, respectively. Category 1 writing assignments entail modeling mathematical situations by having students write story problems.

Scott, Foresman and Company provided more writing activities in Category 3 in both their student and teacher's editions. Their emphasis in writing activities was on explanations and definitions of mathematical ideas. Addison-Wesley provided the least number of writing assignments in their student editions in this category.
Silver Burdett Ginn devoted approximately three-fourths of their writing assignments to Categories 1 and 3 in both their student and teacher's editions.

Addison-Wesley provided more Category 4 writing assignments in their student editions than the other three publishers, especially in grade 6 with 49 percent of the writing assignments requiring interpretation or application of mathematical ideas. Scott, Foresman and Company provided the least number of writing assignments in this category.

Very few writing assignments were provided by all four publishers in the student and teacher's editions for grades six through eight. No writing assignments were located in the Scott, Foresman and Company basal mathematics textbook series for Category 5 in both the student or teacher's editions.

The student editions published by Macmillan/McGraw-Hill and Silver Burdett Ginn contained no Category 6 writing assignments. The teacher's editions published by Scott, Foresman and Company contained no Category 6 writing assignments.

Note: To ensure accuracy in reporting the data in the tables and the relationship to the writing assignments, the totals in the Category 2 column in Table XV correspond to the Expressive column in Table XIV, the totals in the Category 5 column in Table XV correspond to the Persuasive column in Table XIV, and the totals in the Category 6 column of Table XV correspond to the NONE column in Table XIV and the W→not column in Table XIII.
## TABLE XV
Writing Assignments Which Correspond to the NCTM Standards
Comparison Among Publishers

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* NCTM Category 1 models mathematical situations, Category 2 reflects on or clarifies thinking (Expressive), Category 3 develops understanding and includes definitions, Category 4 deals with interpretation and evaluation of ideas, Category 5 includes conjectures and convincing arguments (Persuasive), and Category 6 appreciates mathematical notion and its role (non-composition).
FIGURE 5

WRITING ASSIGNMENTS WHICH CORRESPOND TO THE NCTM STANDARDS
COMPARISON AMONG PUBLISHERS BY NUMBER
FIGURE 6

WRITING ASSIGNMENTS WHICH CORRESPOND TO THE NCTM STANDARDS
COMPARISON AMONG PUBLISHERS
BY PERCENT

Addison-Wesley
Macmillan/McGraw-Hill
Scott, Foresman & Co.
Silver Burdett Ginn
CHAPTER V

SUMMARY, IMPLICATIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to identify and compare specific writing assignments provided in the student editions and in the teacher's editions in four basal mathematics series, grades six through eight, adopted by the state of Texas in 1990. Each of the writing assignments was identified and compared with regard to type of problem, how the writing assignments compared to the four purposes of discourse mandated in the *English Language Arts Framework, Kindergarten through Grade 12* for the state of Texas, how the writing assignments compare with the recommendations for communication opportunities stated in the National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards for School Mathematics* for grades five through eight, and how the four basal mathematics textbook series compare to each other with regard to the number and types of writing assignments provided in the student editions and the teacher's editions.

In a review of the literature, found in Chapter II, *Writing to Learn* suggests a powerful role language plays in the production, as well as the presentation, of knowledge (Connolly, 1989). *Writing to Learn* focuses on better thinking and learning (Gere, 1985). The student who participates in a writing-to-learn program is likely to learn more content, understand it better, and retain it longer (Myers, 1984). The *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989) identifies learning to communicate as an important goal. It involves the ability to read and write mathematics and to interpret meanings and ideas. According to James Kinneavy (1971), purpose in discourse is all
important. At the state level, Texas educators have chosen Kinneavy's theory and terminology (informative, persuasive, literary, expressive purposes) as the basis for the English language arts curriculum (TEA, 1988). Britton (1975) acknowledged three different kinds of language use by distinguishing the transactional, poetic, and expressive functions of language which share some of the features of Kinneavy's purposes of discourse informative/persuasive, literary, and expressive, respectively. In Britton's study, 63 percent of the students did transactional writing, 18 percent did poetic writing, and only 5.5 percent did expressive writing. Applebee's (1984) study had similar results. Basal mathematics textbook series are used as a standard work of formal study of a particular subject (Cole & Sticht, 1981) and they are used from 75 to 90 percent of classroom time depending on the subject and study (Muther, 1985). Furthermore, in Durkin's (1984) observational study of elementary teachers to learn about what parts of manual teachers use and why as well as to find out why manual recommendations had been used, altered, skipped, showed that 93 percent of the teachers who use the manual assigned all the written practice referred to in skill development sections. Since the textbook largely determines what is taught as well as what strategies are used in teaching it, there is concern about the content of these books and how they can be used more effectively by the classroom teacher.

The investigator believed that the identification and correlation of specific basal writing assignments to the purposes of writing mandated in the state of Texas' essential elements and to the NCTM's communication recommendations would assist teachers in planning a curriculum that would include various types of writing assignments to enable students to focus on better thinking and learning as they write to learn mathematics while at the same time produce better products as they write across the curriculum. It was also believed that the identification and categorization of these writing assignments would
provide relevant information to consultants in school districts and regional service centers to develop supportive integrative mathematics/language arts lessons for classroom use and for in-service training of classroom teachers. The results of this study would also provide important information in the development of future basal mathematics textbook programs incorporating writing activities.

A content analysis was the research method selected for collecting data to accommodate the four purposes of this study. The student editions and the teacher's editions of the four basal mathematics textbook series, grades six through eight, adopted by the state of Texas in 1990 were examined for writing assignments and subjected to a content analysis.

The data were presented in Chapter IV in summary form that reflects the four specific purposes of this study which were to (1) identify how many and what types of writing assignments are provided in the student editions and in the teacher's editions of the four basal mathematics textbook series, grades six through eight, adopted by the state of Texas, (2) to identify and compare how the writing assignments relate to the purposes of discourse mandated in the English Language Arts Framework, Kindergarten through Grade 12 for the state of Texas, (3) to identify and compare how the writing assignments relate to the recommendations for communication opportunities stated in the National Council of Teacher's of Mathematics' Curriculum and Evaluation Standards for School Mathematics for grades five through eight, and (4) to see how the basal mathematics textbook series compare with each other with regard to the number and types of writing assignments provided in the student editions and in the teacher's editions of the four basal mathematics textbook series. The instrument designed to collect the raw data consisted of a data sheet with four columns to indicate the location and categorization of the specific writing assignments. Using an instrument with four columns enabled the investigator to
identify each writing assignment and then to code it with regard to type of writing assignment, English Language Arts Frameworks' four purposes of writing, and NCTM recommendations for communication tasks. Three coding lists were devised to categorize the writing assignments and can be found in Appendices A, B, and C. The instrument used to collect the data can be found in Appendix D. The data were analyzed and then summarized using four different types of tables and two different types of bar graphs. The first set of tables displayed a summary of the number and types of writing assignments provided in the student and teacher's editions by each publisher. The second set of tables displayed a summary of the number and purposes of writing assignments provided in the student and teacher's editions by each publisher. The third set of tables displayed a summary of the number and categories of writing assignments corresponding to NCTM Standards by each publisher. The fourth set of tables compared the four publishers by types of writing assignments, purposes of writing, and NCTM recommendations. The bar graphs were used to graphically illustrate the summarized data presented in the fourth set of tables by number and percentage of writing assignments.

Summary of Data Findings

1. The ease in locating writing assignments provided by each of the four publishers varied. Macmillan/McGraw-Hill was more accurate in that 79 percent of writing assignments in the student editions agreed with the problem title than with the other three publishers. Silver Burdett Ginn did not label any of its writing assignments as writing assignments in the student editions. Some publishers mislabeled non-composition writing assignments as composition type writing assignments. Since textbooks are used from 70 to 95 percent of the classroom time and are the most reliable means of transmitting knowledge and providing coherence to the curriculum, they should provide an accurate
model for students and teachers to follow. However, according to A. Graham Down (1988), the public regards textbooks as authoritative, accurate, and necessary.

2. Most of the writing assignments provided in the student and teacher's editions of the four basal mathematics series correspond to the Informative purpose of writing. Macmillan/McGraw-Hill's student editions contained 98 percent of the writing assignments in this category, followed by Scott, Foresman and Company's teacher's editions with 96 percent, Silver Burdett Ginn's student and teacher's editions with 89 percent, Addison-Wesley's student editions with 86 percent, Scott, Foresman and Company's student editions with 80 percent, and Addison-Wesley's teacher's editions with 72 percent. This finding supports previous research by Britton and Applebee which found that transactional or informational writing -- writing to inform or instruct -- is used most often.

3. Very few writing assignments were provided in the student and teacher's editions of the four basal mathematics series corresponding to the Literary, Expressive, and Persuasive purposes of writing. Percentages of writing assignments provided by the four publishers ranged from zero to six percent in these three categories.

4. There was a variation among the four publishers regarding the types of Informative writing. The NCTM recommendations provided definition to three subcategories of Informative writing assignments which included modeling mathematical situations, making explanations and definitions, and making interpretations and applications of mathematical ideas. Macmillan/McGraw-Hill's student editions provided the most opportunities for modeling mathematical situations by requiring students to create story problems of their own while Scott, Foresman and Company focused a majority of their writing assignments in the student's editions on requiring students to give explanations or to define mathematical terms. Addison-Wesley contained the largest
percentage of interpretation and application writing assignments in their student editions
than the other three publishers. Although the percentages of writing assignments were
lowest for interpretation and applications, all of the four publishers provided a majority of
the writing assignments, sometimes rather evenly distributed, into the categories of
modeling mathematical situations and giving explanations and definitions about
mathematical ideas. According to one of the findings in Applebee's (1984) study, different
kinds of writing activities lead students to focus on different kinds of information, to think
about that information in different ways, and in turn to take quantitatively and qualitatively
different kinds of knowledge away from their writing experiences.

5. Overall, each of the four publishers provided several hundred writing
opportunities in their 1991 student and teacher's editions of the basal mathematics
textbooks considering that the National Council of Teachers of Mathematics'
recommendations for focusing on a communications strand in the mathematics curriculum
were established in 1989.

Implications

The findings of this study suggest several implications for classroom teachers,
mathematics coordinators, curriculum developers, textbook evaluators, and textbook
publishers. The writing assignments provided in the basal mathematics textbook series
corresponding to the purposes of writing mandated in the English Language Arts
Framework, Grades Kindergarten through 12 for the state of Texas and to NCTM's
Curriculum and Evaluation Standards for School Mathematics will assist mathematics
coordinators at district, regional, and state levels in developing appropriate in-service
training to classroom teachers to help students learn and retain mathematics as well as
produce better written products across the curriculum. By relating the purposes of writing
in the English language arts curriculum with the recommendations for writing activities by the NCTM, a comprehensive integrated mathematics/language arts curriculum program can be created by mathematics curriculum developers. By identifying which basal mathematics textbook series contain specific writing activities with regard to the number and types of opportunities for writing, curriculum evaluators on school textbook committees can make more appropriate selections in the future. By identifying the number and types of writing assignments in existing basal mathematics textbook series, publishers can provide a wider variety of writing assignments and label writing assignments more accurately in the future. According to Osborn, Jones, and Stein (1985), improving textbook programs used in American schools is an essential step toward improving American education.

Recommendations

This study was limited to determining the number and types of writing assignments for grades six through eight in four basal mathematics series adopted by the state of Texas. And, the results of this study are most applicable for the state of Texas since the categories for the writing assignments were correlated to the *English Language Arts Framework, Grades Kindergarten through 12* for the state of Texas. Therefore, the following recommendations for future research are suggested.

1. A content analysis of the writing assignments could be conducted on all the basal mathematics textbook series besides the four programs that were adopted by the state of Texas without great expense in terms of time and money.

2. A content analysis of the writing assignments could be conducted on all the integrated mathematics textbook series to determine if inclusion of other subject matter with mathematics reduces or increases the number and types of writing assignments.
provided and whether the type of subject integration affects the inclusion of writing assignments.

3. A content analysis of the writing assignments provided in basal mathematics textbook series could be conducted for the elementary grades kindergarten through five and the high school grades nine through 12 to determine which grade levels or range of grade levels provide the greatest number and variety of writing assignments.

4. A content analysis of the writing assignments suggested in the teacher's editions of basal mathematics textbook series could be conducted to include all teaching commentary related to the process of writing and scoring rubrics.

5. A content analysis of the writing assignments contained in the student editions and of the suggested writing assignments in the teacher's editions could be conducted to find out how many writing assignments fell into each category of the four purposes of writing (i.e., How many writing assignments suggested "explanations" for the Informative purpose of writing? or How many writing assignments suggested writing a "poem" for the Literary purpose of writing?).

6. A qualitative study could be conducted to describe the students' and teachers' responses to different types of writing (i.e., expressive, informative, literary, persuasive) in a content area such as mathematics.

In conclusion, a content analysis of classroom materials—especially the textbook—can reveal various strengths and weaknesses in an instructional program. Since the textbook is used as a standard work of formal study of a particular subject (Cole & Sticht, 1981) and represents a critical element in the connection between the student and curriculum mandates and recommendations (Wong & Loveless, 1991), it is important that future editions of commercially published instructional materials incorporate the most effective and efficient modes of instruction and the most relevant topics. Also, since more
than 75 percent of the teachers reported using a single textbook predominately in the classroom with 53 percent of them following the texts closely (Porter, 1981), it is imperative that activities contained in the student editions and the suggested activities contained in the teacher's editions include a rich and vast array of pedagogically sound ideas and concepts to assist teachers in planning a comprehensive curriculum. Therefore, since the adoption of new textbooks is the central method of spread of new curriculum (Cole & Sticht, 1991), it should be seen as an important excellence movement (Altbach, Kelly, Petrie, & Wies, 1991) when results of pilot studies, learner verification, and content analyses are used to improve their content.
CHAPTER BIBLIOGRAPHY


APPENDIX A

CATEGORIES OF NONCOMPOSITION
TYPES OF WRITING
CATEGORIES OF WRITING ASSIGNMENTS NOT CONSIDERED TO BE "COMPOSITION" TYPES OF WRITING

Please disregard problem instructions that include the word "write" that is used to indicate recording an answer, performing a calculation, or translating mathematical phrases or sentences. Non-composition types of writing instructions usually preclude a set of exercises to be acted upon. Examples include the following:

Write the number.
Write the number sentence (equation) for the problem.
Write an expression for each phrase.
Write and solve an equation.
Write an addition (subtraction, multiplication, division) sentence for the problem.
Write the fact families.
Write the word name.
Write the name of the figure (angle, line segment).
Write even or odd. Write yes or no. Write true or false.
Write slide, flip, or turn.
Write the number (power) in standard form.
Write the number in expanded form.
Write the ordered pair.
Write each number in two different ways.
Write the related multiplication sentence for the problem.
Write the digit ....
Write the value of each digit in the number.
Write the amount.
Write in order from least to greatest.
Write as a fraction (improper fraction, mixed number, decimal, ratio, proportion, percent, whole number).
Write the fraction (mixed number, answer) in simplest form.
Write the letter of the correct answer.
Write >, <, or = in the blank to make the statement true.
Write +, -, x, or ÷ in the blank to make the statement true.
Write each missing number.
Write the reciprocal for each number.
Record the results.
Rewrite each problem using exponents.
List the numbers (prime numbers) ....
List all the factors of the number.
Describe ... (could mean discuss, talk about)
Copy the information
Copy and complete the table.
APPENDIX B

CODING LIST OF WRITING ASSIGNMENTS CORRESPONDING TO THE FOUR PURPOSES OF WRITING
CODING LIST OF WRITING ASSIGNMENTS CORRESPONDING TO THE FOUR PURPOSES OF WRITING

<table>
<thead>
<tr>
<th>INFORMATIVE</th>
<th>PERSUASIVE</th>
<th>LITERARY</th>
<th>EXPRESSIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis*</td>
<td>Advertisement</td>
<td>Ballad</td>
<td>Diary</td>
</tr>
<tr>
<td>Biography</td>
<td>Commercial</td>
<td>Clues puzzle</td>
<td>Explain own process</td>
</tr>
<tr>
<td>Compare</td>
<td>Convincing argument</td>
<td>Drama</td>
<td>Explain own thinking</td>
</tr>
<tr>
<td>Conclusion</td>
<td>Editorial</td>
<td>Haiku</td>
<td>Journal</td>
</tr>
<tr>
<td>Contrast</td>
<td>Letter to editor</td>
<td>Humorous account</td>
<td>Learning log</td>
</tr>
<tr>
<td>Definition</td>
<td>Slogan</td>
<td>Joke</td>
<td>Opinion</td>
</tr>
<tr>
<td>Description</td>
<td></td>
<td>Lyric</td>
<td>Reaction</td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td>Poem</td>
<td></td>
</tr>
<tr>
<td>Directions</td>
<td></td>
<td>Puzzle</td>
<td></td>
</tr>
<tr>
<td>Explanation</td>
<td></td>
<td>Rhyme</td>
<td></td>
</tr>
<tr>
<td>Evaluation</td>
<td></td>
<td>Script</td>
<td></td>
</tr>
<tr>
<td>Generalization</td>
<td></td>
<td>Short story</td>
<td></td>
</tr>
<tr>
<td>Instructions</td>
<td></td>
<td>Tall tale</td>
<td></td>
</tr>
<tr>
<td>Guidelines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generalization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instruction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Letter (to explain)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>List ideas, suggestions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manual, guide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method of doing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>News article</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outline</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan (event)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prediction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procedure, process</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propose solution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Questions, questionnaire</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Report</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rewrite (word) problem</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rule</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Write word (story) problem</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Writing assignments are listed in alphabetical order under each category. (TEA, 1988).
APPENDIX C

CODING LIST OF WRITING ASSIGNMENTS CORRESPONDING TO THE NCTM RECOMMENDATIONS
**CODING LIST OF WRITING ASSIGNMENTS CORRESPONDING TO THE SIX NCTM RECOMMENDATIONS IN STANDARD 2: MATHEMATICS AS COMMUNICATION**

1. **Model situations**  
   (Informative, Literary)  
   - Analogy  
   - Adventure story  
   - Ballad  
   - Clues puzzle  
   - Drama  
   - Haiku  
   - Humorous account  
   - Joke  
   - Limerick  
   - Lyric  
   - News article  
   - Poem  
   - Project  
   - Puzzle  
   - Riddle  
   - Rhyme  
   - Sentence  
   - Short story  
   - Statement  
   - Tall tale  
   - Write word (story) problem

2. **Reflect on, clarify thinking**  
   (Expressive)  
   - Diary  
   - Explain own process  
   - Explain own thinking  
   - Journal  
   - Learning log  
   - Opinion  
   - Reaction  
   - Write about self

3. **Develop understanding, include definitions**  
   (Informative)  
   - Analysis  
   - Compare  
   - Conclusion  
   - Contrast  
   - Definition  
   - Description  
   - Diagnosis  
   - Directions  
   - Explanation  
   - Generalization  
   - Guidelines  
   - Instructions  
   - Letter (to explain)  
   - Manual, guide  
   - Method, strategy  
   - Procedure, process  
   - Report  
   - Rewrite word problem  
   - Rules  
   - Solution  
   - Summary  
   - Write the steps
CODING LIST OF WRITING ASSIGNMENTS CORRESPONDING TO THE SIX NCTM RECOMMENDATIONS IN STANDARD 2: MATHEMATICS AS COMMUNICATION (Continued)

<table>
<thead>
<tr>
<th>4. Interpretation, evaluate math ideas (Informative)</th>
<th>5. Conjectures, convincing arguments (Persuasive)</th>
<th>6. Appreciate notation and its role (Non-composition types)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Advertisement</td>
<td>Refer to the list of non-composition type writing assignments</td>
</tr>
<tr>
<td>Computer program</td>
<td>Brochure</td>
<td>in Appendix A.)</td>
</tr>
<tr>
<td>Develop game, program</td>
<td>Commercial</td>
<td>Also include:</td>
</tr>
<tr>
<td>Design game, program</td>
<td>Conjecture</td>
<td>Code deciphering</td>
</tr>
<tr>
<td>Example</td>
<td>Convincing argument</td>
<td>Dates</td>
</tr>
<tr>
<td>List</td>
<td>Defend position</td>
<td>Dimensions</td>
</tr>
<tr>
<td>Outline</td>
<td>Editorial</td>
<td>Fill in the blanks</td>
</tr>
<tr>
<td>Plan</td>
<td>Hypothesis</td>
<td>Grid, graph labels</td>
</tr>
<tr>
<td>Project</td>
<td>Letter to editor</td>
<td>Write the number</td>
</tr>
<tr>
<td>Questionnaire</td>
<td>Prediction</td>
<td></td>
</tr>
<tr>
<td>Survey</td>
<td>Slogan</td>
<td></td>
</tr>
<tr>
<td>Uses of mathematics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The NCTM Curriculum and Evaluation Standards for School Mathematics

**STANDARD 2: MATHEMATICS AS COMMUNICATION**

In grades 5-8, the study of mathematics should include numerous opportunities for communication so that students can:

♦ model situations using oral, written, concrete, pictorial, graphical and algebraic methods.
  *(informative, literary purposes of writing*)

♦ reflect on and clarify their own thinking about mathematical ideas and situations.
  *(expressive purpose of writing)*

♦ develop common understanding of mathematical ideas, including the role of definitions.
  *(informative purpose of writing)*

♦ use the skills of reading, listening, and viewing to interpret and evaluate mathematical ideas.
  *(informative purpose of writing)*

♦ discuss mathematical ideas and make conjectures and convincing arguments.
  *(persuasive purpose of writing)*

♦ appreciate the value of mathematical notation and its role in the development of mathematical ideas.
  *("non-composition" type of writing)*

* Each of the NCTM recommendations stated for Standard 2 have been aligned to the four purposes of discourse mandated in the *English Language Arts Framework, Kindergarten through Grade 12* for the state of Texas.

*(Curriculum and Evaluation Standards for School Mathematics, NCTM, 1989, p. 78)*
APPENDIX D

DATA COLLECTION SHEET
### LOCATION AND TYPE OF WRITING ASSIGNMENTS

ADDITION-WESLEY, STUDENT EDITION, GRADE 6

<table>
<thead>
<tr>
<th>PAGE/PROBLEM#/PROBLEM TITLE</th>
<th>PROB TITLE → ASSIGN</th>
<th>4 PURPOSES</th>
<th>NCTM STD #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/10/Write Your Own Problem</td>
<td>W→W</td>
<td>Informative</td>
<td>4</td>
</tr>
<tr>
<td>Write a question for a set of data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13/23/Write Your Own Problem</td>
<td>W→not</td>
<td>none</td>
<td>6</td>
</tr>
<tr>
<td>Use break apart and compatible numbers to write a problem</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26/Project</td>
<td>P→W</td>
<td>Informative</td>
<td>1</td>
</tr>
<tr>
<td>Make up (story) problems for a set of data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53/24/Write Your Own Problem</td>
<td>W→W</td>
<td>Informative</td>
<td>1</td>
</tr>
<tr>
<td>Write (story) problems for a set of data</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX E

RATER RESPONSE FORM
Dear Rater:

As a doctoral student at the University of North Texas, I am currently in the process of conducting a study consisting of a content analysis of the writing assignments contained in four basal mathematics textbook series adopted by the State of Texas. In order to verify the reliability of this study, an interrater coefficient must be determined.

Thank you for agreeing to be a rater in this study. The enclosed Rater Response Form consists of three short sections with specific directions for each section to enable you to code ten (10) writing assignments in three different ways. Each section of the Rater Response Form also contains sample practice problems to help you code the writing assignments according to each set of directions. The actual coding of the ten writing assignments is contained in a multiple-choice format. Simply read each writing assignment in the left column and then circle the choice of codes to the right of each writing assignment. Coding lists are included for each section of the Rater Response Form to help you complete each section.

Also, I would appreciate your cooperation in completing the enclosed Demographic Information Form. I am especially interested in your educational background and professional experience. Completion of the last four questions regarding your personal information is optional.

Thank you for your participation in this study.

Sincerely,

Barbara Bando Irvin

Enclosures: Rater Response Form
Self-addressed stamped envelope
Selected Writing Assignments in Basal Mathematics Textbook Series

Rater Response Form

Rater # ___

Overview:
As a rater in this study, you are to code ten (10) writing assignments in three different ways. This Rater Response Form contains three different sections to correspond to each task. Specific directions and sample items are contained in each section to help you prepare yourself for coding of the ten writing assignments (on the white pages) in this Rater Response Form.

Selected Writing Assignments in Basal Mathematics Textbook Series

Section 1: Writing Assignment Title vs. Writing Assignment Content

Directions: Read each example A, B, and C and its title. Circle the choice that corresponds to the criteria shown below. Suggested responses are listed at the bottom of the page.

W→ W: The word "writing" is mentioned in the title of the problem; the assignment involves "composition" type of writing.
(W→ W stands for "writing" title leading to a "written composition" task.)

P → W: The word "writing" is not mentioned in the title of the problem but the assignment involves "composition" type of writing.
(P→ W stands for "problem" title leading to a "written composition" task.)

W→ not: The word "writing" is mentioned in the title of the problem; the assignment involves "non-composition" type of writing.
(W→ not stands for "writing" title leading to a "non-composition" task.)

To help you make your choice, refer to the attached list CATEGORIES OF WRITING ASSIGNMENTS CONSIDERED TO BE "NON-COMPOSITION" TYPES OF WRITING TASKS.

Examples:

A. Communication: Writing Math  
   Have each student write an explanation of how to write an improper fraction as a mixed number and vice versa. Tell them to include definitions of the two terms in their explanations.

B. Write What You Think  
   Have pairs of students write 4- and 6-digit numbers and then correctly place the digits on a place value chart.

C. Using Critical Thinking—Organize an Argument  
   Suppose a student said that both of the pictures at the right [figure shown at right] show a ratio of 4:5. Write an argument that would convince a classmate that this statement is correct or incorrect.

Suggested responses: A: W→ W, B: W→ not, C: P→ W

Now turn to the next page to complete the coding of the ten writing assignments found on the white pages for Section 1.
Section 1: Writing Assignment Title vs. Writing Assignment Content

Directions: Read each problem 1-10 and its title. Circle the choice that corresponds to the following criteria: 

W–W: The word 'writing' is mentioned in the title of the problem;
the assignment involves "composition" type of writing.

P–W: The word 'writing' is not mentioned in the title of the problem
but the assignment involves "composition" type of writing.

W–not: The word 'writing' is mentioned in the title of the problem;
the assignment involves "non-composition" type of writing.

Write a generalization about the coordinates
of lines that are parallel to the x-axis.

2. Write About Math W–W P–W W–not
How many different ways can you write 64 using exponents.

Have students choose a design in nature, such
as a leaf or a snowflake, and ask them to write
a haiku [17-syllable poem], using this design as
a subject while capturing a mental image of an
event, mood, or feeling in the 5-7-5 structure.

Write rules for a number-cube game for two players.
Each player should have the same chance of winning.

5. Writing Activity W–W P–W W–not
Have students write about what kind of
shopper he or she is and why.

6. Write a problem that contains more W–W P–W W–not
information than needed to solve the problem.

7. Subject Integration Project W–W P–W W–not
Have students, working in groups, think of a short
commercial that involves math. Have students
create storyboards with captions.

Have students write a few sentences explaining
their thinking and the computation necessary for
finding answers to Items 8-10 and 21.

Have students write a manual for a consumer education
class that is learning how to balance their checkbooks.

Fill in the blanks with numbers in the form asked for:
$.25 is the same as _______ of $1.00,
________ of $1.00, and _______ of $1.00.
You may use this Coding List with Sections 1, 2, and 3.

CATEGORIES OF WRITING ASSIGNMENTS CONSIDERED TO BE "NON-COMPOSITION" TYPES OF WRITING TASKS

Please disregard problem instructions that include the word "write" that is used to indicate recording an answer, performing a calculation, or translating mathematical phrases or sentences. Non-composition types of writing instructions usually preclude a set of exercises to be acted upon. Examples include the following:

Write the number.
Write the number sentence (equation) for the problem.
Write an expression for each phrase.
Write and solve an equation.
Write an addition (subtraction, multiplication, division) sentence for the problem.
Write the fact families.
Write the word name.
Write the name of the figure (angle, line segment).
Write even or odd. Write yes or no. Write true or false.
Write slide, flip, or turn.
Write the number (power) in standard form.
Write the number in expanded form.
Write the ordered pair.
Write each number in two different ways.
Write the related multiplication sentence for the problem.
Write the digit ....
Write the value of each digit in the number.
Write the amount.
Write in order from least to greatest.
Write as a fraction (improper fraction, mixed number, decimal, ratio, proportion, percent, whole number).
Write the fraction (mixed number, answer) in simplest form.
Write the letter of the correct answer.
Write >, <, or = in the blank to make the statement true.
Write +, -, x, or ÷ in the blank to make the statement true.
Write each missing number.
Write the reciprocal for each number.
Record the results.
Rewrite each problem using exponents.
List the numbers (prime numbers) ....
List all the factors of the number.
Describe ... (could mean discuss, talk about)
Copy the information.
Copy and complete the table.
Selected Writing Assignments in Basal Mathematics Textbook Series

Section 2: Writing Assignments Corresponding to Four Purposes of Writing

Directions: Read each example A-E. Circle the choice that corresponds to the four purposes of writing mandated in the English Language Arts Framework, K-12 for the State of Texas. The four purposes of writing are: Informative, Persuasive, Literary and Expressive.

If the assignment is a "non-composition" type of writing assignment, choose "none."

To help you make your choice, refer to the attached list CODING LIST OF WRITING ASSIGNMENTS CORRESPONDING TO THE FOUR PURPOSES OF WRITING. When you read each assignment, look for a key word that can be found in the coding list.

Examples:

A. Writing Activity
   Informative Persuasive Literary Expressive none
   Have students write a funny short story.
   It should include at least two whole numbers, two fractions, and two mixed numbers.

B. Using Critical Thinking--Organize an Argument
   Informative Persuasive Literary Expressive none
   Suppose a student said that both of the pictures at the right [figure shown at right] show a ratio of 4:5. Write an argument that would convince a classmate that this statement is correct or incorrect.

C. Write What You Think
   Informative Persuasive Literary Expressive none
   Have pairs of students write 4- and 6-digit numbers and then correctly place the digits on a place value chart.

D. Alternative Assessment: Student Writing
   Informative Persuasive Literary Expressive none
   For Items 1 and 2 [shown on page], have students write sentences explaining how they determined their answers.

E. Communication: Writing Math
   Informative Persuasive Literary Expressive none
   Have each student write an explanation of how to write an improper fraction as a mixed number and vice versa. Tell them to include definitions of the two terms in their explanations.

Suggested responses: A: Literary, B: Persuasive, C: none, D: Expressive, E: informative

Now turn to the next page to complete the coding of the ten writing assignments found on the white pages for Section 2.
Section 2: Writing Assignments Corresponding to Four Purposes of Writing

Directions: Read each problem 1-10. Circle the choice that corresponds to the four purposes of writing mandated in the English Language Arts Framework, K-12 for the State of Texas. The four purposes of writing are: Informative, Persuasive, Literary and Expressive.
If the assignment is a "non-composition" type of writing assignment, choose "none."

1. Explore Math
   Write a generalization about the coordinates of lines that are parallel to the x-axis.

2. Write About Math
   How many different ways can you write 64 using exponents.

3. Writing Activity
   Have students choose a design in nature, such as a leaf or a snowflake, and ask them to write a haiku [17-syllable poem], using this design as a subject while capturing a mental image of an event, mood, or feeling in the 5-7-5 structure.

4. Creative Thinking -- Game
   Write rules for a number-cube game for two players. Each player should have the same chance of winning.

5. Writing Activity
   Have students write about what kind of shopper he or she is and why.

6. Write a problem that contains more information than needed to solve the problem.

7. Subject Integration Project
   Have students, working in groups, think of a short commercial that involves math. Have students create storyboards with captions.

8. Alternative Assessment: Student Writing
   Have students write a few sentences explaining their thinking and the computation necessary for finding answers to items 8-10 and 21.

9. Communicating Mathematics
   Have students write a manual for a consumer education class that is learning how to balance their checkbooks.

10. Communication: Writing to Learn
    Fill in the blanks with numbers in the form asked for: 
        $.25 is the same as _____ of $1.00, 
        _____ of $1.00, and _____ of $1.00.
Use this Coding List with Section 2.

**CODING LIST OF WRITING ASSIGNMENTS CORRESPONDING TO THE FOUR PURPOSES OF WRITING**

<table>
<thead>
<tr>
<th>INFORMATIVE</th>
<th>PERSUASIVE</th>
<th>LITERARY</th>
<th>EXPRESSIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis*</td>
<td>Advertisement</td>
<td>Ballad</td>
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<td>Write word (story) problem</td>
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*Writing assignments are listed in alphabetical order under each category. (TEA, 1988).
Selected Writing Assignments in Basal Mathematics Textbook Series

Section 3: Writing Assignments Corresponding to Six NCTM Recommendations

Directions: Read each example A-F. Circle the choice that corresponds to the six NCTM recommendations in Standard 2 of the *Curriculum and Evaluation Standards for School Mathematics*, Grades 5-8.

1 = Model mathematics situations (Informative, Literary)  
2 = Reflect on, clarify thinking (Expressive)  
3 = Develop understanding, definitions (Informative)  
4 = Interpretation, evaluate ideas (Informative)  
5 = Conjectures, convincing arguments (Persuasive)  
6 = Appreciate notation; its role (Non-composition type)

To help you make your choice, refer to the attached list CODING LIST OF WRITING ASSIGNMENTS CORRESPONDING TO THE SIX NCTM RECOMMENDATIONS. When you read each assignment, look for a key word that can be found in the coding list.

Examples:

A. Writing Activity  
   Have students write a funny short story. It should include at least two whole numbers, two fractions, and two mixed numbers.

B. Using Critical Thinking--Organize an Argument  
   Suppose a student said that both of the pictures at the right [figure shown at right] show a ratio of 4:5. Write an argument that would convince a classmate that this statement is correct or incorrect.

C. Write What You Think  
   Have pairs of students write 4- and 6-digit numbers and then correctly place the digits on a place value chart.

D. Alternative Assessment: Student Writing  
   For Items 1 and 2 [shown on page], have students write sentences explaining how they determined their answers.

E. Communication: Writing Math  
   Have each student write an explanation of how to write an improper fraction as a mixed number and vice versa. Tell them to include definitions of the two terms in their explanations.

F. Writing Activity  
   Have students design a questionnaire that would help them investigate the conditions of the environment in a room or on the school grounds.

Suggested responses: A: 1, B: 5, C: 6, D: 2, E: 3, F: 4

Now turn to the next page to complete the coding of the ten writing assignments found on the white pages for Section 3.
Section 3: Writing Assignments Corresponding to Six NCTM Recommendations

**Directions:** Read each problem 1-10. Circle the choice that corresponds to the six NCTM recommendations in Standard 2 of the *Curriculum and Evaluation Standards for School Mathematics*.

- 1 = Model mathematics situations (Informative, Literary)
- 2 = Reflect on, clarify thinking (Expressive)
- 3 = Develop understanding; definitions (Informative)
- 4 = Interpretation, evaluate ideas (Informative)
- 5 = Conjectures, arguments (Persuasive)
- 6 = Appreciate notation; its role (Non-composition type)

1. **Explore Math**
   Write a generalization about the coordinates of lines that are parallel to the x-axis.

2. **Write About Math**
   How many different ways can you write 64 using exponents.

3. **Writing Activity**
   Have students choose a design in nature, such as a leaf or a snowflake, and ask them to write a haiku [17-syllable poem], using this design as a subject while capturing a mental image of an event, mood, or feeling in the 5-7-5 structure.

4. **Creative Thinking – Game**
   Write rules for a number-cube game for two players. Each player should have the same chance of winning.

5. **Writing Activity**
   Have students write about what kind of shopper he or she is and why.

6. **Write a problem** that contains more information than needed to solve the problem.

7. **Subject Integration Project**
   Have students, working in groups, think of a short commercial that involves math. Have students create storyboards with captions.

8. **Alternative Assessment: Student Writing**
   Have students write a few sentences explaining their thinking and the computation necessary for finding answers to Items 8-10 and 21.

9. **Communicating Mathematics**
   Have students write a manual for a consumer education class that is learning how to balance their checkbooks.

10. **Communication: Writing to Learn**
    Fill in the blanks with numbers in the form asked for.
    
    $0.25 is the same as _____ of $1.00.
    
    _____ of $1.00, and _____ of $1.00.
Use this Coding List with Section 3.

**CODING LIST OF WRITING ASSIGNMENTS CORRESPONDING TO THE SIX NCTM RECOMMENDATIONS IN STANDARD 2: MATHEMATICS AS COMMUNICATION**

<table>
<thead>
<tr>
<th>1. Model situations</th>
<th>2. Reflect on, clarify thinking</th>
<th>3. Develop understanding, include definitions</th>
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<tr>
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<td>(Informative)</td>
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<td>Conclusion</td>
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<td>Rewrite word problem</td>
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<td>Rules</td>
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<td>Tall tale</td>
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<td>Solution</td>
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<td>Write word (story) problem</td>
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<td>Write the steps</td>
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<table>
<thead>
<tr>
<th>4. Interpretation, evaluate math ideas</th>
<th>5. Conjectures, convincing arguments</th>
<th>6. Appreciate notation and its role</th>
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<tr>
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<td>Develop game, program</td>
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<td>Design game, program</td>
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<td>Example</td>
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<td>List</td>
<td>Defend position</td>
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</table>
This information may help you to complete Section 3.

The NCTM Curriculum and Evaluation Standards for School Mathematics

STANDARD 2: MATHEMATICS AS COMMUNICATION

In grades 5-8, the study of mathematics should include numerous opportunities for communication so that students can:

♦ model situations using oral, written, concrete, pictorial, graphical and algebraic methods.
   [informative, literary purposes of writing*]

♦ reflect on and clarify their own thinking about mathematical ideas and situations.
   [expressive purpose of writing]

♦ develop common understanding of mathematical ideas, including the role of definitions.
   [informative purpose of writing]

♦ use the skills of reading, listening, and viewing to interpret and evaluate mathematical ideas.
   [informative purpose of writing]

♦ discuss mathematical ideas and make conjectures and convincing arguments.
   [persuasive purpose of writing]

♦ appreciate the value of mathematical notation and its role in the development of mathematical ideas.
   ["non-composition" purpose of writing]

* Each of the NCTM recommendations stated for Standard 2 have been aligned to the four purposes of discourse mandated in the English Language Arts Framework, Kindergarten through Grade 12 for the state of Texas.

(Curriculum and Evaluation Standards for School Mathematics, NCTM, 1989, p. 78)
Demographic Information Form

Rater #  

PLEASE CIRCLE THE APPROPRIATE CHOICE OR FILL IN THE BLANKS.

Highest Degree Completed: Bachelor  Masters  Doctorate

Major Course of Study:

Bachelor:  Major:  Minor:  

Masters:  

Doctorate:  

Certification(s):  

Current Position:  

Years of Classroom Teaching Experience:  

Years of Non-classroom Education-related Experience:  
(i.e., curriculum coordinator, subject specialist, principal, etc.)

PERSONAL INFORMATION:

Gender:  Male  Female

Ethnicity:  Afro-American  Asian  Caucasian  Hispanic  Other:  

Age:  20-29  30-39  40-49  50-59  60-69

Name:  

Thank you for your cooperation.
APPENDIX F

RELIABILITY DATA SHEETS
AND COEFFICIENTS
Selected Writing Assignments in Basal Mathematics Textbook Series
Rater Responses

Section 1: Writing Assignment Title vs. Writing Assignment Content

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Number in Agreement with Rater #1

C. R.

Composite reliability = ___________________________ = ________
Section 2: Writing Assignments Corresponding to Four Purposes of Writing

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Number in Agreement with Rater #1

C. R.

Composite reliability = _______ = _______
Section 3: Writing Assignments Corresponding to Six NCTM Recommendations

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Number in Agreement with Rater #1

C. R.

Composite reliability = ________________ = _____


