A DESCRIPTIVE STUDY OF FACTORS RELATED TO PRESERVICE TEACHERS' WRITTEN RESPONSES TO CHILDREN'S LITERATURE WITH GEOMETRIC CONTENT

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TABLE OF CONTENTS

LIST OF TABLES

Table Page

CHAPTER I

INTRODUCTION

Introduction

Over the past twenty years, children's literature has begun to be used in elementary school classrooms in different ways than before. We now observe teachers presenting fiction and non-fiction trade books, not only for their literary aspects, but also for the purposes of content learning (Karolides, 1997). At the same time, many teachers of children's literature in elementary and middle level school classrooms have focused on teaching literature for personal engagement rather than as a motivational way to teach reading skills (Eeds & Peterson, 1991). Consequently, researchers have considered not only what literature is being presented in classrooms, but also how teachers utilize trade books. Current preservice teachers are being educated in an environment that favors integrated curriculum, as well as the use of children's literature across the curriculum. While many of them recall entire years of schooling when the teacher did not read a book aloud with the class, this is rarely the case in their observation of classrooms today.

Literature is a part of the world, not apart from it. As Gillet and Temple express it, "We don't read sawdust" (1994, p. 5). We don't read books about literature, but rather

about the world around us. Even novels, written primarily for aesthetic purposes, are filled with interpretations of sociology, history, psychology, and other "content" areas. Literature encompasses and interprets the world. Because literature is situated in the world, it follows that there are many works of literature in general and children's literature in particular that lend themselves to be the impetus for study in content areas, just as there are works of literature that should be read with purely aesthetic purposes in mind.

The "literature across the curriculum" movement extols the virtues of using children's literature in elementary and middle schools in all disciplines as the jumping off point for content area learning (Whitin and Wilde, 1992; Karolides, 1997). In these cases, it is necessary that the teacher has the content area knowledge necessary to utilize the literature in a manner that will promote student learning of the particular content area in question. It is also hoped that the integrity, or literary value, of the literature has not been diminished by its use as the context for instruction. Children are often asked to respond to the literature through the use of response journals or response logs. For example, some teachers ask students to write about particular questions after reading and at other times, teachers lead a discussion first, then ask for free responses to be kept in one notebook. These records of responses are kept in the classroom sometimes as a part of the students' reading response logs or as a part of their journals for that particular subject. Teachers will read these journals as a means of gaining insight into students' learning and understanding of the content area.

The response journal concept is an outgrowth of the literature response or transactional reading movement first presented by Louise M. Rosenblatt in 1938 and is common in elementary and middle schools today. Rosenblatt (1995) also brought to the forefront the notion of two stances that a reader may take simultaneously or at different points in the reading. The efferent stance is one in which the reader is focused on acquiring information, while an aesthetic stance is one in which the reader is reading for personal satisfaction. While most reading incorporates aspects of both stances, one is always dominant and it is helpful to understand from which stance a reader is approaching a work of literature. Rosenblatt (1978) explains the difference between the two stances in the following manner:

> In the efferent situation, a paraphrase or summary or restatement may be as useful as the original text.... But no one can read a poem for you. Accepting an account of someone's reading is analogous to seeking nourishment through having someone else eat your dinner for you and recite the menu.... The paraphrase does not equal the poem. (p. 86)

Teachers and preservice teachers who ascribe to a transactional approach to reading and responding to literature allow for a variety of interpretations of literature from their students, understanding that the meaning is derived not simply from the work itself, but in the transaction that takes place between the reader and the text. In other words, each reader brings a personal history and wealth of background knowledge that influences how he/she will respond to the literature. These individual interpretations should be valued even while they are being gently challenged so that readers can have an

aesthetic experience with the literature when that is called for, or an efferent one, when that is appropriate to the situation and to the reader in question.

Both aesthetic and efferent experiences with literature are appropriate to the mathematics classroom. Mathematics teaching is often enhanced in elementary schools by the use of children's literature. In fact, the National Council for Teachers of Mathematics (NCTM) has emphasized that mathematics in the context of human experiences will benefit school children (1989). Slaughter (1993) writes "children find it easier to comprehend elementary concepts regarding numbers, time, and measurement when these concepts are linked to everyday experiences. Predictable stories can be used to connect math to other areas of the curriculum, thus making the lesson more relevant to the child. In addition, may predictable stores make direct references to mathematical concepts and provide illustrations to explain them" (p.83). The use of children's literature to "grip the imagination of students and teachers" (Welchman-Tischler, 1992, p. 38) in mathematics learning is important enough to mathematics educators that volumes of teacher idea books have been published on this topic (Whitin & Wilde, 1992; Wilde, 1998; Welchman-Tischler, 1992).

Although the focus of this research could have been on children's literature with content from a variety of disciplines, children' literature with mathematical content was selected for this study. Rather than select any works of children' literature with mathematical content, those with geometric content, in particular, were chosen. This allowed for a narrower focus to the study and is also related to the fact that the preservice

teachers at this university are required to take a geometric structures course before taking the mathematical methods course.

Statement of the Problem

It is clear that children's literature is being utilized with elementary and middle school students to introduce content area study (mathematics in particular) or sometimes as the context for learning across the curriculum. Research shows that teachers of these students promote a more efferent response than an aesthetic one in the texts they choose, the questions they ask, and the activities that follow reading (Sebesta, Monson, & Senn, 1995). A balance between aesthetic and efferent approaches to literature may be more appropriate for elementary students as well as for their teachers. Teachers can choose to broaden students' literature experiences by learning to help them delve deeper into themselves and the text. However, if the teachers themselves are not aware of the possibilities and have not had opportunities to explore the range of their own transactions with literature, they cannot be expected to be guides for their own students. With limited teacher knowledge and experience, there is a potential for literature to be not only "used" across the curriculum, but actually "abused." A basic question has not been thoroughly explored yet: that of how teachers and preservice teachers themselves respond to the literature that may be read for aesthetic as well as efferent purposes in their classrooms and how their content area knowledge and orientation toward literature affect these responses.

Purpose of the Study

The purpose of this study was to describe preservice teachers' written responses to literature with geometric content and to attempt to correlate the stances and content of their responses with their scores on a measure of geometric thought and with their scores on a measure of orientation toward literature. Specific questions that guided the research considered preservice teachers' written responses to three different works of children's literature with geometric content and asked: (1) What themes will emerge? (2) Do the participants respond more to the literary, mathematical, or integrated content? (3) Do the participants respond more aesthetically or efferently? (4) How are the responses related to the participants' levels of geometric thought? and (5) How are responses related to the participants' orientation toward literature?

Definition of Terms

The following terms have been defined for the purposes of this study:

- Literature refers to published works of writing, fiction and non-fiction, for children or adult audiences that are written to provide artistic, pleasurable experiences for the reader. They may be narrative and/or informational.
- Written reader response refers to the written reactions of the participants as they record during and after reading.

- Response statement refers to a single segment of the response that represents a complete thought of the writer.
- Response stance refers to a "readers readiness to organize thinking about what is read according to a more efferent or a more aesthetic framework" (Cox, 1997, p. 30).
- Efferent stance refers to the predominant focus of the reader/writer to respond to the information to be taken away from the text. An example is reading the bus schedule to decide which bus would be the best one to take. Aesthetic stance refers to the predominant focus of the reader/writer to respond to the personal aspects of a text, focusing attention on the lived-through experience of the reading (Cox, 1997, p. 30). An example would be relating and identifying with the emotions of a main character in a novel.
- Response content refers to the predominant focus of the written response unit to be on the literary or mathematical concepts presented in the book.
- Literary content refers to the reader/writer's written responses that are focused on the literary content of the book. This includes discussion of the book's characterization, plot, theme, writing style, illustrations, and tone.
- Mathematical content refers to the reader/writer's written responses that are focused on the mathematical content of the book. This includes discussion of the book's mathematical accuracy, value, visibility, appropriateness, and concepts.
- Integrated content refers to the reader/writer's written responses that include both literary and mathematical components.

Significance of the Study

Because research that addresses how preservice teachers respond to children's literature is scarce, this study attempts to fill that gap by describing preservice teachers written responses to literature with geometric content. Furthermore, this study attempts to initiate inquiry into the relationship between content area knowledge and written response to literature as well as the relationship between orientation toward literature and written response to literature. The knowledge gained in this study may influence how preservice teachers view the use of literature for content area study with elementary students and may be the impetus for additional qualitative as well as quantitative research. Further, this information may impact how literature study for content area learning is viewed by the education community.

Assumptions

This study was based on the following assumptions:

- Preservice teachers will be willing to express their written responses to literature.
- Differences between aesthetic and efferent response stances and among literary, mathematical, and integrated content to literature will be evident to the raters and to the researcher.
- The written responses of the preservice teachers will be representative and inclusive of their actual responses to the literature.
- Identifiable themes or categories of written responses will emerge.

- Participants will have had previous exposure to children's literature.
- Participants will have some knowledge of mathematics, particularly geometry.

Limitations

This study was subject to the following limitations:

- The study was limited to eighty-five preservice teachers in a Midwestern university town who were enrolled in reading and mathematics methods courses.
- The reader response portion of the study was limited to written reader responses on three children's literature picture books with geometric content.
- The study participants were mostly female, Caucasian, elementary education majors.
- Generalizability of results is limited due to a non-random sample of participants.

Organization of the Study

This study is presented in five chapters. Chapter I provides an overview of the study including background information, a formal statement of the problem to be investigated, the purpose of the study, a definition of terms used in this study, a discussion of the significance of this research, and the assumptions and limitations of the study.

Chapter II reviews the literature and related research in the areas of reader response, writing as a mode of responding to literature, literature used across the curriculum, orientation toward literature, and preservice teachers' content area knowledge

(specifically in geometry). Chapter III presents the methodology used in the study including description of the participants, the instruments used, and the research design and procedures utilized. Chapter IV presents the analysis of the data and Chapter V summarizes the findings as well as discusses conclusions and implications of this study.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

The purpose of this chapter is to review the research that is relevant to written responses to literature and content area knowledge of preservice teachers. This discussion will focus on five areas related to the study. First, the framework of reader response theory will explain the role of the reader and two different stances a reader may take while reading and responding to a work of literature. Second, research that provides support for the use of written responses to literature in a descriptive study will be discussed. Third, the history and current status of literature used across the curriculum will set the context for the examination of preservice teachers' response to literature. Fourth, theory and research that is related to readers' orientation toward literary texts will be presented. Finally, research that discusses preservice teachers' knowledge of geometry and instruments to measure that knowledge will be presented.

Reader Response Theory

In 1938, Rosenblatt (1995) was the first researcher to emphasize the equal nature

of the text and the reader in a literary transaction. This theory "focused on the reciprocal relationship between the reader and the text resulting in the individual creation of the literary work of art" (Hancock, 1991, p.24). The meaning of the literature is not viewed as coming directly from the text to the reader, nor as merely being a reflection of the reader. Rather, both reader and text perform a "symbolic dance" as a new entity is created resulting from the act of reading. Consequently, the reader must become an active part of the reading act, combining experiences, prior knowledge, and feelings with a serious attempt to understand and interpret the author's words (Probst, 1984).

The role of the students and teacher in a classroom is formed by the teacher's philosophy about students and how they learn (Karnowski, 1997). The teacher is the final decision maker in determining what literature is studied and how that literature is presented. Focusing on the question of how children's literature is presented, Heald-Taylor (1996) discussed three paradigms for literature instruction in upper elementary grades. The first is to think of the curriculum as fact and relegate the learner to receiver of information. Literature teachers working under this set of assumptions would help students come to the one meaning that is important in a work of literature; that of the author. The second paradigm is to think of the curriculum as activity, with students being guided by the teacher to understand the text and to show that understanding through activities that display the students learning. Cochran-Smith's (1984) view fits into this paradigm when she presents the teachers role as that of "helping children discover the

meaning that a book's message, theme, or information might have in their own lives" (p.173).

The third paradigm presented by Heald-Taylor is that of curriculum as inquiry, based on reader response theories. Learners in an inquiry based classroom would be assumed to make meaning by transacting with the text and sometimes in collaboration with others. The process of literature study would be valued as much as the product, and teachers would facilitate each individual students exploration through literature.

The curriculum as inquiry view of literature with elementary and middle level students reflects the reader response theories first presented by Rosenblatt (1995) in 1938. She argued that reading should not be presented to students as merely information gathering, but rather that the reader "can begin to achieve a sound approach to literature only when he reflects upon his response to it, when he attempts to understand what in the work and in himself produced that reaction, and when he thoughtfully goes on to modify, reject, or accept it" (p.76). The role of the student reader is enhanced and is quite different from that in classrooms employing the curriculum as fact or curriculum as activity paradigms, with both teachers and students being viewed as being active creators of knowledge (Heald-Taylor, 1996).

Rosenblatt introduced a way of considering the different purposes with which a reader approaches a text, explaining that while an individual reader may have more than one purpose in mind when reading, one will be predominant. According to Hancock (1991) a reader who is reading primarily for informational purposes would be said to be

taking an efferent stance (from the Latin *efferre:* carry away). From this stance, the reader would focus on the aspects of the text that would be useful, such as reading a National Geographic to find out the mating habits of a penguin. On the contrary, a reader who is taking an aesthetic stance (from the Greek *aisthetikos:* perceptions through the sense, feelings , and intuitions) would focus on those aspects of the text that have personal meaning, such as remembering what it was to be a child when reading a poem about a walk in the woods.

Rosenblatt (1995) points out the possibility for the reader to take both stances when reading, but that the aesthetic stance may be more appropriate for works of literature, which she considers to be art:

> In both kinds of reading, efferent and aesthetic, the reader focuses attention on the stream of consciousness, selecting out the particular mix of public and private linkages with the words dictated by the purpose of the reading. Teachers often forget that if students know that they will be tested primarily on factual aspects of the work (often by multiple-choice questions), a full aesthetic reading is prevented, and the mix swings toward the efferent end of the continuum. (p. 293)

In the forward to the Fifth Edition of *Literature as Exploration*, Wayne Booth (1995) comments that we could view a beginning stance of reading as being efferent, but that our perspective and understanding broadens when we move further on the continuum toward an aesthetic reading stance. This focuses our attention on the expectations that the teacher of literature sets up. In a reader response classroom, the teacher would view students as active participants and decision makers in their own learning and closely

examine his/her own ethical criteria, understanding that it affects all he/she says and does in the classroom. The teacher in a reader response classroom views students as active participants and decision makers in their own learning and closely examines his/her own ethical criteria, understanding that it affects all he/she says or does in the classroom (Rosenblatt, 1995). Therefore, the teacher's influence cannot be overstated. Common to most research on reader response to literature is the focus on the teacher and the environment he/she creates in the classroom (Heald-Taylor, 1996; Karnowski, 1997; Eeds & Peterson, 1991; Rosenblatt, 1995). O'Flahaven (1995) discusses the central role of the teacher in the reading of literature in the classroom, writing that the very act of a teacher allowing or disallowing discussions of personal interpretations of literature sets the tone for all literature discussion.

Teachers of literature who choose to use a response-based approach make decisions on a regular basis that affect student reading and writing based on their own interpretations of what response to literature means. Four objectives of a response-based approach to school literature that may draw those with disparate views together are presented by Purves, Rogers, and Soter in *How Porcupines Make Love III* (1995). They are:

1. Each student will feel secure in her response to a poem and not the parrot of someone else's response. A student will trust herself.
2. Each student will know why he responds the way he does to a novel--what in him causes that response and what in the novel causes that response. He will get to know

himself.

3. Each student will respect the response of others to the play as being as valid for them as hers is for her. She will recognize her differences from and similarities to other people.
4. Each student will reach through the story to the writer and seek to understand the culture that underlies the story to find both unique elements and points of connection to hi sown culture and that of other readers. He will recognize his similarity and differences with other places, other peoples, other times. (Purves, Rogers, & Soter, p.59)

Written Response to Literature

Rosenblatt is explicit in her emphasis on what Dewey calls the "vicarious experience" of writing, "The reader seeks to participate in another's vision--to reap knowledge of the world, to fathom the resources of the human spirit, to gain insights that will make his own life more comprehensible" (1995, p.7).

Emig discusses the power of writing in *Writing as a Mode of Learning* (1977). She cites Bruner and Piaget's three major ways we deal with actuality (enactive, iconic, and symbolic) and claims they are all at work when we write. The fact that writing requires the use of the hand, eyes, and brain points to the idea that the more modalities involved in learning, the more it will "take." The slower pace of writing over reading makes it an excellent reflective learning tool and Emig explains that we write at our own

pace, just as we learn at our own pace. Because writing is also slower paced than speaking, Atwell (1987) explains that writing gives students time to consider their thinking, and can even spark new insights that may be missed in conversation.

Writing is more than a cognitive activity. According to Barton (1991), it has many affective dimensions as well. This points up the individuality of writing; it is just as individual as the learning process. Vygotsky is well known for his social approach to literacy. According to Vygotsky's work (1978), writing is a complex cultural activity, not simply a motor skill and occurs as a part of a natural progression of communication development. "...children should be taught written language, not just the writing of letters" (p. 119).

Other researchers consider writing to be just one of many sign systems humans use to communicate. Short, Harste, and Burke (1996) discuss the "authoring processes" inherent in interdisciplinary studies. Music, art, and even mathematics are viewed as being systems of communication within which the authoring cycle takes place. Making meaning is viewed as a process through which learners are both the receivers and the senders of information. "All children come to school with experiences and language. Although some educators may not personally like the particular experiences and/or language children bring with them to school, it is this base from which children grow" (p.53).

Graves (1984) also considers the flow of information as he equates reading with receiving information and writing with sending it. He argues passionately for the

emphasis of writing in the curriculum, stating, "Writing is the basic stuff of education. It has been sorely neglected in our schools. We have substituted the passive reception of information for the active expression of facts, ideas, and feelings. We now need to right the balance between sending and receiving. We need to let them write" (1984, p.75).

Researchers have used written responses to literature as vehicles to analyze content and understanding of text (Atwell, 1987; Flood & Lapp, 1994; Kelly, 1990; Many, 1991; Russell, 1994). Russell (1994) considers students as early as second grade to be capable of responding to literature through writing and drawing, with those older capable of responding in different formats, such as journals and reader response essays.

Flood and Lapp (1994) found in their research that writing provides an opportunity for readers to reflect upon what the story means to them and further research has shown that students who write about what they read better understand the texts (Kelly, 1990). Purves, et al. draw these notions together as they continue Rosenblatt's theme of exploration through literature and write, "Writing, unlike the other avenues for response, offers an opportunity to explore what we think and to record that exploration simultaneously" (1995, p. 151).

William Zinsser (1988) writes convincingly about writing across the curriculum from years of experience as a writer, editor, and teacher. He promotes writing, not just in the English class, but as an organic part of the entire curriculum. Zinsser argues that writing, thinking, and learning are all parts of the same process and that writing can take the fear out of learning in content area in which one is uncomfortable. "I was once such a

student, morbidly afraid of the sciences and other disciplines that looked alien and forbidding. Now I began to think that I could have written and thereby reasoned my way into those disciplines--far enough, at least, so that they would have lost their terrors" (p. ix).

Mett (1989) concurs that writing has been shown to be an effective tool to help students reflect, summarize, and personalize a theory. She used writing in her university mathematics classes extensively and wrote a defense of the practice. Previous studies that suggest a strong relationship between writing and mathematics are cited in *Writing in Mathematics* as well as the author's belief that writing is a valuable teaching tool. Mett's goal was to assist students in gaining a more meaningful way to communicate mathematically, understanding that the sequential nature of mathematics makes it imperative for students to understand each step as the semester progresses.

In addition to the values of reading and writing in content area classrooms, Wood (1992) included speaking and listening as important tools to help students understand mathematical concepts. A common thread of the language communication strategies that Wood presented is that they emphasized metacognition, or knowing what you know. Because writing is a physical as well as a mental act, the emphasis on reflecting on ones learning instead of just repeating exercise after exercise led to greater comprehension. Dyson (1990) is less apt to adopt "rigid expectations" of children's responses to literature, but rather to recognize the diverse possibilities that are opened up when literature is presented.

Burton (1992) concurs with Wood in her argument that mathematical concepts are not directly transmitted from the teacher to the student, but need to be built up by the learner. Burton presented language as a valuable tool that can allow students to share and build up their conceptions of mathematical structures. Children need to talk, read, and write, as well as listen in mathematics classes in order to develop their understanding.

Many (1991) used written responses to successfully analyze fourth, sixth, and eighth graders responses to literature, and Nash (1995) found that through analyzing written student responses to literature, she gained insights into children's reading behaviors as well as an understanding of their individual interpretations of text.

Purves, et al. illustrate the connection between literature and writing: "There exists between literature and writing a very close and natural link--a symbiotic relationship. All writers confess to having been strongly influenced by what others have written and may similarly influence other writers in their immediate surroundings" (1995, p.153). Calkins and Harwayne (1991) draws the worlds of reading, writing, and teaching together into an interwoven unit when she writes, "The reason that many of us care so much about the teaching of reading and writing is that we, too, have found that when we give the children of the world the words they need, we are giving them life and growth and refreshment" (p.24).

Burton (1992) summarizes the value of writing when she writes, "We find out what we think when we write" (p. 26).

Literature Across the Curriculum

A literature-based approach to teaching reading is relatively new (Karnowski, 1997). Books are being presented in classrooms because they are interesting and motivating, not only to teach reading skills (Slaughter, 1993). Karnowski describes the cycle of instruction that was more prevalent before the literature-based movement:

> You probably learned to read using a reader and a matching workbook or two. Your teacher had a teacher's edition that was at least double the size of your reader, and it contained all of the questions and the answers related to the stories you would be reading. You probably began the reading session with flash cards to help you learn new vocabulary. You were then instructed to read in a round-robin fashion, sometimes only getting through part of a selection. You may have been admonished not to read ahead, but there really wasn't time to do that. There was a vocabulary worksheet page and a comprehension page or two to finish. The next day would begin by correcting and the discussion of the workbook pages before beginning the whole cycle over again. (p.307)

Hennings (1993) promotes the instructional value of reading across the curriculum as she writes, "If reading instruction is to be effective, it must take place across the curriculum as students read within a variety of disciplines" (p. 363). Towery (1991), Schiro (1997), and others have developed criteria for literature presented in classrooms; it should be developmentally appropriate, have literary value, and present accurate information. Texts presented for study across the curriculum may be fiction or non-fiction informational books, but reading strategies can be varied depending on the needs of the particular students. "All teachers need to prepare students to study the texts used in

their classes and to vary their study strategies depending on the nature of the texts and task they encounter. All teachers need to instruct students in working with the types of texts used in their classes, which in many cases will be expository texts" (Graves, 1989, p. 211).

The role of reading across the curriculum has been studied and researchers have found both reading and writing to be effective tools to introduce, teach, and reinforce the learning of mathematics (Drake & Amspaugh, 1994; Siegel & Borasi, 1992; Siegel & Fonzi, 1995; Wood, 1992). Reading can be used to augment content area instruction (Siegel, Borasi, Fonzi, Sandridge, & Smith, 1996). These authors view reading as a generative meaning making process with active participation from the reader being integral to the process. Using specific strategies to help students make sense of the mathematical concepts served to be very effective in promoting mathematical problem solving in their studies with middle school children. Siegel and Fonzi (1995) report on the findings of a long term study that is part of the well-known "Reading to Learn Mathematics" project in New York. Their findings promote mathematical learning as a constructive process that actively involves the learner as opposed to being an act of transmission from teacher to student.

In addition to the research on reading and writing strategies that are effective in promoting math learning, some research has been done to examine the relationship between literature and mathematics teaching and learning. Whitin and Wilde (1992) wrote *Read Any Good Math Lately?* to provide teachers with ideas to integrate the use of

children's literature in math classrooms. "Through books, learners see mathematics as a 'common human activity' (NCTM, 1989) that is used by people in different contexts for different purposes" (Whitin, 1995, p. 134). Besides Whitin and Wilde's work, the National Council for Teachers of Mathematics (NCTM) published a booklet authored by Rosamond Welchman-Tischler (1992) that delineates ways to use children's literature to teach mathematics. Welchman-Tischler writes, "Children must find mathematical experiences interesting if they are to achieve their mathematical potential, and using literature as a springboard is one way to capture their interest" (p. 38). In addition to the NCTM, the International Reading Association and the National Council for Teachers of English have made statements promoting the use of writing across the curriculum. Each of these scholarly organizations have included calls for teachers to take advantage of the close relationship of writing to learning across the curriculum.

Smith (1995) writes that "literature selections that encourage teachers and children to make authentic connections between mathematics and other curricular areas are essential" (p.288). She takes children's literature used for mathematical study one step further when she suggests that books may not have to be explicitly about mathematics in order for them to be used in the mathematics classroom; those with a more implicit or subtle math theme are also valuable resources.

Considering both an efferent and an aesthetic stance while reading to be valuable, Slaughter (1993) writes, "Indeed, sharing books across the curriculum can lead to increased learning in all areas of early childhood education and will put young children

on the road to reading for information and for pleasure" (p. 93).

Slaughter (1993) views the benefits of integrating literature across the curriculum as being two-way, with literacy development being enhanced as well as the content area. She believes the different systems of communication (art or mathematics, for example) provide students with the opportunity to view information from different perspectives.

Throughout *Literature as Exploration*, Rosenblatt (1995) encourages not just a "touchy-feely" approach to literature in the classroom, but more importantly, that teachers should help students develop rational thinking skills to help them understand their emotional responses. She is adamant that educators should resist the temptation to polarize art and science, remembering that literature is not written about words, but about concepts, things, events, and the substance of our lives.

Karnowski (1997) admonishes teachers to trust the literature and not feel obligated to teach quality literature in much the same way that we would have taught basal stories in the past. Peer-teacher discussions allow for deeper thought and more meaningful experiences with literature than the typical question and answer sessions directed by the teacher. 'Children's book author, Natalie Babbitt, points out that literature across the curriculum, in some cases, has led to the "basalization" of works of literature: "So it seemed sensible to try using real stories in the classroom--stories that could grab the children's fancies and how them what the joy of reading is all about. But what I see happening now is that these real stories are being used in the same way that the old text

were used...I worry that this will make a dry and tedious thing out of fiction" (1990, pp. 696-697).

Michael Schiro (1997) convincingly writes about asking students as young as elementary school age to evaluate both the literary merits and the mathematical merits of children's literature with mathematical content. The integrity of the literature and of the mathematics need to be preserved if we are to make good use of literary reading in content area study.

Exposure to good literature is a vital component of a student's education, but the way this literature is presented and transacted with is as important as the quality of the literature itself. The potential for use as well as abuse is present and at times, excellent literature is *abused* across the curriculum, not just used.

Orientation Toward Literature

Two central motives for reading are pleasure and understanding. However, there are also other specific appeals for the reader. Literature shows human motives, provides form for individuals' experience, reveals life's fragmentation, helps us focus on what is essential in our world, and entices us to meet a writer-creator. "Words are merely words, but real literature for any age is words chosen with skill and artistry to give the readers pleasure and to help them understand themselves and others" (Lukens, 1982, p. 178). In the past, research in the reading of literature put the spotlight on the text itself or the author, with the reader engendering little notice (Rosenblatt, 1978). Rosenblatt suggests

that the writer, the text, and the reader should all be highlighted, as they transact in any literary reading.

Readers choose to focus attention on particular aspects of literary works that appeal to them personally. Rosenblatt referred to this as selective attention. Karolides (1997) further explains this notion as he writes, "From the array of meanings and feelings that are conjured up, readers select those that seem to them appropriate, that fit the work that is being evoked, in relation to the reading situation. The created response is the realized experience of the reader" (p. 13). The reader may be affected by a word or phrase, by the connections between personal experiences and the written word, or by closely identifying with a character, event, or social issue (Karolides, 1997).

In some cases, the writer of the literary text is viewed as being central to a reader's response. "They don't sit still on the page--or the screen. Writers and readers enter into a dialogue through the text" (Purves, et al., 1995, p.52). In developing the theory that the reading of a literary work is a complex, yet individual process, in *How Porcupines Make Love III*, Purves and his co-authors see the writer-text-reader relationship as a universe to be explored each time a reader picks up a book. Karolides (1997) concurs, noting that the nature of the text, while being important, is not the only determining factor in a literary reading that is dynamic, rather that static.

In recent years, responding to literature from a more aesthetic stance has been shown to help students connect their prior knowledge and experiences with text to gain a deeper and more accurate understanding of the text (Kelly, 1990). Cox (1997) notes the

value and naturalness of children's initial aesthetic responses to literature when she wrote, "When unprompted, children's natural responses to literature indicate that they take a predominantly aesthetic stance" (p.31). It should be noted, that even though a reader may take a predominantly aesthetic stance, this does not preclude the value or pervasiveness of the efferent stance. The predominant stance does, however, predict the activity or response of the reader. "The stance that a reader adopts affects the reader's activity. This choice results, perhaps, from the encouragement of the text itself, the reader's inner focus of attention and interests, the reader's cultural experiences and concerns, the situational context of the reading, or the directed purpose. Readers may blend their responses as affected by a combination of factors. How a response is generated and the nature of the evoked response is determined accordingly" (Karolides, 1997, p. 15).

The central role of the teacher in literature reading is emphasized by Karnowski (1997). She admonishes preservice and inservice teachers to become readers if they are not already. "Teachers who have felt the effects literature can have on their lives are able to share these feelings with students. If you have never felt the relevance of literature to your personal life, you will not be able to model this" (p.302). Karnowski is suggesting that teachers need to examine their own personal approaches to literature in order to be effective literature facilitators for their students.

David S. Miall and Don Kuiken (1995) of the University of Alberta have developed an instrument that will assist preservice and inservice teachers in considering

their approaches to literature. The Literary Response Questionnaire (LRQ) was the result of these authors' interest in individual differences in literary response and orientation toward literature. Readers have been found to be able to describe accurately what they are thinking as they read, and some indicators suggest that individual differences are stable across reading situations. In other words, individual readers will respond differently to different texts, but those individuals still have a similarity of orientation toward literature that cuts across the various reading events.

The stated purpose of the Literary Response Questionnaire is "...to assess several significant attributes of readers' approaches to literary texts" (Miall & Kuiken, 1995, p. 38). The developers of the LRQ do not consider one mode of response to be preferable to another, but rather, seek to understand and describe different orientations toward literature. The 68 item questionnaire assesses readers' approaches to reading literature and includes the following seven factors (orientations): insight, empathy, imagery vividness, leisure escape, concern with author, story-driven reading, and rejecting literary values.

Preservice teachers' orientation toward literature can be described using the LRQ, and this orientation could be considered to be a measure of their pedagogical knowledge, or understanding of the process of reading literary texts. A relationship between preservice teachers' responses to children's literature and their scores on the LRQ could indicate that teachers' own transactions with literary texts affect their classroom interactions with children as they read together in classrooms. It may be that a measure

of preservice teachers' content area knowledge will also shed light on a relationship between that knowledge and their responses to children's literature.

Preservice Teachers' Knowledge of Geometry

Strutchens and Blume (1997) write, "Geometric shapes, ideas, and concepts are experienced by students daily in the real world and thus are important components of the kindergarten through grade twelve curriculum" (p. 165). Despite the ubiquitous nature of geometry, teachers must be well versed in both the content and the pedagogical aspects of this area of mathematics to make it visible to their students. This is a concern for McDiarmid, Ball, & Anderson (1989), who authored a chapter in the comprehensive volume about preservice teacher preparation, *Knowledge Base for the Beginning Teacher*. They write that teachers' instructional judgments are based on their understanding of how people learn, how particular students learn and develop, about the subject matter being taught, and about the context in which learning will occur. "In teaching for subject matter understanding, the teacher's role is to connect children to the communities of the disciplines. To do so, teachers must be able to view the subject matter through the eyes of the learner, as well as interpret the learner's comments, questions, and activities through the lenses of the subject" (p.194).

Although teachers will be more effective instructors if they have a well-developed understanding of their subject matter, recent evidence suggests that many preservice teachers, secondary as well as elementary, do not understand their subject areas in depth

(McDiarmid, et al., 1989). Concern about preservice teachers' content area knowledge is not new. However, Grouws and Schultz (1996) note, "There is a noticeable lack of empirical research of mathematics teacher education" (p.443). They further analyze the status of mathematics teacher education and comment on the concerns of many teacher educators that preservice teachers do not possess a conceptual understanding of elementary mathematics.

Grouws and Schultz (1996) discuss a project at the University of California, Santa Barbara that was designed to improve mathematics education. One of the project's specific goals was "increasing teachers' knowledge about mathematics and changing their attitudes about mathematics and mathematics teaching" (p.451). Not only did teachers increase their own mathematical understanding, but that deeper knowledge led to improved self confidence that encouraged them to use more mathematics in various subject areas. When teachers' own mathematical knowledge was increased, their students were the beneficiaries.

Gonzales (1996) considered preservice teachers' mathematical knowledge and its relationship to pedagogical knowledge when she conducted a study with college students who were enrolled in mathematics courses for prospective elementary and secondary teachers. Students were given a mathematics situation and asked to generate five questions about it that would be appropriate in an elementary or secondary classroom. Analysis revealed that the questions generated were those that could be answered explicitly in the text with little demand made for students to stretch the boundaries of the

data provided. Gonzales suggests that much work needs to be done by teacher education programs to foster future teachers' development of expertise in question posing. McDiarmid, et al. (1989) concur as they write, "Teachers' capacity to pose questions, select tasks, evaluate their pupils' understanding, and make curricular choices all depend on how they themselves understand the subject matter" (p. 198). Schram (1988) highlights the relationship between pre- and inservice teachers' mathematical knowledge and ability to teach when she wrote, "For many elementary teachers, the limitations of their knowledge about mathematics and teaching mathematics constrains their ability to teach conceptually" (p. 1).

The measure of geometric thought first introduced in 1957 presents a valuable tool for assessing and promoting geometric understanding in preservice teachers. Since P.M. van Hiele and D. van Hiele-Geldof developed the theory of a measure of geometric thought in 1957, Usiskin modified it and designed the Van Hiele Geometry Test (1982). The twenty-five question test, with five questions in each of five subtests has been used extensively to assess middle school and high school students' readiness for geometry or their success after completing a course. It has also been utilized in research with university students, but very limited use has been noted with preservice teachers (Mayberry, 1983). In a study of preservice teachers' levels of geometric thought, Mayberry found that the van Hiele levels of geometric thought did form a hierarchy; in other words, students did progress through the stages Basic - IV. Further, it was found that no students were functioning at the highest level of geometric thought, while the bulk

were found to be at levels II and III.

The methods teachers use and the strategies taught come from two main sources, from outside themselves and from inside themselves. Outside sources include curricular materials and discussions with colleagues, while inside sources include their own inventions, understandings, knowledge, experience, and imaginations (McDiarmid, et al., 1989). The ability of teachers to connect their outside and inside sources of understanding may be crucial to their students' learning. As McDiarmid, et al. write, "Flexible understanding of a subject entails the ability to draw relationships within the subjects as well as across disciplinary fields and to make connections to the world outside of school" (p.193). One of the relationships that is central to mathematics learning may be the connections teachers can help their students forge between literature and geometry.

Summary

The framework of reader response theory has been reviewed to explain the role of the reader and the two stances a reader may emphasize while reading a work of literature. Research that provides support for the use of written responses to literature has been discussed to validate the collection of written responses as data in this study. Current research into the practice of using literature across the curriculum has been reviewed to set the context for examining preservice teachers' responses to literature. The role of readers' general orientation toward literature and an instrument to measure that orientation has been presented and preservice teachers' levels of geometric thought and

an instrument to measure that knowledge has been presented.

This study seeks to examine preservice teachers' responses to children's literature with geometric content and to look for a relationship between those written responses and the van Hiele Geometric Thought Test and between the responses and the Literary Response Questionnaire. This study seeks to find answers to the following questions:

1. What themes will emerge as preservice teachers' written responses to children's literature with geometric content are examined and analyzed?
2. Do preservice teachers respond in writing more to the literary, mathematical, or integrated content of children's literature with geometric content?
3. Do preservice teachers respond in writing more aesthetically or efferently to children's literature with geometric content?
4. In what ways are preservice teachers' levels of geometric thought related to their written responses to literature with geometric content?
5. In what ways are preservice teachers' performances on a measure of their orientation toward literary texts related to their written responses to literature with geometric content?

CHAPTER III

METHODOLOGY

Introduction

This chapter describes the participants and the instructional setting in this study, the instruments used, the design of the research, and the procedures that were followed.

Participants and Instructional Setting

The participants in this study were 85 (78 females and 8 males) preservice elementary teachers who were enrolled in reading and mathematics methods courses at a university in the Midwestern United States. Students in two reading methods courses, one mathematics methods course, and one integrated reading and mathematics methods course were asked to participate. While the participants were not selected at random, all students who were enrolled in the courses and who agreed to participate were included in the study.

The methods courses were the instructional setting for the study and participation in the study was a part of the normal course work. The reading methods course focused on helping preservice teachers learn about diagnosis and remediation of children with

reading problems. A prerequisite of this course was a foundations course in reading instruction. The mathematics methods course focused on helping preservice teachers learn to work with children at the intermediate level as they develop mathematical skills. Prerequisites of this course were a primary mathematics methods course and two content area math courses; mathematical structures and geometric structures. The integrated reading and mathematics methods course included the above purposes, and also sought to prepare preservice teachers to teach the two subjects integratively. As a required portion of all of the courses, preservice teachers tutored an elementary or middle level student in mathematics and/or reading.

The average age of the participants was 22.7 years. Fifty (58.8%) of the participants were seniors, 32 (37.6%) were juniors, and 3 (3.5%) were students who had bachelor's degrees and were returning for teacher certification. Seventy-five (89.3%) Caucasians were the largest group of the participants (88.2%) , with non-Caucasians (African-Americans, Latino/as, Native Americans, and other) making up the remaining 10 (11.8%). There were 66 (77.6%) elementary education majors, 16 (18.8%) early childhood education majors, and one each (1.2%) special education, family relations, and speech pathology majors.

Table I shows the numbers and percentages of participants who had already taken, were currently enrolled in, or had not taken a course in children's literature and a course in language arts methods. Table II shows the participants' self concepts of their achievement/understanding in mathematics, reading, and children's literature. In some

cases, participants did not complete items on the survey, so totals on the tables are not always equal to the total number of participants.

Table I

Participants' Enrollment in Children's Literature and Language Arts Courses

	Have Taken		**Currently Enrolled**		**Not Taken**	
	Number	Percent	Number	Percent	Number	Percent
Children's Lit.	63	74.1	21	24.7	1	1.2
Language Arts	24	29.3	41	50.0	17	20.7

Table II

Participants' Self Concepts of Achievement

	Excellent		**Average**		**Poor**	
	Number	Percent	Number	Percent	Number	Percent
Math	17	20.2	60	71.4	7	5.9
Reading	39	45.9	41	48.2	5	5.9
Children's Literature	13	15.9	62	75.6	7	8.5

Instruments

The following instruments were used in conducting this study:

1. van Hiele Geometry Test: This instrument was developed by P.M. van Hiele and D. van Hiele-Geldof to determine students' levels of geometric thought. Originally developed for use with secondary students, it has been found to be both reliable (.81)

and valid for use with preservice teachers (Usiskin, 1982; Mayberry, 1983). A sample of this instrument is included in Appendix A.

2. Literary Response Questionnaire: This instrument was developed by Miall and Kuiken of the University of Alberta to measure significant attributes of readers' approaches to literary texts (1995). It was found to have adequate internal consistency, retest reliability, and factorial validity (Miall & Kuiken, 1995). A copy of this instrument is included in Appendix B.
3. Literature/Geometry Survey: This instrument was designed by the researcher to elicit responses to issues concerning preservice teachers' perceptions of the use of literature with geometric content with elementary and middle level students. This survey included demographic information about the participants and open-ended questions about the participants' perceptions of their own understanding of literature used for content area study in elementary classrooms. A copy of this instrument is included in Appendix C.
4. Children's Literature: Three works of children's literature with geometric content were selected for this study. They are The Greedy Triangle by Marilyn Burns (1991), Grandfather Tang's Story by Ann Tompert (1990), and A Cloak for the Dreamer by Aileen Friedman (1994). The researcher selected possible books first by reading Whitin and Wilde's *Read Any Good Math Lately?* (1992), then by considering possible books using Schiro's Children's Mathematics Trade Books Evaluation Form (1997). From an original bibliography of more than fifteen picture books that had

geometric content, three were selected to be reviewed by one children's literature reviewer and one mathematics reviewer. See Appendix D for the evaluation form used to consider the mathematical and literary merits of these works of literature which were used to elicit written responses from the participants. Each book earned at least an average of 4.5 on a scale of 1-5 from both reviewers for both mathematical and literary qualities.

5. Children's Mathematics Trade Books: Evaluation Form: This instrument was developed by Michael Schiro (1997) and includes evaluation measures for not only the literary elements of plot, characterization, and so on, but also the mathematical merits of works of children's literature. These mathematical elements include the following: accuracy, effective presentation of mathematics concepts, visibility of the mathematics, and complementary qualities of the book's story and mathematics. A copy of this instrument is included in Appendix D.

Children's Literature Reviews

In order to ensure that readers could respond in writing to both the mathematical and the literary elements of the stories read, two reviewers evaluated each of the three books using the evaluation form developed by Schiro (1997; see Appendix D) independent of one another to ensure unbiased evaluations. These reviewers were selected based on their academic preparation and experience relative to children's literature.

A Cloak for the Dreamer is written by Aileen Friedman and illustrated by Kim Howard. It is one of the collection of Marilyn Burns Brainy Day Books that integrate the world of mathematics with children's literature selections. The theme of individuality within the context of a family's love is apparent throughout. In this slow paced and calming story, a tailor with three sons expects each of them to be initiated into his trade. The father gives each an opportunity to design and sew a cloak for the archduke, with the requirements that they be colorful and provide protection for the archduke from the elements. The two eldest sons, with their own artistic interpretations, create beautiful and useful cloaks. However, the youngest son, Misha designs his cloak not with the sensibility of a tailor, but with the eye of a traveler. With the circles of its design representing the oceans, meadows, deserts, and routes of faraway lands, it meets the criteria for colorful, but will not keep out the wind and the rain. Rather than be harsh with his son, the tailor and his oldest sons redesign the circle cloak to be Misha's gift as they send him out to follow his dream of traveling the world. The illustrations are of soft jewel-tones, with the text fitting within each two-page spread illustration. The setting is presumed to be the 19th century in a European or Russian city.

At the end of the story, information is provided for adults about the mathematics in the book, with a delightful explanation of children's developing sense of geometric shapes and their properties. Instructional ideas are also included.

The professional reviewers of this book found it to have somewhat flat characterization and a standard plot; however, the universal theme told with great

warmth compensated for the predictability. The illustrations were found to be appealing and to represent and extend the text. The connection between artistic expression and mathematics was described as a strength by one reviewer, as well as the ease with which readers could choose to extend the story through art. The mathematics was implicit, flowing nicely with the story; some readers may choose to focus on it, while others would simply relate to the literary elements.

Grandfather Tang's Story: A Tale Told with Tangrams is written by Ann Tompert and illustrated by Robert Andrew Parker. The story begins with Grandfather Tang and his granddaughter, Little Soo, sitting under a peach tree entertaining each other by making shapes with their tangram pieces. Grandfather Tang then begins a story of the fox fairies, traditional Chinese characters, who compete in a rivalry that turns dangerous as they change themselves into one animal after another, with one always in pursuit of the other. Completing the story-within-a-story format, the book ends with Grandfather and Little Soo bringing their day to an end as they form their tangrams to be images of themselves relaxing together until they are called to supper. The theme of the book seems to be friendship between friends, but also between generations of the same family. The illustrations have the sparse lines and muted colors reminiscent of Chinese scrolls, with each animal that the fox fairies transform themselves into being represented in bold black with the seven shapes delineated. The last page of the book shows how the shapes can be formed to make a square and gives a brief history of the use of tangrams in

Chinese storytelling. The reader is encouraged to trace the tans, cut them out, and make original shapes.

The professional reviewers of *Grandfather Tang's Story* found the use of suspense and the close relationship of the grandfather and granddaughter to be the books best literary features. The fact that the tangram animals were shown as each transformation takes place was viewed as a mathematical strength. Because some readers may not view the tangrams as mathematical, this book is more explicitly math-related than *A Cloak for the Dreamer*, but not overt in its presentation.

The Greedy Triangle is written by Marilyn Burns and is illustrated by Gordon Silveria. It is a Marilyn Burns Brainy Day Book, part of a series of children's literature publications that seek to present mathematics as being imaginative and accessible. The main character, a triangle with a pleasant life and many friends, becomes bored with doing the same old things. He approaches the local shapeshifter who agrees to give him one more angle and one more side. The Greedy Triangle, now referred to as "the shape," discovers new, exciting things to do and be as a quadrilateral, but he quickly becomes dissatisfied again. Each time the shape returns to the shapeshifter, he gains a side and an angle, finally coming close to resembling a circle. He is unable to keep his balance, has abandoned and been abandoned by his friends, and realizes he wants to be himself again. With a theme of being true to one's own self, the author takes an unlikely protagonist and creates a character that is very human-like. The illustrations are bright and the writing is clever; the reader is surprised by all the places the various shapes can

be found and is presented with the correct mathematical terminology for each polygon.

As with other Brainy Day Books, instructional ideas as well as carefully crafted explanations of the mathematics imbedded in the story are presented at the end.

The professional reviewers found this to be the best of the three books in both mathematical and literary criteria. The bright and lively illustrations include end pages that extend and support the text. The books plot was found to be imaginative and fun, with a moral that is not didactic in nature. The literary reviewer described the main character as being dynamic, not static, one children could relate to. The alliteration and vivid writing style make this one a particularly good book to read aloud. The examples of the different shapes in everyday situations elicited comment from the mathematical reviewer. The mathematics concepts in *The Greedy Triangle* are the most explicit of the three books used to elicit responses in this study, with the very title and the way the main character changes evoking mathematical thinking. Throughout the text, the shapes are described using the correct terminology and while each shape is equilateral, they are all illustrated accurately.

Reviewers

One reviewer is currently completing a doctorate in education with a focus on mathematics learning. Her bachelor's degree is in elementary education, her master's degree is in psychometry, and she has six years of experience teaching at the elementary school level. She has completed children's literature courses at the bachelor's and

doctoral levels and has enthusiastically shared literature with her elementary aged students. The first reviewer focused primarily on the mathematical elements of the books.

The second reviewer is a doctoral candidate in education and has a master's degree in library and information sciences. She has 7 years of experience as a school librarian. Her bachelor's degree is in secondary English education and she has 4 years of experience teaching at that level. She has extensive knowledge and experience with children's literature. The second reviewer focused primarily on the literary elements of the books.

Research Design

This study employed both qualitative and quantitative analyses in order to gain insight into the nature of preservice teachers responses to literature with geometric content. Qualitative methodology, content analysis with investigator triangulation, was used to designate individual response statements as being efferent or aesthetic. A quantitative descriptive study design was used for the descriptive statistics elicited from the Geometry/Literature Survey, analysis of the relationship between participants' performance of the van Hiele Geometric Thought Test and their written responses to literature, and analysis of the relationship between participants' scores on the Literary Response Questionnaire and their written responses to literature. In addition, excerpts from the written responses to literature and from the Geometry/Literature Survey are

included in Chapter IV and V to illustrate the findings and implications of the study.

Content analysis is a technique developed to quantify the description of various forms of communication. To perform the content analysis, a Guide for Rating Efferent and Aesthetic Responses was developed by the researcher (Appendix E). First, the researcher designated response statements, single segments of the responses that represent complete thoughts of the writers. Next, the researcher met with and trained two other raters, who were selected based on their academic preparation and experience relative to written responses to literature. Then all three read and reread the responses independently, rating each of the individual response statements that had previously been labeled by the researcher.

The ratings of the written responses to literature were triangulated through comparison of the three raters' markings. The raters met to discuss their individual ratings of the efferent and aesthetic designations and to provide the researcher with their impressions and interpretations of the responses as a whole. The written responses were representative of the writers' emotions, thoughts, wonderings, personal situations, and reflected their sense of self on the day they were written, and so were complex and challenging to analyze. When possible, consensus was reached; when this was not possible, the researcher made the final decision on the individual response statements. Examples of aesthetic and efferent responses are provided in Chapter IV.

Traditionally, triangulation led to the expectation of a "singular proposition about the phenomenon being studied (Mathison, 1988, p. 13). Nevertheless, in this study, the

purpose of the triangulation was less to come to consensus on individual statements and more to provide the researcher with confirmation or alternative views of the written responses. This is considered to be appropriate by Mathison (1988), Denzin (1989), and Huberman & Miles (1994). Denzin notes that agreement can never be complete because each rater approaches the data from a "unique perspective that reflects past experiences, personal idiosyncrasies, and current mood" (1989, p. 236). For this reason, investigator triangulation led to a broadening of the researcher's understanding of the written responses to literature, but the ultimate coding of response statements was the province of the researcher. The raters' analysis of the themes of the written responses are presented in Chapter V to further illustrate assertions made by the researcher.

Raters

The first rater earned an Ed.D. in curriculum and instruction and her dissertation research considered the effects of using children's trade books on student achievement. Her master's degree is in language arts education and her bachelor's degree is in elementary education. This rater has 25 years of experience teaching at the elementary level and is the elementary curriculum coordinator for her school district.

The second rater earned her master's degree in curriculum and instruction with a focus on language arts. Her bachelor's degree is in secondary English education and she has attended the Oklahoma State University Writers' Workshop, a program that is affiliated with the National Writers' Workshops. She has four years of teaching

experience at the middle school and secondary levels.

The coding of the content of the responses was conducted independently of the coding of the stances. Again, the response statements were already labeled and the total number of response statements is the same for the two different analyses. The researcher conducted the analysis of responses relative to their content. Using the definitions from Chapter I, the content of each response unit was rated as being literary, mathematical, or integrated literature and mathematics. Examples of each of these responses will be included in Chapter IV.

Role of the Researcher

The role of the researcher in this study was participant observer, which varies from a formal descriptive study (Gay, 1996), but is considered to be effective for this particular study because of its qualitative as well as quantitative nature. "Participant observation ranges across a curriculum from mostly observation to mostly participation" (Glesne, 1999, p. 44). Glesne (1999), in her instruction to qualitative research, *Becoming Qualitative Researchers*, puts forth four points on the continuum; those points are observer, observer as participant, participant as observer, and full participant. In this study, the researcher fulfilled the role of observer as participant. The researcher's role was primarily one of observing, but reading books aloud to the participants to elicit written responses was considered to be a participation role. There was interaction between the participants and the researcher in the style and delivery of reading and in the

discussions that often ensued with participants after the written response sessions that may have influenced the written responses to the literature. Some participants chose to discuss the books with the researcher, sometimes asking for author and publication information, sometimes wondering how they could use that particular book with their elementary-aged tutees.

Procedure

This study was conducted in three phases. After initial IRB approval (See Appendix F), the first phase involved asking students to participate in the study (see Appendix G for statement made by researcher to all participants), collecting all consent forms, the completing the Literature/Geometry Survey, and administering the van Hiele Geometry test. Participants were then asked to complete the Literary Response Questionnaire. Approximately one hour was required to complete this phase which was administered by the researcher and completed the first week of the spring semester, 1999.

The second phase involved participants in completing the Literary Response Questionnaire. This required approximately 30 minutes and was administered by the researcher. This was completed the second week of the spring semester, 1999.

The third phase of the study involved the participants in reading and responding in writing to literature with geometric content. It was completed the third and fourth weeks of the spring semester of 1999 and required a total of approximately two hours (30-40

minutes for each of three sessions). The literature selections were read orally by the researcher and participants were asked to respond in writing at the reading response sessions.

Before each book was read, participants were asked to listen and consider their thoughts during the reading. After the books were read orally by the researcher to each of the four classes, participants were asked to simply "fill a page" with their thoughts about the book (Sebesta, Monson, & Senn, 1995). They were asked to think not only as preservice teachers, but also to respond from a personal standpoint. This was emphasized because the researcher had experienced asking preservice teachers to respond in writing to two of the books used in this study in previous semesters and had found that they wrote only from their perspectives as future teachers. This may be because the setting for the reading and responding was the reading and mathematics methods courses, as it was in this study. Just as the books that were used had to present both quality mathematics and quality literature to facilitate responses to both, the participants needed to consider their roles as individual readers and writers and as future teachers so it would be possible to elicit responses representative of their true transactions with the literature.

Data are analyzed and the results are presented in Chapter IV and the findings are discussed in Chapter V.

CHAPTER IV

RESULTS

Introduction

The data collected for this study included responses on the Literature/Geometry Survey, participants' written responses to children's literature, performance on the van Hiele Levels of Geometric Thought test, and performance on the Literary Response Questionnaire. A Guide for Rating Efferent and Aesthetic Responses was developed to assist in the analysis of data. This instrument was developed by the researcher and piloted using responses to literature from preservice teachers (see Appendix E).

Written responses to the literature were analyzed using content analysis, a qualitative methodology. Quantitative methodology was used in the remainder of data analysis. T-tests were used to determine if there were any significant differences among participants' response stances and among the content categories of responses. A Pearson correlation was used to describe the relationship between stance of responses and content of responses. Summary information was compiled from data collected on the Literature/Geometry Survey that all participants completed. This data was used as control variables in the regression analyses in order to be confident that any differences

were due to the variable being tested, as opposed to other characteristics of the participants. Regression analysis was used to describe the relationship between the stance and content of written responses to literature (Dependent Variables) and participants' levels on the van Hiele Geometry Test and demographic controls (Independent Variables), and between the stance and content of written responses (Dependent Variables) and performance on the Literary Response Questionnaire and demographic controls (Independent Variables). The alpha level was set at 0.05 unless otherwise stated.

These analyses assisted the researcher in (1) describing themes that emerged as the researcher and as raters read and reread the written responses to literature, (2) ascertaining the extent to which variability exists among preservice teachers relative to their written responses (content and stance) to literature with geometric content, (3) determining whether the participants differ in their responses to literature with geometric content as a function of their levels of geometric thought, and (4) determining whether the participants differ in their responses to literature with geometric content as a function of their performance on the Literary Response Questionnaire.

The findings are presented in six sections: (1) Themes of the Responses, (2) Content of the Responses, (2) Stances of the Responses, (3) The van Hiele Geometric Thought Test, (4) The Literary Response Questionnaire, (5) Additional Findings, and (6) Summary.

Themes of the Responses

Research Question #1: What themes emerged as preservice teachers' written responses to children's literature with geometric content were examined and analyzed?

Upon the first reading of the participants' written responses to literature, they seemed to be only surface, cursory reactions to the stories read. However, upon careful reflection and thoughtful rereadings, patterns of responses emerged which portrayed the participants as being more expressive readers with stronger reactions to the stories than was previously assumed. The researcher first determined themes that were prominent in the analysis of the written responses, then reread all of the data to ascertain the consistency of these themes. This process was completed four times, with each rereading further refining the nature of the themes. With each rereading, themes were modified and described again to ensure that the heart of the data was represented by the themes. After the researcher completed this process, the raters were asked to provide feedback about the representative nature of those themes selected. Six related, but distinct themes emerged in the researcher's multiple readings of the responses to the three works of literature and the researchers' discussions with the raters of the response statements. These themes depict preservice teachers, in written responses to literature, who are: (1) making personal connections with the literature, (2) reading *for* children, (3) being the teacher, (4) looking for the math, (5), finding instructional ideas, and (6) focusing on morals. These themes will be discussed in more detail in Chapter V.

Content of the Responses

Research Question #2: Do preservice teachers respond in writing more to the literary, mathematical, or integrated content of children's literature with geometric content?

There were a total of 1,704 response statements included in the participants' written reactions to the three works of children's literature with geometric content. The participants responded significantly more to the literary aspects of the books than to the mathematical aspects (t=17.54, p=0.0001, N=77) or integrated aspects (t=29.94, p=0.0001, N=77). They also responded significantly more to the mathematical elements than to the integrated elements ((t=-9.82, p=0.0001, N=77). In other words, there was a definite order of frequency of responses; literary responses occurred most frequently, mathematical responses next, and integrated responses occurring least frequently. Table III shows the numbers and percentages of responses to each of the content areas by individual book and for all three books together.

Table III

Content of Response Statements by Book

	Literature		**Mathematics**		**Integrated**	
	Number	Percent	Number	Percent	Number	Percent
Cloak / Dreamer	368	75.3	102	20.9	19	3.8
Grandfather	385	69.5	117	21.1	52	9.4
Greedy Triangle	444	67.2	155	23.4	62	9.4
Total	1197	70.2	374	21.9	133	7.8

Examples of literary response statements are: "I don't remember ever reading books like this when I was younger. I usually read fairy tales instead of informational books,"; "I noticed repetition and patterning in this book that I think children can easily pick up on,"; and "It was fun and enjoyable and never a boring part."

Examples of mathematical responses are, "It talks about all the different shapes used in society and everyday life."; "It showed how shapes, when sides are continually added, almost and then do become circles."; and "Using a piece of children's literature to teach geometry is much more amusing than a textbook."

Examples of responses that integrate literature and mathematics are: "It helps children relate to the experiences they have had with clothes, shapes, colors, places to go, etc."; "Great integration of math, art, and social experiences."; "I would use this because it has a cross between reading and math." ; and "Using the tangrams to make the shapes of the animals is a great idea, but they did not compromise the quality of the story in order to teach a lesson on tangrams."

A particularly interesting finding is that if a participant's mathematical response percentage was higher than average for the group, we would expect that person to respond less to the literature, but similarly to the integrated elements of the books compared to the average response. Alternatively, if a participant's literary response percentage was higher than average for the group, we would expect that person to

respond much less to both the mathematical and the integrated qualities of the literature. Table IV displays the correlation coefficients and p values that articulate these findings.

Table IV

Response Content Categories' Relationships
(N=77)

	Literary Percentage	**Math Percentage**
Math Percentage	Rho=-0.82959	
	p=0.0001	
Integrated Percentage	Rho=-0.52493	Rho=-0.03978
	p=0.0001	p=0.7313

Stances of the Responses

Research Question #3: Do preservice teachers respond in writing more aesthetically or efferently to children's literature with geometric content?

Participants responded in writing more to the efferent, or informational, aspects of the literature than to the aesthetic aspects. Examples of efferent responses from the participants' written responses are: "There are many ways to use this in the classroom."; "I first thought, how do you spell clock (sic)?"; and "I feel the story did not need the last few pages." Examples of aesthetic responses are, "I'm a dreamer and I love to live life."; "Where's the boys' mother?"; and "The story reminded me of Joseph's coat of many colors in the Bible."

Table V

Stance of Response Statements by Book

	Efferent		**Aesthetic**	
	Number	Percent	Number	Percent
Cloak/Dreamer	247	50.5	242	49.5
Grandfather	322	58.1	232	41.9
Greedy Triangle	394	59.6	267	40.4
Total	963	56.5	741	43.5

Considering the three books together, there were 963 (56.5%) efferent response statements and 741 (43.4%) aesthetic response statements, for a total of 1704 response statements as the data were coded by the two raters and the researcher. For this analysis, the average of the individual participant's means were used. While the difference between efferent and aesthetic responses is noticeable, it was not found to be significant using a two tailed t-test at the .05 significance level (t=1.18). Table V shows the efferent and aesthetic responses by number and percentage for each of the three books. While there are no significant differences in efferent and aesthetic responses within each book, there are significant differences among the books. A T-test analysis indicated that participants responded significantly more to the aesthetic features of *A Cloak for the Dreamer* than to either *Grandfather Tang's Story* (t=2.25, r=.0273) or *The Greedy Triangle* (t=2.87, r=.0053). Following are illustrative examples that exemplify the variety of participants' aesthetic responses to *A Cloak for the Dreamer.*

- It brings memories to me of when I first left home to come to college.
- I felt as if I could see all of the four beautiful cloaks.

- I have many feelings about this book, but find myself having a difficult time putting them into words.
- It made me feel sad and tired afterwards.
- I have always wanted to travel.
- It takes a lot of courage to let the son go as he did.
- I don't think the father was very supportive. It was like he {the father} sent him off.
- Lots of people choose different roads of life.
- Like, my parents are teachers and for as long as I can remember, I've wanted to be a teacher.
- The story makes me think of a part of my life. I, too, have a very supportive family.
- I've learned the customs and traditions of my family and I learned to sew also, but I cannot be tied down. I can't do everything exactly perfect, but I am very independent.
- My parents are wonderful and I could not have fulfilled my dream of graduating from college and teaching without them.
- The book made me feel good because of the colors and the use of them.
- My family has done the same thing and it just makes me realize how important they are to me.

Both *Grandfather Tang's Story* and *The Greedy Triangle* elicited more efferent responses from the study participants. Following are examples.

From *Grandfather Tang's Story*:

- The book showed that you can use tangrams to make any shapes.
- The book was interesting enough for all grade levels.
- I have never seen a story written to incorporate tangrams.
- The book helps us understand another culture and is a wonderful model and illustration of storytelling.
- It has a good moral to the story. If you keep trying to be something you're not, then you could wind up getting hurt.
- I thought the language would be great for my students to hear and become familiar with.
- Teaches friendship and the value of caring for those that we love.
- It shows how the tangrams can be used in many different ways.

From *The Greedy Triangle*:

- I would incorporate this particular book in a geometry lesson.
- It has a good message about being yourself.
- One topic I noticed was the issue of personal satisfaction with one's self and

learning to like one's self.

- This is a good (cute) book that offers some real mathematics.
- I really liked how these abstract ideas of shapes were linked to things in the children's environment. I think that is so important.
- I think children would begin to grasp the concepts in the book without even realizing they were being taught.
- The message about being happy with yourself is also good for younger people.
- It is engaging and makes the reader want to know about all the different shapes.
- A triangle in the crook of an arm--cute!

van Hiele Geometric Thought Test

Research Question #4: In what ways are preservice teachers' levels of geometric thought related to their written responses to literature with geometric content?

Participants completed the van Hiele Geometric Thought test and their results and explanation of the scores were provided to them at the completion of the study (see Appendix H). The results are reported in terms of levels of geometric thought, with each level representing a hierarchical understanding of geometry. The results of this measure of geometric thought are presented in Table VI and the levels are described by Mayberry (1983) as follows:

BASIC LEVEL: At this level, figures are recognized by appearance alone. A figure is perceived as a whole, recognizable by its visible form, but properties of a figure are not perceived. At this level, a student should recognize and name figures and distinguish a given figure from others that look somewhat the same.

LEVEL I: Here, properties are perceived, but they are isolated and unrelated. Since each property is seen separately, no relationship between properties is noticed and relationships between different figures are not perceived. A student at this level should recognize and name properties of geometric figures.

LEVEL II: At this level, definitions are meaningful, with relationships being perceived between properties and between figures. Logical implications and class inclusions are understood. The role and significance of deduction, however, is not understood.

LEVEL III: At this level, deduction is meaningful. The student can construct proofs, understand the role of axioms and definitions, and know the meaning of necessary and sufficient conditions. A student at this level should be able to supply reasons for steps in a proof.

LEVEL IV: The student at this level understands the formal aspects of deduction. Symbols without referents can be manipulated according to the laws of formal logic. A student at this level should understand the role and necessity of indirect proof and proof by contrapositive (p.--).

Table VI

Levels of Geometric Thought

Level	Number	Percentage
Basic	20	24.1
I	15	18.1
II	39	47.0
III	6	7.2
IV	3	3.6

The levels of geometric thought were not found to have predictive power for the stance of the participants' responses. Regardless of how high or low the preservice teachers' levels of geometric understanding, the aesthetic versus efferent responses did

not move in accordance with those levels. This was true for all three books together as well as for each of them separately. Table VII includes the regression analysis statistics that demonstrate the relationship between the van Hiele test and the stance of responses. The statistics shown are for only efferent responses; the coefficients and p values for aesthetic responses would be of the opposite sign, but would still show no relationship.

The levels of geometric thought were also not found to have predictive power for the content of the participants' responses. The written responses to the books did not tend to be more mathematical, literary, or integrated with differing levels of geometric thought. Table VIII includes the regression analysis statistics that demonstrate the relationship between the van Hiele test and the content of responses.

Table VII

Results from Regression Analysis for Response Stance vs. van Hiele Test

	Coefficient	**p value**	**df**
Cloak	-0.04	0.06	61
Grandfather Tang	0.03	0.15	61
Greedy Triangle	0.01	0.64	61
Total Responses	-0.01	0.64	60

Despite the fact that the van Hiele test was not found to be related to response stance or content, a finding worth noting is that participants' concepts of their math ability, as measured by responses on the Literature/Geometry Survey was strongly positively correlated to their levels of geometric thought as measured by the van Hiele

test (t(61)= 3.147 p=0.0026). This indicates that the preservice teachers in this study were aware of their geometry achievement and could accurately predict their own performance. One participant wrote, "I truly believe that knowing geometry helped me to focus on deeper points within the story."

Table VIII

Regression Analysis for Response Content vs. van Hiele Test

	Total Responses
Degrees of Freedom	61
Math Coefficient	0.01
Math p value	0.50
Literature Coefficient	-0.03
Literature p value	0.98
Integrated Coefficient	-0.92
Integrated p value	0.36

Literary Response Questionnaire

Research Question #5: In what ways are preservice teachers' performances on a measure of their orientation toward literary texts related to their written responses to literature with geometric content?

Participants completed the sixty-eight item Literary Response Questionnaire and their results and an explanation of them were provided to them at the completion of this study (see Appendix I). This instrument measures seven different aspects of orientation toward literary texts. While it cannot totally define an individual's approach to literature, it can open a window into that individual's thinking.

Table IX presents the summary of the number and percentage of participants for whom individual factors were the highest and lowest factors. Descriptions of the factors are as follows:

1. Insight (14 items): This factor reflects an approach to reading in which the literary text guides recognition of previously unrecognized qualities, usually in the reader, but also in the reader's world.

2. Empathy (7 items): This factor indicates projective identification with fictional characters. (In other words, you project yourself into the character and "feel" what the character is feeling.)

3. Imagery Vividness (9 items): This factor expresses imaginary elaboration of a literary world that becomes vividly present not only visually, but also in feeling, sound, and smell.

4. Leisure/Escape (11 items): This factor indicates an approach to reading that emphasizes reading for pleasure and as an enjoyable and absorbing departure from everyday responsibilities.

5. Concern with Author (10 items): This factor reflects interest in the author's distinctive perspective, themes, and style, as well as the author's biographical place in a literary or intellectual tradition.

6. Story-Driven Reading (8 items): This factor reflects an approach where the reader is focused on plot or story-line, with particular emphasis on interesting action and compelling conclusions.

7. Rejecting Literary Values (9 items): This factor represents the rejection of careful reading, of scholarly study, and of instructional presentation of literary texts. Reading literature is regarded as a compulsory and irrelevant task (Miall & Kuiken, 1995).

Findings that seem to stand out for this group of preservice teachers are the high number of participants whose orientation toward literature focuses on leisure/escape and the large number who scored low on rejecting literary values. However, the factor scores

of the Literary Response Questionnaire were not found to have predictive power for the stance of the participants' responses for all three books together nor for each of them separately. Regardless of the high or low factors of preservice teachers' orientation toward literature, the aesthetic vs. efferent responses did not move in a predictable pattern. Table X includes the regression analysis statistics that demonstrate the lack of relationship between the Literary Response Questionnaire and the stance of responses. The statistics shown are for only efferent responses; the coefficients and p values for aesthetic responses would be of the opposite sign, but would still show no relationship.

Table IX

Literary Response Questionnaire High and Low Factors

	# Participants with Each High Factor	Percent	# Participants with Each Low Factor	Percent
Insight	23	27.7	0	0.0
Empathy	4	4.8	19	22.9
Imagery Vividness	0	0.0	3	3.6
Leisure/Escape	38	45.8	6	7.2
Concern with Author	3	3.6	19	22.9
Story-driven Reading	14	16.9	1	1.2
Rejecting Lit. Values	1	1.2	35	42.2

Table X

Results from Regression Analysis for Response Stance vs. Literary Response

	Coefficient	p value	Df
Insight	-0.07	0.17	42
Empathy	0.01	0.61	42
Imagery/Vividness	0.02	0.59	42
Leisure/Escape	0.02	0.55	42
Concern w/ Author	-0.01	0.86	42
Story-Driven	-0.01	0.95	42
Reject Lit. Values	-0.01	0.99	42

Table XI

Results from Regression Analysis for Response Content vs. Literary Response Questionnaire

	Insight	Empathy	Imagery	Leisure	Author	Story	Reject
Math Coefficient	-0.07	-0.01	-0.05	0.03	0.01	-0.03	-0.02
Math p value	0.15	0.98	0.23	0.25	0.92	0.45	0.59
Lit. Coefficient	0.09	-0.02	0.05	-0.05	-0.01	0.01	0.07
Lit. p value	0.09	0.52	0.24	0.17	0.81	0.84	0.16
Integ. Coefficient	-0.02	0.02	-0.01	0.01	0.01	0.02	-0.05
Integ. p value	0.54	0.31	0.88	0.58	0.82	0.47	0.15
Df	43	43	43	43	43	43	43

The factor scores of the Literary Response Questionnaire were also not found to have predictive power for the content of the participants' responses for the three books as a whole nor for the books separately. The written responses to the books did not tend to be more mathematical, literary, or integrated in relationship to differing orientations toward literature. Table XI includes the regression analysis statistics that demonstrate the relationship between the Literary Response Questionnaire and the content of responses.

Additional Findings

There are two additional findings that are presented here and discussed in Chapter V. The first additional finding is that using correlation analysis, a moderate positive relationship was found between aesthetic and literary responses (Rho=0.618, p=0.0001, N=77), and modest relationships were found between efferent and mathematical responses (Rho=0.460, p=0.0001, N=77) and between efferent and integrated responses (Rho=0.405, p=0.0003, N=77). Table VIII shows the breakdown of stance and content of responses.

Table XII

Relationship Between Response Stance and Content

	Literature		**Mathematics**		**Integrated**	
	Number	Percent	Number	Percent	Number	Percent
Efferent	477	28.0	366	21.5	120	7.0
Aesthetic	720	42.3	8	0.5	13	0.8

The second additional finding is that there was a positive correlation between aesthetic responses and the children's literature course (Rho=0.28, p=0.01, N=77). In other words, those who have already had the children's literature course tended to respond more aesthetically than those who had not taken it or those who are currently enrolled in it.

Summary

The analysis of data has been presented in this chapter. While the van Hiele Geometric Thought Test and the Literary Response Questionnaire did not provide explanatory value for the preservice teachers' written responses to literature, there are other findings that do point to variability among the participants and their approaches to literature with geometric content. In addition, the preservice teacher participants seemed to be aware of their own mathematical conceptual understanding and scored in an interesting pattern on the measure of literary orientation. The fact that there were significantly more responses to the aesthetic aspects of one particular book as well as significantly more responses to the literary aspects of all the books warrant examination. These findings are discussed in Chapter V, along with recommendations for further research.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

The participants in this study were largely female (78 of 85), were the traditional college student age (22.7 years), and were Caucasian (75 of 85). Despite the fact that they were a homogenous group of people in some aspects, each approached the literature from his/her own personal situation with his/her own background knowledge, experiences, and emotions.

Preservice teachers who were read aloud to in methods courses were found to use children's literature more often when working with children, were more likely to create games and teaching statements utilizing children's literature, and were found to have more personal enjoyment of literature (Andrews, Moss, & Stansell, 1985). Moreover, Zancanella (1991) found a strong relationship between inservice teachers' personal approaches to literature and their teaching of literature. These connections between exposure to literature and teaching of literature were illustrated in this study. It was common for participants to discuss the books with each other or with the researcher after responding in writing, and it was just as common for them to refer back to a previously

read book in their written responses to the current book. Many of the participants also commented on the pleasure they derived from listening to books being read aloud.

While this chapter focuses on a discussion of the findings and attempts to find trends among the preservice teacher participants, this does not diminish the very individualized nature of literature response. The responses were written by real people who in many respects could not be easily categorized. These people were university students whose laudable goal it is to become teachers; this is the common thread that binds them together.

The preservice teachers' participation in this study not only provided data for analysis, it also gave them the chance to practice responding to literature and considering their orientation toward literature and their geometric knowledge base. Unless preservice teachers are given the opportunity to experience a literature response approach to children's literature, they will not be able to translate that experience into a variety of opportunities with literature for their future students. Unless they examine their personal approaches to literature study and literature across the curriculum, they cannot change their attitudes and beliefs. As Newman (1987) writes, "Before we can change our attitudes and beliefs, we have to know what they are" (p.736).

Discussion of Research Findings

The discussion of research findings will focus on three areas. These are: (1) themes that were found in the written responses; (2) the tendency of participants'

responses to be either focused on literature or on the mathematical and integrated features of the books; and (3) the participants' aesthetic versus efferent stances.

Themes of Responses: What themes emerged as preservice teachers' written responses to children's literature with geometric content were examined and analyzed?

Multiple readings by the researcher and discussions among the researcher and two raters assisted the researcher in identifying themes in the written responses to literature. The themes are described here to provide the reader with a window into the preservice teachers' thinking and to provide background information for the discussion of the other findings. Six distinct themes emerged from the written responses. They are: (1) Making Personal Connections with Literature; (2) Reading for Children; (3) Being the Teacher; (4) Looking for the Math; (5) Finding Instructional Ideas; and (6) Focusing on Morals. These themes are presented individually with direct quotes from the responses that illustrate each commonality among participants.

Making Personal Connections with Literature

Many participants related the books to their own lives, as has been found to be crucial to quality literature engagement (Karnowski, 1997; Lukens, 1982; Purves, et al., 1995). Their responses highlighted parts of their own lives that the stories evoked as they listened to the books being read aloud. *Grandfather Tang's Story* elicited responses filled with yearning for family connections, as one participant wrote, "How I wish I had grandparents to spend time with!" and another wrote, "I never was close to my

grandfathers due to divorce and never had long talks with either of them. I wish I could have shared family traditions like they did in the story."

The Greedy Triangle brought responses related to participants' own feelings of inadequacy: "I am like that, always feeling my happiness is somewhere just around the corner, but out of reach." and "It makes me think about why I want to be other things in life. For example, when I try to be something else, will I get tired of it and go back to the original style?" One participant felt a personal message was delivered by the book, as he/she wrote, "Freedom of choice. That is a big area in my life right now so it was easy to pick up on that." Another participant related the story to friends' struggles with identity: "I know how those friends felt because I have had friends who change who they really are to fit in or have fun and I felt neglected and I didn't like being around them anymore because they weren't the same person." In addition, one participant wrote an emotional response linked to the mathematics, "Geometry is one of the most uninteresting things to me. I absolutely love math, but I don't like shapes."

One participant took a special interest in an aspect of *A Cloak for the Dreamer*, writing, "This book simply shows me how things in life can easily be adjusted to become perfect. Misha used circles. He thought it was a failure, but all it needed was simple adjustment."

Reading for Children

Daniel Hade (1993), a professor of children's literature at Pennsylvania State University, explained his students' focus on reading books for children, "My students are

acutely aware they are reading *children's* literature, so when they read, they seem to read not just for themselves, but also for the children they imply as readers" (p.6). This was also the case for the participants in this study who assumed knowledge about children's taste in literature. Examples of this are the following responses: "I know children would really love this book."; "Most children would relate to this story in some way."; "Older children would enjoy it."; "I think students would enjoy this book because of the magic feel and the old time setting."; and "It's a fun story and would keep the children interested."

Some would disagree with the assumptions made by preservice teachers in this study. Dyson (1990) argues for an eclectic approach to literacy in the classroom: "Clearly, there can be no rigid expectations for how children respond to school literacy activities...what does seem essential is a recognition of the diversity inherent in literacy and its development" (p.203).

Being a Teacher

For many participants, their future roles as teachers are pervasive in their responses. They are constantly searching for ideas and materials with which to teach. As one rater put it, they are looking for "magic tricks" to teach math and other content areas through literature. There are abundant ideas in teacher practice journals and entire books for using children's literature to teach concepts in content areas. One example is Whitin and Wilde's (1992) collection of ideas that integrate children's literature and

mathematics. The popular *Instructor* magazine includes regular features of ready-made activities for using literature across the curriculum to enhance content area learning.

Two participants illustrated the tendency to search for well-developed ideas for teaching mathematics by writing, "To me, the sign of a good piece of literature to use in a classroom is one where ideas for activities jump out at you as you read it," and "The creation of these types of books have given me great ideas on how to make math a liked subject, not a disliked one." Another participant picked up on a way to promote mathematics without children's advance knowledge, writing, "This would get the students interested in the tangrams before they realized they were actually related to math." One participant explained how the book shows students there are multiple ways to complete tasks, writing, "This would be excellent so students could realize that even when doing the same project, there are different ways to do it right." One response represents many others who felt that their personal opinions about a book did not matter if it would be a good tool for a particular purpose in the classroom. This participant wrote, "I personally wouldn't buy this book, but as a teacher, I feel it would be a good book to keep in my classroom."

Hade (1993) is concerned about preservice teachers who choose to read for the implied child reader instead of for their own enjoyment, explaining, "...my students were closing off possibilities of meaning for themselves, depriving themselves of experiences with literature" (p.6). One particular response highlights this tendency and the importance of their future roles as teachers that is descriptive of many of the participants:

"I felt it was really hard to write as a person because I am always looking for new ways to help young people as a teacher."

Looking for the Math

Mathematical concepts do not need to be explicit in a book in order for it to be used in the mathematics classroom (Smith, 1995). However, some participants in this study had difficulty finding the "real" mathematics in the books. *A Cloak for the Dreamer*, in particular, elicited confusion from some participants who knew that this study was being conducted using children's literature with geometric content. Responses along this vein include: "I wasn't sure if the book was intended to integrate reading and math. If it was, I didn't really see where the integration fit in besides the discussion of various shapes."; "I don't really see a lot of math in this book."; "I really don't think this book serves my uses as a teacher. It's a good story, but it doesn't deal with math in a way in which I would use it."; and "This is obviously providing some use of shapes, but I'm not sure if it is enough to use as a math concept book." Unless the mathematics was explicit, as in the case of The *Greedy Triangle* or *Grandfather Tang's Story*, some participants did not view the literature as useful for mathematics learning in the classroom.

Finding Instructional Ideas

Literature can be a part of the process of learning in a content area, not just a method to develop interest in a topic (Short & Armstrong, 1993). The participants in this

study did seem to view the works of literature to be valuable resources for introducing topics as well as developing conceptual understanding. The written responses to the three works of literature are filled with ideas for ways to use these books with children. Some of the instructional ideas could be classified as being respectful of children, the content, and the literature, while others are much less so. The ultimate test of these ideas, of course, would be in the future classrooms of these prospective teachers, as some ideas could be respectful or disrespectful depending on the disposition of the teacher and the lesson. Illustrative of respectful ideas are the following response excerpts: "The students could be challenged to figure out how the father plans to fix the cloak."; "What a fun way to introduce tangrams,"; "The students could experience shapes that do not fit together, such as circles, and work with them until they did fit together." ; and "I would let the students work with tangrams and tessellations after we read the book."

Two examples of instructional ideas that seem to be less respectful of students, the content area, and the literature are, "The use of shapes would be good for lower level math students." and "I would read this to my class if I wanted to get them settled down after being outside."

Focusing on Morals

A major theme found in the written responses was the preservice teachers' predilection to focus on the moral issues presented in the three works of literature. Hade (1993) views this as a detriment to literary experiences, writing about a children's

literature student who responded didactically to a book, "Too many of my students appeared to be committing the heresy that this student had done: reading a piece of fine literature as one would a moral tract" (p.2). He further explains, "They believe that meaning is hidden for a child and that an adult is needed to make meaning clear...They see children as passive sponges. They see children in need of control" (p.9). Hade is adamant in his disdain for moral readings of children's literature, but does show that it is a common way for preservice teachers to respond to children's books. This was borne out in the responses in this study.

Some participants touched lightly on the moral nature of the stories, writing responses such as, "This had great morals behind the story." and "I like this story because it models values and some morals." Other participants wrote about specific morals they think would be valuable to teach to children found in the literature: "I would use this book for several topics. One would be manners and politeness...to help teach students not to be greedy or selfish and not to ignore your friends." and "Children could learn what respect means, what role models are for."

Gooderham (1993) draws a distinction between moralizing and providing a moral environment for children as he writes, "There is, however, a difference between moralizing on the one hand and moral structure, development, and education on the other" (p.115). He would probably be comfortable with the following two responses: "I think it shows what knowledge and wisdom we can learn from elders." and "I can put this into a religious context. I place the Shapeshifter as God and the little triangle as an

unsatisfied human. The Shapeshifter is willing to turn the shape into anything he wants to be. However, in the end the Shapeshifter knows that the little shape is happiest as himself."

Literary versus Mathematical and Integrated Responses: Did preservice teachers respond in writing more to the literary, mathematical, or integrated content of children's literature with geometric content?

The written responses to children's literature with geometric content in this study were more likely to be reflective of a literary response than a mathematical or integrated one (70.2% literary, 21.9% mathematical, and 7.8% integrated). It should be noted, however, that the literary responses were not necessarily all aesthetic in nature. In fact, when coded in conjunction with the aesthetic versus efferent responses, 60% were aesthetic. The remaining 40% were efferent responses, largely instructional ideas for presenting the literature to children. Two participants were surprised to find that they enjoyed a book despite its mathematical content, responding, "Even though the book had math embedded into the story, it was fun." and "Who would've thought a book about shapes could be so moving and carry such a message."

These preservice teachers are discovering what some educators have been promoting for quite some time: literature and mathematics can be mutually supportive, but we do need to be circumspect in selecting *what* books to use and *how* we use them. David Whitin and Sandra Wilde (1992) suggest ways to increase both the literary and the mathematical pleasure derived from reading a book with mathematical content. "Don't

destroy the magic of a story by interrupting it with mathematical questions as you read it aloud. Each book is a unique literary experience and should be enjoyed for its own sake. The first step in any of the explorations we've suggested is an uninterrupted reading with time for spontaneous, unstructured personal response" (p.18). Wilde (1998) further writes, and Schiro (1997) concurs, that specific criteria are needed when selecting children's literature with mathematical content. Readers need opportunities to be aware of the "natural wonder and excitement of mathematics" because there is more "potential for dryness and boredom than with many other topics" (Wilde, 1998, p.133).

There were two types of tendencies in the responses. If a participant's mathematical response percentage was higher than average for the group, we would expect that person to respond less to the literature, but similarly to the integrated elements of the books compared to the average response. Contrarily, if a participant's literary response percentage was higher than average for the group, we would expect that person to respond much less to both the mathematical and the integrated qualities of the literature (see Table V). It seems that two types of readers emerged: one was the literary reader, while the other was the mathematical/integrated reader. These types of readers do not have to remain fixed and are likely to change with different genres, subjects, and texts. In fact, it could be argued that because the mathematics included in the three works of literature was not of a sophisticated nature, the responses were skewed. A study of responses with literature with varying levels of geometry could demonstrate whether

there is a relationship between more difficult geometric concepts and the mathematical and literary content of responses.

Teachers' knowledge is not stagnant; it is, instead, "tentative, that is, subject to change and transient" (Fisher, Fox, & Paille, 1996, p.415). Fisher, et al. promote continued research on teacher thinking because it provides a better-developed understanding of teaching as a profession. This study illustrates the idea that examinations of preservice teachers' thinking about literature with subject area content are valuable, as is continued research with inservice teachers.

"Teachers' beliefs about teaching may shape the particular manner in which the content is ultimately presented" (Nespor, 1987, p.161). Preservice teacher beliefs about literature and content area study are already at work as they participate in field experiences with children in schools and on the university campus. The following response to *The Greedy Triangle* by one of the participants demonstrates that this particular prospective teacher may present mathematical learning within the context of literature in a very favorable light: "Connecting my students' own struggles to find themselves in the world with geometry shows how math is the language of our universe. Imagine the possibilities."

Aesthetic versus Efferent Responses: Did preservice teachers respond in writing more aesthetically or efferently to children's literature with geometric content?

Stance is considered to be important to reader response theorists. Spiegel (1998) places it as central to a balanced literacy approach. She presents as evidence a 1992 study

by Many and Wiseman that found that third graders who participated in a program that focused on literary elements of text responded from an efferent stance and those that participated in a program whose focus was the lived-through experience of reading responded from a more aesthetic stance. There were more efferent responses to the children's literature in this study than aesthetic responses (see Table III). However, in the case of *A Cloak for the Dreamer*, the stances were roughly equivalent. It may be that the implicit nature of the mathematics in this book increased the possibility for participants to respond aesthetically. Conversely, the explicit nature of the mathematics in *The Greedy Triangle* and *Grandfather Tang's Story* may have increased the possibility for participants to respond efferently. This raises the question of the relationship between participants' stance and content of response. An aesthetic stance was found to be correlated with literary content, and an efferent stance was found to be correlated with mathematical content as well as with integrated content. However, even though these stances and content areas were found to be related, the correlations are moderate, so it does not automatically follow that they are measuring identical traits. Participants seemed to respond both aesthetically and efferently to the literary qualities of the literature, but only efferently to the mathematical qualities. Further analysis is warranted to determine the strength of the relationship between stances of responses and the content area responses.

More research efforts have been directed toward the *stance* of literature response in general than to the *content* of the responses when the literature includes subject area

information. In fact, the stance of response to content area literature has been examined by researchers. The value of responding aesthetically to content area texts has been noted by Frager (1993) and Spink (1997). Frager (1993) suggests before, during, and after reading strategies that include students responding to the affective dimensions of content area texts. Spink (1997), a fourth grade teacher, writes of his initial introduction to reading content area texts when he moved from teaching a primary grade to an intermediate one. He "assumed that we would be reading stories for fun and reading information books to learn" (p.281). Instead, he found that reader response theory applies to nonfiction as well as fiction and that his students not only enjoyed reading more, but also learned and retained more information. A participant in this study responded aesthetically to the information provided in *The Greedy Triangle*, writing, "I picked up on just how the Shapeshifter kept giving the triangle more and more sides even though he knew that it would eventually go back to being a triangle."

Karolides (1997) claims it is "possible to read information-oriented texts with an aesthetic or partially aesthetic stance; the details of a battle or a baseball game in the newspaper or a textbook's account of the environmental crisis or the development of a litter of kittens may call forth emotions from the wellsprings of memory" (p.14). A study participant reflected that claim, responding to *Grandfather Tang's Story* by writing, "I was amazed at how the tangrams could be changed into so many different animals."

Only two of the eighty-five participants responded from only one stance to an individual book. The remainder of the responses to the books was a mix of efferent and

aesthetic response statements. This substantiates Karolides's (1997) claim that, "A dualistic view of stance is inappropriate. Potentially, there are readings at either extreme end of the aesthetic-efferent continuum...the degree of blending that occurs is variable from reader to reader, situation to situation, and is changeable over time. At the theoretical middle of the stance continuum, the reader would be applying an equal measure of the expectations, attitudes, and reading behaviors of the two stances" (p.14). Rosenblatt (1978) concurs that both stances are appropriate, but favors an aesthetic response to literature. Despite indications that this group of readers responded equivalently to the efferent and aesthetic qualities of literature, preservice teachers' scores on the Literary Response Questionnaire portray a group who value reading as a pleasurable activity and choose to read as an escape from everyday responsibilities. The scores also indicate that they value careful reading and instructional presentations of literary texts. They view reading literature as optional, but very relevant. A participant responded to *The Greedy Triangle* in a manner that illustrates the possibility for literature to get at the very core of a person, writing, "I don't know why today of all days a message that strong would come from such a random place."

Conclusions

Underpinning this study is the use of works of children's literature to enhance the learning of mathematics. It may be that authors and publishers of literary works with mathematical content for children would be advised to consider not only the

marketability of particular books, but also to evaluate the literary and mathematical merits of them. Schiro's (1997) evaluation instrument could serve as a model for those involved in the publication and promotion of children's literature with mathematical content.

Research such as this descriptive study can begin to paint a picture of preservice teachers' responses to literature, but the picture may never be completely drawn. "It may also be that the essential nature of the importance of literature in literacy learning cannot be measured fully" (Galda & Cullinan, 1994, p.533). Regardless of the outcome of research, it is imperative that teachers make available quality fiction and informational literature for their students. The criteria for good children's literature varies, but Bishop (1992) suggests that it should be "...well written, tell a good story, have strong characterization, and offer a worthwhile theme or themes children could be expected to understand" (p.49). All literature shared in the classroom should be expected to meet these criteria. A richer, more meaningful literary experience can be gained when good literature with a variety of content is read, written about, and discussed. Lukens (1982) writes "literature at its best gives both pleasure and understanding" (p.178). She suggests that the process of exploring a work of literature gives the reader an opportunity to consider the human condition on his/her own terms in cooperation with an author.

One participant in this study obviously found both pleasure and understanding from *Grandfather Tang's Story*, writing, "First, on a lesser, surface level, it reminds me of Calvin and Hobbes and the transmogrifier. Deeper than that, however, I enjoy this

book for its ability to carry on, in a sense, an old tradition of storytelling in a modern world." The power of narrative was demonstrated in the written responses in this study. This seems to be a good sign, as many researchers have found a strong relationship between teachers' personal approaches to literature and their teaching of it. Unless teachers themselves are engaged readers, it will be impossible for them to model engaged reading for their students. It also follows that unless teachers are personally engaged in mathematics, the modeling process cannot take place.

The preservice teachers' written responses to literature show that they do seem to love a good story, but that passion is tucked slightly behind their concern about their future roles as teachers. The participants seemed to separate their own reading from the reading they will do with their future students. It is perfectly understandable for preservice teachers in a methods course to be concentrating on their futures. However, it is worrisome in some ways. Because many of the preservice teachers in this study don't read with their own pleasure foremost, they are robbing themselves of a valuable experience if they don't allow themselves to experience art first-hand.

The tendency of the participants to read for the implied child reader, making assumptions about individual children they have never even met, is very troubling. It seemed at times that the future teachers couldn't stop themselves from reading to find out what would be a "good" story that includes moral concepts their future students "need" to be taught. This seems to be a particularly dangerous way to respond to literature. Hade (1993) differentiates reading a work of literature from reading a moral tract. It seems this

group of preservice teachers felt it was their responsibility to make the meaning clear to their students, assuming that their students would not be able to think through issues for themselves.

Before conducting the study, the researcher thought that aesthetic responses would be literary and efferent responses would be mathematical. This did not turn out to be the case, even though there is a high correlation. Participants responded to literature both aesthetically and efferently, but were unable to find aesthetic features of the mathematical content of the works of literature. It seems that very few of the preservice teachers were aware of the natural wonder and excitement of mathematics (Wilde, 1998). It seems apparent that the influence of the teacher cannot be overstated in literature study, but this is also true to mathematics. Our beliefs about math will shape the way we present it to our students.

The influence of the elementary teacher must be juxtaposed against the influence of the university professor of teacher education. It has been almost fifteen years since Andrews, Moss, & Stansell (1985) wrote about the value of reading aloud to preservice teachers in methods courses, but it may be that reading aloud is not enough. Are teacher educators sufficient models of personal engagement in literature and mathematics? Are we setting expectations high enough for our preservice teachers? Do we really expect them to not only know the math and the literature, but also to know how to relate to it personally, then go on to teach it to their future students? Are we helping them discover the total engagement that is possible when one takes responsibility for finding personally

meaningful experiences in mathematics, literature, and in their work with children? In other words, can we take literature and mathematics from the level of *ought* to the level of *caught*?

Many university students seeking to become teachers do so because they love children. This researcher and others believe that is not enough. Jill May wrote *Children's Literature and Critical Theory* (1995) with the primary purpose of forcing readers to consider themselves as role models, censors, and conveyors of attitude. As she writes in that volume:

> "Rarely does a student say that she has entered the field of elementary education because she wants to help children learn new ways of thinking or consider new concepts that will help them as adults...because they have never developed reading habits, have never allowed themselves time to reflect on ideas, and have never explored divergent points of view, they lack a philosophy about the role of lifelong learners and they consider children's literature a teaching tool to use in skills units" (1995, p.5).

While this appears to be somewhat harsh, it is important to note that reading literature with children should be raised to a much more sophisticated level than has been the case; respect for the literature is paramount, but more crucial is respect for the children who will be our students.

We, as educators, must carefully examine not only *what* literature we present to children and *how* we utilize it, but also thoughtfully challenge ourselves to be readers ourselves so that we can help children to be the same. Rosenblatt (1995) considers reading well, transactionally, with the ability of individuals to create and maintain a democracy. She puts the reader, the text, and the author in a kind of three ring circus,

with the spotlight being shared by all three. Rosenblatt takes issue with the teacher being the arbiter of literary knowledge, the only one who really knows what the author or text means. Instead, the reader is responsible for transacting with the text to create the meaning as well as to defend that meaning. Reading and perhaps doing mathematics transactionally is much more demanding for students and teachers than a top-down model of teaching and learning. Louise Rosenblatt's writing has been a driving influence in this researcher's explorations with literature and provides an concluding caution and challenge:

> I am not under the illusion that the schools alone can change society. However, I can reaffirm the belief uttered so many years ago: We teachers of language and literature have a crucial role to play as educators and citizens. We phrase our goals as fostering the growth of the capacity for personally meaningful, self-critical literary experience. The educational process that achieves this aim most effectively will serve a broader purpose, the nurturing of men and women capable of building a fully democratic society. The prospect is invigorating! (1990, p. 107)

Recommendations

The purpose of this study was to describe preservice teachers' responses to children's literature with geometric content and to explore a relationship between the stance and content of these responses with geometric understanding and orientation toward literature. The limitations of this study should be noted if additional studies with similar purposes are undertaken. This study was limited to eighty-five preservice

teachers in one university setting who were homogenous in some ways. In addition, this study described the quantitative analysis of written responses to literature and attempted to quantify these responses. It may be beneficial for future researchers to focus in depth on one particular area. Possibilities for more narrowly focused research include studies of responses to literature with content from other disciplines, such as science and social studies, case studies with fewer participants in a variety of settings, and studies that consider the responses of newer and more experienced teachers. In particular, a descriptive study of how elementary children's responses to literature compare to their teachers' responses would be fascinating. These suggestions all include responses to literature because this does seem to be an under-explored area. Each of these studies would provide educators with some of the underlying assumptions of an important issue, that of how children's literature can be effectively and respectfully used, without being abused, to teach various curriculum areas.

There remains much to be discovered about the relationships among preservice teachers' responses to literature and their future classroom practice. Future research could seek to describe children's, teachers', and preservice teachers' responses to children's literature with a variety of contents (i.e. social studies, science, etc.), as well as could seek to find other factors that are related to the stance and content of those responses. More focused, in-depth studies of small groups of readers could also be conducted, in a case-study approach similar to that of Handloff and Golden's (1995) work with a fifth grader's reading response journal. It would be interesting to compare

and contrast the responses to literature from the different stakeholders in the literature classroom: the students, the teachers, and the parents.

The data collected for this study could be used to conduct a qualitative analysis of the responses on the Literature/Geometry survey as well as an analysis of the responses using a different coding system. Sebesta, Monson, & Senn (1995) have developed a hierarchy to assess reader response that would provide a different way to consider the responses gathered in this study. Their taxonomy includes at the bottom level, an efferent response, and four stages of response that represent continually more sophisticated transactions with literature. As a participant of this study wrote, imagine the possibilities!

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APPENDIXES

APPENDIX A-VAN HIELE TEST OF GEOMETRIC THOUGHT

VAN HIELE GEOMETRY TEST

This test is based on the work of P.M. van Hiele.
(University of Chicago Copyright 1980)

DIRECTIONS:

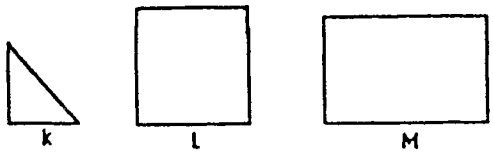
Read each question carefully. Decide on the answer you think is correct and write that answer on the appropriate place on your answer sheet. There is only one correct answer to each question.

Use the blank paper provided for any notes. Please do not write on this test.

You will have 35 minutes to complete this test. It is not expected that you will know the correct answer for all 25 questions.

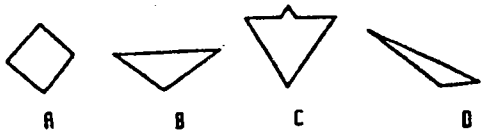
1. Which of these are squares?

a. K only
b. L only
c. M only
d. L and M only
e. All are squares



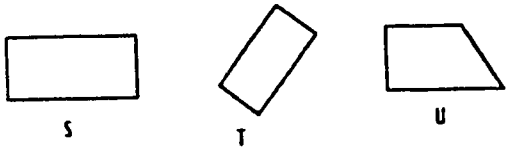
2. Which of these are triangles?

a. None are triangles
b. C only
c. B only
d. B and D only
e. B and C only



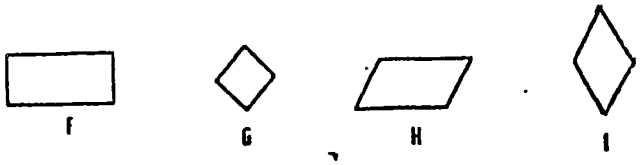
3. Which of these are rectangles?

a. S only
b. T only
c. S and T only
d. S and U only
e. All are rectangles



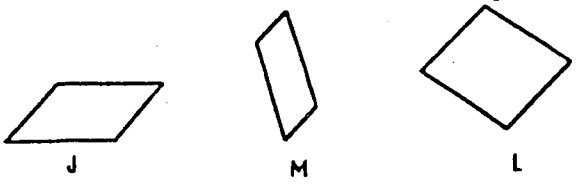
4. Which of these are squares?

a. None are squares
b. G only
c. F and G only
d. G and I only
e. All are squares



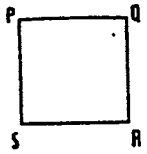
5. Which of these are parallelograms?

a. J only
b. L only
c. J and M only
d. None are parallelograms
e. All are parallelograms



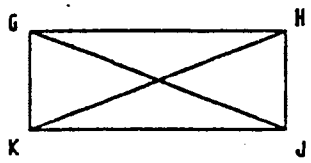
6. **PQRS is a square. Which relationship is true in all squares?**

a. PR and RS have the same length.
b. QS and PR are perpendicular.
c. PS and QR are perpendicular.
d. PS and QS have the same length.
e. Angle Q is larger than angle R.

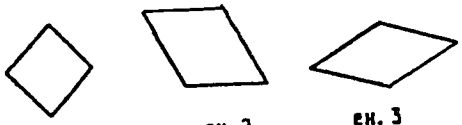


7. **In a rectangle GHJK, $\overline{GJ}$ and $\overline{HK}$ are the diagonals. Which of the following (a-d) is not true in every rectangle?**

a. There are four right angles.
b. There are four sides.
c. The diagonals have the same length.
d. The opposite sides have the same length.
e. All of the above are true for every rectangle.



8. **A rhombus is a 4-sided figure with all four sides the same length. Here are three examples:**

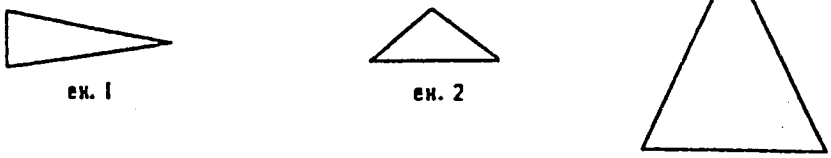


EX. 1 EX. 2 EX. 3

Which of the following (a-d) is not true for every rhombus?

a. The two diagonals have the same length.
b. Each diagonal bisects two angles of the rhombus.
c. The two diagonals are perpendicular.
d. The opposite angles have the same measure.
e. All of the above are true for every rhombus.

9. **An isosceles triangle is a triangle with two sides of equal length. Here are three examples:**

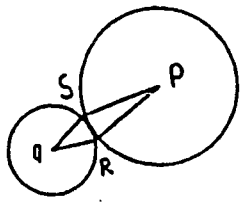


EX. 1 EX. 2 EX. 3

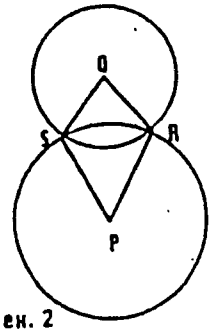
Which of the following (a-d) is true in every isosceles triangle?

a. The three sides must have the same length.
b. One side must have twice the length of another side.
c. There must be at least two angles with the same measure.
d. Three angles must have the same measure.
e. None of the above is true in every isosceles triangle.

10. Two circles with centers P and Q intersect at R and S to form a 4-sided figure PQRS. Here are two examples:



EX. 1



EX. 2

Which of the following (a-d) is not always true?

a. PQRS will have two pairs of sides of equal length.
b. PQRS will have at least two angles of equal measure.
c. The lines PQ and RS will be perpendicular.
d. Angles P and Q will have the same measure.
e. All of the above are true.

11. Here are two statements.
Statement 1: Figure F is a rectangle.
Statement 2: Figure F is a triangle.
Which is correct?

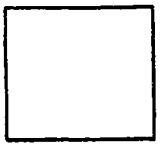
a. If 1 is true, then 2 is true.
b. If 1 is false, then 2 is true.
c. 1 and 2 cannot both be true.
d. 1 and 2 cannot both be false.
e. None of a-d is correct.

12. Here are two statements:
Statement S: Triangle ABC has three sides of the same length.
Statement T: In triangle ABC, angle B and angle C have the same measure.
Which is correct?

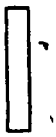
a. Statements S and T cannot both be true.
b. If S is true, then T is true.
c. If T is true, then S is true.
d. If S is false, then T is false.
e. None of a-d is correct.

13. Which of these can be called a rectangle?

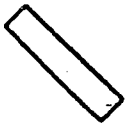
a. All can be called rectangles.
b. Q only
c. R only
d. P and Q only
e. Q and R only



P



Q



R

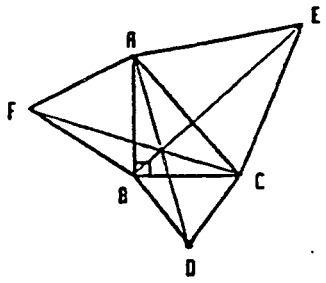
14. Which is true?

a. All properties of rectangles are properties of all squares.
b. All properties of squares are properties of all rectangles.
c. All properties of rectangles are properties of all parallelograms.
d. All properties of squares are properties of all parallelograms.
e. Non of a-d is true.

15. What do all rectangles have that some parallelograms do not have?

a. Opposite sides equal
b. Diagonals equal
c. Opposite sides parallel
d. Opposite angles equal
e. None of a-d

16. Here is a right triangle ABC. Equilateral triangles ACE, ABF, and BCD have been constructed on the sides of ABC.



From this information, one can prove that $\overline{AD}$, $\overline{BE}$ and $\overline{CF}$ have a point in common. What would this proof tell you?

a. Only in this triangle drawn can we be sure that $\overline{AD}$, $\overline{BE}$, and $\overline{CF}$ have a point in common.
b. In some but not all right triangles, $\overline{AD}$, $\overline{BE}$, and $\overline{CF}$ have a point in common.
c. In any right triangle, $\overline{AD}$, $\overline{BE}$, and $\overline{CF}$ have a point in common.
d. In any triangle, $\overline{AD}$, $\overline{BE}$, and $\overline{CF}$ have a point in common.
e. In any equilateral triangle, $\overline{AD}$, $\overline{BE}$, and $\overline{CF}$ have a point in common.

17. Here are three properties of a figure.

Property D: It has diagonals of equal length.
Property S: It is a square.
Property R: It is a rectangle.
Which is true?

a. D implies S which implies R
b. D implies R which implies S
c. S implies R which implies D
d. R implies D which implies S
e. R implies S which implies D

18. Here are two statements:

(1) If a figure is a rectangle, then its diagonals bisect each other.
(2) If the diagonals of a figure bisect each other, the figure is a rectangle.
Which is correct?

a. To prove 1 is true, it is enough to prove that 2 is true.
b. To prove 2 is true, it is enough to prove that 1 is true.
c. To prove 2 is true, it is enough to find one rectangle whose diagonals bisect each other.
d. To prove 2 is false, it is enough to find one non-rectangle whose diagonals bisect each other.
e. None of a-d is correct.

19. In geometry:

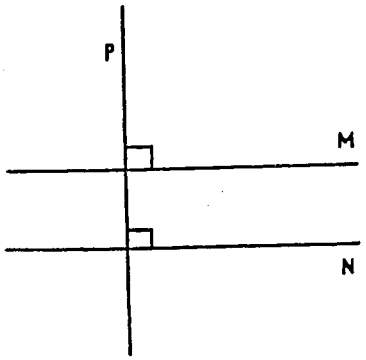
a. Every term can be defined and every true statement can be proved true.
b. Every term can be defined but it is necessary to assume that certain statements are true.
c. Some terms must be left undefined but every true statement can be proved true.
d. Some terms must be left undefined and it is necessary to have some statements which are assumed true.
e. None of the above a-d is correct.

20. Examine these three sentences:

(1) Two lines perpendicular to the same line are parallel.
(2) A line that is perpendicular to one of two parallel lines is perpendicular to the other.
(3) If two lines are equidistant, then they are parallel.

In the figure below, it is given that lines M and P are perpendicular and lines N and P are perpendicular. Which of the above sentences could be the reason that line M is parallel to line N?

a. (1) only
b. (2) only
c. (3) only
d. Either (1) or (2)
e. Either (2) or (3)



21. In F Geometry, one that is different from the one you are used to, there are exactly four points and six lines. Every line contains exactly two points. If the points are P, Q, R, and S, the lines are (P,Q), (P,R), (P,S), (Q,R), (Q,S), and (R,S).

Here are how the words "intersect" and "parallel" are used in F Geometry:
The lines (P,Q) and (P,R) intersect at P because (P,Q) and (P,R) have P in common.
The lines (P,Q) and (R,S) are parallel because they have no points in common.
From this information, which is correct:

a. (P,R) and (Q,S) intersect.
b. (P,R) and (Q,S) are parallel.
c. (Q,R) and (R,S) are parallel.
d. (P,S) and (Q,R) intersect.
e. None of a-d is correct.

22. To trisect an angle means to divide in into three parts of equal measure. In 1847, P.I. Wantzel proved that, in general, it is impossible to trisect angles using only a compass and an unmarked ruler. From his proof, what can you conclude?

a. In general, it is impossible to bisect angles using only a compass and an unmarked ruler.
b. In general, it is impossible to trisect angles using only a compass and a marked ruler.
c. In general, it is impossible to trisect angles using any drawing instruments.
d. It is still possible that in the future someone may find a general way to trisect angles using only a compass and an unmarked ruler.
e. No one will ever be able to find a general method for trisecting angles using only a compass and an unmarked ruler.

23. There is a geometry invented by a mathematician J in which the following is true:

The sum of the measures of the angles of a triangle is less than 180.
Which is correct?

a. J made a mistake in measuring the angles of the triangle.
b. J made a mistake in logical reasoning.
c. J has a wrong idea of what is meant by "true."
d. J started with different assumptions than those in the usual geometry.
e. None of a-d is correct.

24. Two geometry books define the word "rectangle" in different ways. Which is true?

a. One of the books has an error.
b. One of the definitions is wrong.
c. The rectangles in one of the books must have different properties as those in the other book.
d. The rectangles in one of the books must have the same properties as those in the other book.
e. The properties of rectangles in the two books might be different.

25. Suppose you have proved statements (1) and (2).

(1) If p, then q.
(2) If s, then not q.
Which statement follows from statements (1) and (2)?

a. If p, then s.
b. If not p, then not q.
c. If p or q, then s.
d. If s, then not p.
e. If not s, then p.

APPENDIX B-LITERARY RESPONSE QUESTIONNAIRE

Literary Response Questionnaire

Developed by David S. Miall and Don Kuiken, University of Alberta

Please indicate the extent to which the following items are true for you. Use the answer sheet to circle from 1 (not at all true) to 5 (extremely true).

1. Reading literature makes me sensitive to aspects of my life that I usually ignore.
2. In literature I sometimes recognize feelings that I have overlooked during my daily life.
3. I often find my shortcomings explored through characters in literary texts.
4. I find that literature helps me to understand the lives of people that differ from myself.
5. Reading literature often gives me insights into the nature of people and events in my world.
6. I often see similarities between events in literature and events in my own life.
7. I often find my own motives being explored through characters in literary texts.
8. I find that certain literary works help me to understand my more negative feelings.
9. Literature enables you to understand people that you'd probably disregard in normal life.
10. I sometimes find that reading a literary text makes me feel like changing the way I live.
11. In my reading, I learn to recognize more readily certain types of people or events, i.e., I can see these types more clearly after reading about a particular example in a literary text.
12. When I begin to understand a literary text, it's because I've been able to relate it to my own concerns about life.
13. Literature often gives special emphasis to those things that make a moral point.
14. Sometimes while reading literature my feelings draw me toward a distinctly unsettling view of life.
15. Sometimes I feel like I've almost "become" a character I've read about in fiction.
16. I sometimes have imaginary dialogues with people in fiction.
17. When I read fiction I often think about myself as one of the people in the story.
18. I sometimes wonder whether I have really experienced something or whether I have read it in a book.
19. I actively try to project myself into the role of fictional characters, almost as if

I were preparing to act in a play.
20. Sometimes characters in novels almost become like real people in my life.
21. After reading a novel or story that I enjoyed, I continue to wonder about the characters almost as though they were real people.
22. I often see the places in stories I read as clearly as if I were looking at a picture.
23. I can readily visualize the persons and places described in a novel or short story.
24. I sometimes think I could draw a map of the places I have read about in a work of fiction.
25. Sometimes a scene from a story or poem is so clear that I know its smell, its touch, its "feel."
26. I often hear dialogue in a novel as though I were listening to an actual conversation.
27. When I read a literary text, a scene that is only partly described often becomes a whole, vividly present place in my mind.
28. When reading a story, sometimes I can almost feel what it would be like to be there.
29. I usually hear the tone of speech in a dialogue from a story or novel.
30. Often when I read literary texts, descriptions of smells suggest colors, descriptions of colors suggest feelings, and so on.
31. Sometimes I like to curl up with a good book just to enjoy myself.
32. When I have spare time my favorite activity is reading a novel.
33. Very often I cannot put down a story until I have finished reading.
34. Reading literature is a pleasurable way to spend time when I have nothing else to do.
35. Reading a story is a wonderful way to relax.
36. While reading I completely forget what time it is.
37. I find that reading literature is a great help in taking my mind off my own problems.
38. I like to become so absorbed in the world of the literary text that I forget my everyday concerns.
39. Once I've discovered one work by an author I like, I usually try to read all the other works by that author.
40. I am often so involved in what I am reading that I am no longer aware of myself.
41. I often wish I had more time for reading literature.
42. One of my primary interests in reading literature is to learn about the themes and concerns of a given author.
43. In reading I like to focus on what is distinctive about the author's style.
44. One of my primary interests in reading is to learn about the different genres of literature.
45. I like to see how a particular author's work relates to other literature of the

author's period.

46. When reading I usually try to identify an author's distinctive themes.
47. One of my primary interests in reading literature is to appreciate the author's understanding of society and culture.
48. I think literature is especially interesting when it illuminates facts about the author's life.
49. When I find a work of literature I like, I usually try to find out something about the author.
50. The challenge of literature is to comprehend the author's unique view of life.
51. I am often intrigued by an author's literary technique.
52. I like to see tension building up in the plot of a story.
53. The type of literature I like best tells an interesting story.
54. I think the most important part of fiction or drama is plot.
55. When reading a novel, what I most want to know is how they story turns out.
56. I like it best when a story has an unexpected ending.
57. I prefer to read fiction in which there is plenty of action.
58. When reading a novel my main interest is seeing what happens to the characters.
59. I find it difficult to read a novel in which nothing much seems to happen.
60. I think people should spend less time talking or writing about literature.
61. Even if literature were well taught, I think high schools should not devote so much time to it.
62. For me a work of literature is destroyed by trying to analyze it.
63. One of the things I dislike most about being a student of literature is the teachers who tells you what a literary text means.
64. Reading literary texts from past centuries should be left to literary scholars and historians.
65. I don't believe that literature is socially relevant.
66. I disliked English in high school because most of the texts I was asked to read I would not have chosen myself.
67. Works of literature often seem to make the issues of life more complicated than they actually are.
68. If I want to spend time reading, I don't choose "literary" texts.

APPENDIX C-LITERATURE/GEOMETRY SURVEY

Literature/Geometry Survey

Participant's Code Number: _____

1. Age: _____ 2. Sex: __Male __Female

3. Rank or Year in College: __ Sophomore __Junior __Senior __Other

4. Ethnicity: __ African American __ Caucasian __ Latino/a
__ Native American __ Other

5. Major:_____

6. Endorsements:_____

7. I (have taken / have not taken / am currently taking) a course in children's literature. (Please circle one.)

8. I (have taken / have not taken / am currently taking) language arts methods. (Please circle one.)

9. I consider myself:
__Poor in Math __Average in Math __Excellent in Math

10. I consider myself:
__Poor in Reading __Average in Reading __Excellent in Reading

11. I consider my knowledge about children's literature to be:
__Poor __Average __Excellent

12. When I think of children's literature in the elementary classroom, I think of:

13. When I think of geometry in the elementary classroom, I think of:

14. What is your understanding of the difference between reading for information and reading for aesthetic purposes?

15. What do you know about using children's literature to teach subject areas in elementary classrooms?

16. What do you believe are the **advantages** of using children's literature to teach geometry or other subject areas?

17. What do you believe are the **disadvantages** of using children's literature to teach geometry or other subject areas?

APPENDIX D—CHILDREN'S MATHEMATICAL TRADE BOOKS: EVALUATION FORM

CHILDREN'S MATHEMATICS TRADE BOOKS: EVALUATION FORM

by MICHAEL SCHIRO

Reviewer:_____ Date:_____

Book name: Author:	Publisher & Date:
Short description of plot or theme:	
Mathematics content presented:	Target Audience (circle all appropriate): preschool K 1 2 3 4 5 6 7 8 9

Answer the following, based on responses on the subsequent pages of this instrument.

How good is the book, from a mathematical perspective?	5 4 3 2 1 superb average worthless
How good is the book, from a literary perspective?	5 4 3 2 1 superb average worthless

What are the book's best mathematical features?
What are the book's worst mathematical features?
What are the book's best literary features?
What are the book's worst literary features?

Based on your responses above, rate the book:

How good is the book?	5 4 3 2 1 superb average worthless

GENERAL COMMENTS:

Mathematical Standards

Is the book's mathematics correct and accurate?	5 correct	4	3 inaccurate	2	1 incorrect
Comments:					

Is the book's mathematics effectively presented?	5 effectively	4	3 average	2	1 poorly
Comments:					

Is the book's mathematics worthy of being learned?	5 worth learning	4	3 questionable value	2	1 not worth learning
Comments:					

How visible to the reader is the book's mathematics?	5 optimally	4	3 partially	2	1 not visible
Comments:					

Does the book present an appropriate view of mathematics?	5 optimally appropriate	4	3 partially appropriate	2	1 not appropriate
Comments:					

Is the book's mathematics intellectually and developmentally appropriate for its audience?	5 optimally	4	3 partially	2	1 unsuited
Comments:					

How involved does the reader get with the book's mathematics?	5 very	4	3 average	2	1 minimally
Comments:					

Does the book provide the information needed to do its mathematics?	5 fully	4	3 partially	2	1 insufficient	☐ N/A
Comments:						

Do the book's story and mathematics complement each other?	5 complement	4	3 no effect	2	1 detract
Comments:					

Does the book facilitate readers' use, application, transfer, and generalization of its mathematics?	5 help	4	3 neutral	2	1 inhibit
Comments:					

How great are the resources needed to help readers benefit from the book's mathematics?	5 minimal	4	3 average	2	1 excessive	☐ N/A
Comments:						

Literary Standards

Plot: **Is the book's plot or story well developed and imaginative, flowing logically, believably, and sensibly from one idea to the next?***	5 4 3 2 1 ☐ excellent poor N/A
Comments:	

Characterization: **Are the book's characters well portrayed and believable?***	5 4 3 2 1 ☐ excellent poor N/A
Comments:	

Style: **Does the book contain a vivid and interesting writing style that actively involves the child?**	5 4 3 2 1 excellent poor
Comments:	

Language: **Does the book use correct grammar and punctuation and age-appropriate language and style?**	5 4 3 2 1 excellent poor
Comments:	

Readability: **Is the book's knowledge content and readability appropriate to the age of the reader ?**	5 4 3 2 1 excellent poor
Comments:	

Interest: Is the book's interest level relevant and developmentally age-appropriate to the reader?	5 4 3 2 1 excellent poor
Comments:	

Enrichment: Does the book enrich the child by enhancing or increasing the child's developmental level?	5 4 3 2 1 excellent poor
Comments:	

Graphics: Are the book's illustrations, pictures, or graphics well chosen, appealing, text-relevant, and representative of a child's view of the world?	5 4 3 2 1 excellent poor
Comments:	

Unity: Do the book's plot, content, and/or graphics convey the same stylistic message?	5 4 3 2 1 excellent poor
Comments:	

Respect: Does the book's tone respect the reader, do characters provide positive role models who are culturally diverse and free from stereotype?	5 4 3 2 1 excellent poor
Comments:	

Physical Traits: Is the book visually appealing, well organized, durable, and laid out to produce easy comprehension?	5 4 3 2 1 excellent poor
Comments:	

APPENDIX E-GUIDE FOR RATING EFFERENT AND AESTHETIC RESPONSES

Guide for Rating Efferent and Aesthetic Responses
for
A DESCRIPTIVE STUDY OF FACTORS RELATED TO PRESERVICE TEACHERS' WRITTEN RESPONSES TO CHILDREN'S LITERATURE WITH GEOMETRIC CONTENT

Elizabeth Willner
Dissertation Research, Oklahoma State University
Spring 1999

Research Questions

This study seeks to find answers to the following questions:

What themes will emerge from preservice teachers' written responses to children's literature with a geometric theme?

Do preservice teachers respond in writing more to the literary, mathematical, or integrated content of children's literature with geometric content?

Do preservice teachers respond in writing more to the aesthetic or the efferent qualities of children's literature with geometric content?

In what ways are preservice teachers' levels of geometric thought related to their written responses to literature with geometric content?

In what ways are preservice teachers' performances on a measure of their orientation toward literary texts related to their written responses to literature with geometric content?

Because this study considers preservice teachers' responses to children's literature with geometric content, the written responses will be evaluated based on their stance. Written response statements will have already been assigned. For each response statement, each of three raters will be asked to ascertain whether the writer is responding to the efferent or aesthetic qualities of the book. Using the following definitions, please label the responses as being "efferent" or "aesthetic."

Efferent stance refers to the predominant focus of the reader to respond to the information to be taken away from the text. An example is discussing how one would use the mathematical content of the book to teach concepts to students.

Aesthetic stance refers to the predominant focus of the reader to respond to the personal aspects of a text, focusing attention on the lived-through experience of the reading. An example would be relating and identifying with the emotions of a main character in the book.

The following steps will be taken to rate the responses to the literature:

1. The researcher will divide all written responses into units called "response

statements." As written in the dissertation, a response statement refers to a single segment of the response log that represents a complete thought of the writer.

2. Copies will be made and distributed to each of the raters. After being shown examples and being trained by the researcher (using responses to literature from a pilot study), they will be asked to label each response statement in the left column with an "E" for efferent or an "A" for aesthetic.

3. At the top of each student's response, raters will write the total number of "E" responses and total number of "A" responses, then will record these on the spread sheet provided.

4. The researcher will then total all of these ratings, noting where ratings are different. The three raters will then meet to attempt to come to consensus on any discrepancies. If there is a case in which no consensus can be reached, the researcher will make the decision as to the outcome of that response statement.

APPENDIX F-IRB APPROVAL FORM

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD

DATE: 12-21-98 **IRB #: ED-99-067**

Proposal Title: A DESCRIPTIVE STUDY OF FACTORS RELATED TO PRESERVICE TEACHERS' WRITTEN RESPONSES TO CHILDREN'S LITERATURE WITH A GEOMETRIC THEME

Principal Investigator(s): Kouider Mokhtari, Elizabeth Willner

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

Signature: Carol Olson (SC) Date: December 21, 1998

Carol Olson, Director of University Research Compliance
cc: Elizabeth Willner

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modification to the research project approved by the IRB must be submitted for approval. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

APPENDIX G-STATEMENT MADE BY RESEARCHER TO PROSPECTIVE PARTICIPANTS

Statement Made by Researcher to

Prospective Participants

You are invited to take part in a research study that could influence how the education community views the use of children's literature for content area study with elementary and middle level students. This study is funded in part by a National Science Foundation Grant titled, "Rich Problem Solving Contexts: Integrating Mathematics and Reading Curricula for Preservice Elementary Teachers."

If you choose to participate in this study, I will visit your class to ask you to take the van Hiele Geometric Thought test, the Literary Response Questionnaire, and to respond to an informational survey. These tests and/or surveys will not count as a part of your grade for the course, but will serve as part of the information for this study. You will be given the results of your tests, but only a code number will identify you, so you can be assured of confidentiality.

If you choose to participate in this study, I will also visit your class to ask you to listen to children's books being read, then respond in writing to the books. Again, you will have the same code number, so your name will not be used. The activities described above will be a normal part of your course this semester, but they will not be completed for course credit. They can be an integral part of your learning in this class.

Do you have any questions to ask about this study?

APPENDIX H-EXPLANATION OF VAN HIELE LEVELS PROVIDED TO PARTICIPANTS

Student's Code Number _____

INTERPRETATION OF THE LEVELS OF GEOMETRIC THOUGHT
From Joanne Mayberry, Georgia College

BASIC LEVEL: At this level, figures are recognized by appearance alone. A figure is perceived as a whole, recognizable by its visible form, but properties of a figure are not perceived. At this level, a student should recognize and name figures and distinguish a given figure from others that look somewhat the same.

LEVEL I: Here, properties are perceived, but they are isolated and unrelated. Since each property is seen separately, no relationship between properties is noticed and relationships between different figures are not perceived. A student at this level should recognize and name properties of geometric figures.

LEVEL II: At this level, definitions are meaningful, with relationships being perceived between properties and between figures. Logical implications and class inclusions are understood. The role and significance of deduction, however, is not understood.

LEVEL III: At this level, deduction is meaningful. The student can construct proofs, understand the role of axioms and definitions, and know the meaning of necessary and sufficient conditions. A student at this level should be able to supply reasons for steps in a proof.

LEVEL IV: The student at this level understands the formal aspects of deduction. Symbols without referents can be manipulated according to the laws of formal logic. A student at this level should understand the role and necessity of indirect proof and proof by contrapositive. Each level had five questions. The number of correct answers you had for each level are:

Basic _____ Level I _____ Level II _____ Level III _____ Level IV _____

On this particular test, your level was found to be _____. This means that you successfully completed at least 3 of the 5 questions for this level and those levels below this one, but did not correctly answer at least 3 of the questions for the level above.

Remember that this one test does not necessarily label you as being "good" or "bad" in geometry, but it can be an indication of your level of geometric thought. If you have any questions about this test, please contact Liz Willner 225 Willard, 744-7963.

APPENDIX I -EXPLANATION OF LITERARY RESPONSE QUESTIONNAIRE RESULTS PROVIDED TO PARTICIPANTS

Literary Response Questionnaire Results

Your "Code" Number_____

This questionnaire measures seven different aspects of your orientation toward literary texts. While it can't totally define your approach to literature, it can give you a window into your thinking. Following are descriptions of the factors and below that are your highest and lowest areas of literary response.

1. Insight (14 items): This factor reflects an approach to reading in which the literary text guides recognition of previously unrecognized qualities, usually in the reader, but also in the reader's world.

2. Empathy (7 items): This factor indicates projective identification with fictional characters. (In other words, you project yourself into the character and "feel" what the character is feeling.)

3. Imagery Vividness (9 items): This factor expresses imaginary elaboration of a literary world that becomes vividly present not only visually, but also in feeling, sound, and smell.

4. Leisure/Escape (11 items): This factor indicates an approach to reading that emphasizes reading for pleasure and as an enjoyable and absorbing departure from everyday responsibilities.

5. Concern with Author (10 items): This factor reflects interest in the author's distinctive perspective, themes, and style, as well as the author's biographical place in a literary or intellectual tradition.

6. Story-Driven Reading (8 items): This factor reflects an approach where the reader is focused on plot or story-line, with particular emphasis on interesting action and compelling conclusions.

7. Rejecting Literary Values (9 items): This factor represents the rejection of careful reading, of scholarly study, and of instructional presentation of literary texts. Reading literature is regarded as a compulsory and irrelevant task.

Your Highest: _____ Your Lowest: _____

Please do ask me if you would like any more clarification. I am in Room 225 Willard and my phone number is 744-7963. Thanks very much for being a part of my dissertation research! Liz Willner

VITA

Elizabeth Harden Willner

Candidate for the Degree of

Doctor of Education

Dissertation: A DESCRIPTIVE STUDY OF FACTORS RELATED TO PRESERVICE TEACHERS' WRITTEN RESPONSES TO CHILDREN'S LITERATURE WITH GEOMETRIC CONTENT

Major Field: Curriculum and Instruction

Biographical:

Personal Data: Born in Billings, Montana, on July 7, 1957, the daughter of Val J. and Barbara R. Harden. Married to Jonathan Willner since 1987; mother of Corina Harden Willner.

Education: Graduated from Campbell County High School, Gillette, Wyoming in May 1975; earned Bachelor of Arts degree in Business Administration/ Economics from Rocky Mountain College, Billings, Montana in May 1979. Completed teacher certification requirements at the University of Colorado at Colorado Springs in May of 1986. Earned Master of Science degree with a major in Literacy and Children's Literature from Purdue University, West Lafayette, Indiana in August 1994. Completed the requirements for a Doctor of Education degree with a focus on Literacy Education at Oklahoma State University in July 1999.

Experience: Raised in Gillette, Wyoming; employed as food service manager, then as a teacher in Wyoming, Colorado, Indiana, and Illinois; employed by Purdue University as a graduate teaching assistant, then at Oklahoma State University as a graduate teaching and research assistant, 1995 to present.