A review of the literature revealed that there are many variables that influence teachers' instructional practices. These influential variables fall into three categories: those related to the teacher, which are referred to in this study as teacher role characteristics; those related to the inservice education activities of teachers, referred to as staff development variables; and those related to the teachers' individual teaching situations, referred to as school climate variables. It was hypothesized that there may be variables that are related to the use of manipulatives for mathematics instruction by primary grade teachers. Nineteen independent variables in the three categories were studied.

In order to investigate the hypotheses, a population of teachers was located in eight school districts outside of but within a sixty-mile radius of Corvallis, Oregon, and a sample was drawn from those teachers having some specialized training in the use of manipulatives beyond their initial teacher certification college coursework. One hundred eighty teachers were mailed a survey instrument, designed and field-tested by the researcher, whose purpose was to determine amount of manipulatives use. Following the completion of this survey, there were 145 participating teachers who were then sent a questionnaire, designed and field-tested by the researcher, which
Pearson correlations were calculated for the variables based on continuous data and one-way analysis of variance was computed for the variables based on categorical data. Multiple regression analysis was then performed on the three independent variables that were statistically significant at the .05 level.

A teacher's attitude toward the usefulness of manipulatives training, his/her current teaching beliefs (child-centeredness), and perceived attitude of students' parents were all highly correlated with manipulatives use. In the final regression model, each of these three variables made a unique contribution for explaining the variance in teachers' use of manipulatives. Other variables that may also have some relationship to the use of manipulatives included: quality of manipulatives training, follow-up from initial manipulatives training, and perceived response from students.
THE RELATIONSHIP OF TEACHER ROLE CHARACTERISTICS, 
STAFF DEVELOPMENT, AND SCHOOL CLIMATE 
TO THE USE OF MANIPULATIVES 
IN PRIMARY GRADE MATHEMATICS

by

Karen Clark Smith

A THESIS

submitted to

Oregon State University

in partial fulfillment of 
requirements for the 
degree of 

Doctor of Education

Completed May 25, 1990
Commencement June 1991
APPROVED:

Redacted for Privacy

Associate Professor of Elementary Education in charge of major

Redacted for Privacy

Chairman of Department of Curriculum and Instruction

Redacted for Privacy

Dean of the College of Education

Redacted for Privacy

Dean of Graduate School

Date thesis is presented: May 25, 1990

Typing and production work by Mary Anne Brown for Karen Clark Smith
ACKNOWLEDGMENTS

I am indebted to the members of my committee for their many hours of advice, support, and encouragement. They include: Dr. Jerry Girod, Dr. Jake Nice, Dr. Alan Sugawara, Dr. Zoe Ann Holmes, and Dr. Marjorie Reed. A special thanks goes to Dr. Jo Ann Brewer, chair of my committee, whose steadfastness and commitment were beyond all expectation. I am also very appreciative of the statistical expertise provided by Suzi Maresh.

Acknowledgment must be given to those friends, colleagues, and family members who recognized and assisted my efforts to bring this study to completion. I am most grateful for the contributions made by Jan Heaton and Dr. Martin Abbott, who participated in many invaluable ways.

Finally, to my children, Cameron and Emmilia, I express my love and appreciation for their unselfish acceptance that Mom was always "studying." And last, to my husband, Phil, whose love and respect enabled me to do this work, I share and dedicate this project.
# TABLE OF CONTENTS

**Chapter One - Introduction to the Study**
- Purpose of the Study 4
- Hypotheses 4
- Variables 5
  - Teacher Role Variables 5
  - Staff Development Variables 5
  - School Climate Variables 6
- Definition of Terms 6
- Basic Assumptions 7
- Limitations 8

**Chapter Two - Review of the Literature**
- Staff Development 9
  - Types of Staff Development 10
  - Characteristics of Staff Development 11
  - Effective Staff Development 13
  - Evaluation of Staff Development 16
- Teacher Role Characteristics 19
  - Teacher Career Stages 20
  - Adult Development 22
- School Climate 24
  - Political Influences 25
  - The Social Realities of Teaching 26
  - The Process of Change in Schools 30
- Elementary School Mathematics 34
  - Cognitive Learning Theory 34
  - Effective Instruction in Elementary School Mathematics 36
  - Elementary Mathematics Curriculum 38
  - Teaching Mathematics 40
  - Staff Development in Elementary School Mathematics 42
  - Mathematics Manipulatives 45
- Review of the Literature - Conclusion 48

**Chapter Three - Methodology**
- Design 50
  - Teacher Role Variables 50
  - Staff Development Variables 51
  - School Climate Variables 51
- Sample 52
- Sampling and Data Gathering Procedures 53
- Instrumentation and Field Tests 56
- Hypotheses and Analysis 63
<table>
<thead>
<tr>
<th>Chapter Four - Results and Analysis</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results</td>
<td>65</td>
</tr>
<tr>
<td>Dependent Variable</td>
<td>66</td>
</tr>
<tr>
<td>Independent Variables</td>
<td>66</td>
</tr>
<tr>
<td>Descriptive Information</td>
<td>76</td>
</tr>
<tr>
<td>Analysis</td>
<td>82</td>
</tr>
<tr>
<td>Results of Pearson Correlations</td>
<td>82</td>
</tr>
<tr>
<td>Results of Analysis of Variance (ANOVA)</td>
<td>84</td>
</tr>
<tr>
<td>Results of Multiple Regression Analysis</td>
<td>86</td>
</tr>
<tr>
<td>Hypotheses</td>
<td>89</td>
</tr>
<tr>
<td>Summary</td>
<td>91</td>
</tr>
</tbody>
</table>

| Chapter Five - Summary, Discussion and Conclusions, Implications and Recommendations | 92 |
| Summary                                                                       | 92 |
| Discussion and Conclusions                                                     | 93 |
| Teacher Role Characteristics                                                   | 93 |
| Staff Development Variables                                                    | 97 |
| School Climate Variables                                                       | 100 |
| Implications and Recommendations for Further Research                          | 101 |

| Bibliography                                                                   | 111 |

| Appendices                                                                     |     |
| Appendix A - School District Packet of Information                              | 119 |
| Appendix B - Survey A and cover letter                                          | 133 |
| Appendix C - Survey B: Cover letter-Final Version;                              |     |
| Final Version-Survey B; Reminder letter;                                      |     |
| Survey B-Versions 1 and 2; Scoring device for item 19, Survey B-Version 2; and Classroom Observation Form | 136 |
| Appendix D - Factors Questionnaire: Cover letter-Final Version, Factors Questionnaire-Final Version, Factors Questionnaire-Field Test Version | 151 |
| Appendix E - Participant Response Card and Thank You/Reminder Card              | 176 |
LIST OF TABLES

Table 1. Data for Pearson correlations of teachers' use of manipulatives to teacher role, staff development, and school climate variables 83

Table 2. Data for one-way analysis of variance on teachers' use of manipulatives to teacher role and staff development variables 85

Table 3. Regression analysis of teachers' use of manipulatives to teacher and school variables (final model) 88

Table 4. Correlations between independent variables in regression analyses 89
This study was initiated from the researcher's experiences as a primary grade classroom teacher and as an instructor of manipulatives workshops for teachers, as well as from her belief in the use of manipulatives for mathematics instruction. The researcher observed that many of her colleagues became very interested in using manipulatives following their participation in manipulatives workshops, specifically those based on the *Mathematics Their Way* books and materials. These primary grade teachers seemed to be convinced that the use of manipulatives was essential for effective mathematics instruction of young children. Many of these teachers incorporated manipulatives into their mathematics teaching. Over several years, however, it appeared that some of these teachers were either unwilling or unable to use manipulatives to any extent, and some actually seemed to decrease their use of manipulatives in their classrooms. The researcher's question was: why? What influences some teachers to incorporate manipulatives into their teaching, and what inhibits such use? These questions gave impetus to the research study presented here.
CHAPTER ONE

INTRODUCTION TO THE STUDY

There is a widely held opinion that schools can and must improve. The Nation at Risk report confirmed what many people already believed: schools are not doing their jobs as well as they should. Of all the possible options, staff development seems to be one of the most promising solutions to this problem. It is probably safe to say that, in this country, there is now some kind of staff development activity going on most of the year. Yet,

Staff development in education is a curious phenomenon; it resembles the world's search for eternal peace. . . . Everyone extolls its merits and sees the need for it. Many even agree on what characterizes an effective staff development program. Yet the lament from the vast majority of those who are subjected to staff development activities is that they are ineffective and generally a failure (Williams, 1979, p. 95).

Efforts directed at school change and renewal that were so prevalent in the 1960's and 1970's were more often focused on curriculum and programs. "Teacher-proof" materials were packaged and sent out into the school systems, whereupon they often met with apathy and disregard. It has become increasingly apparent that teachers are the bottom line in any change, and if they are unable or unwilling to implement the improvement, it will probably not take place (Schiffer, 1979; Griffin, 1985).

With all the finger pointing, fault finding, and simplistic diagnoses and prescriptions in the recent reports criticizing the status of
education, a constant is the teacher. There seems to be a recognition that if improvements are to be made, changes in how teachers are selected, trained, and upgraded are essential. This is because the teacher is viewed as the main catalyst for improving our schools, and rightfully so (Burke, Fessler, & Christensen; 1984; p.7).

Staff development and inservice training are designed to provide teachers with the upgrading they usually want and need. Recently, staff development programs in school districts have been changing "from the traditional, one-shot workshop approach to more comprehensive, adaptive approaches that focus on the specific needs and concerns of individual teachers" (Waxman, 1987, p. 1). Many teachers look to these efforts to help them improve their practices. However, teachers often respond unfavorably to them (Korinek, Schmid, and McAdams; 1985). They sometimes find the content to be impractical and unusable, or they are unsure how to apply what they have learned to their own classrooms.

One area of the curriculum that has received a great deal of attention recently is that of mathematics. The need for every person to have a solid foundation in mathematics is clearly evident in today's society. Schools are expected to produce mathematically literate, functional, and adaptable citizens to deal with the ever expanding need for scientific and technological knowledge. However, many students end up lacking the understanding of mathematics that is required. Reporting on the most recent National Assessment of Educational Progress, it was stated that,

It appears that in many of the content areas (in mathematics), students have been introduced to the procedures before they fully understand the concepts . . . . Students may benefit from more time spent on understanding why mathematics works the way it does; more time spent on working with physical and pictorial models and actively discussing how those models are related to the symbolic and abstract procedures of mathematics; and more time spent on thinking about situations before producing answers (Kouba, et al., 1988, p. 16).
Recommendations for improving mathematical understanding and capability include the use of "hands-on" physical objects called manipulatives. Research (Driscoll, 1981; Parham, 1983) shows that learning mathematics with manipulatives is effective and essential to the development of concepts, especially for children at the elementary level. In response to the need for increased knowledge for teaching mathematics using manipulative materials, programs have been devised and materials have been developed advocating and demonstrating instructional use of manipulatives. Elementary teachers have received preservice and inservice instruction in the use of these materials through workshops, seminars, and college coursework. Good and Grouws (1987) present their *Active Mathematics Teaching* model through such inservice training and report that teachers changed their teaching behaviors from participation. However, they also emphasized that

... a few teachers did not benefit from the program. This finding underscores the fact that individual teachers need different things in terms of mathematical knowledge, teaching skills, and the ability to integrate the two. For this reason, any program of inservice education will be more effective for some teachers than for others (p. 783).

In the literature it is reported that when teachers are teaching mathematics in their classrooms, many do not use manipulatives to any extent, if at all (Scott, 1987; Scott, 1983; Wiebe, 1981). Krug (1988) investigated the effects of teacher training, teacher attitudes, and school climate on the use of manipulatives and found that, of the variables studied, recent training in manipulatives use contributed significantly to classroom use of manipulative materials.

It appears that some teachers are able to utilize what they have learned through inservice training and they incorporate mathematics manipulatives into their classrooms. Yet, there are those who do not use them extensively,
even when they have been trained to do so. What is it that differentiates these teachers? What influences some teachers to implement programs of instruction that utilize manipulatives? What inhibits other teachers from use of these materials? There is a need for further investigation to determine what other factors may be associated with use of manipulative materials by teachers in elementary classrooms.

**Purpose of the Study**

The purpose of this study was to identify and examine teacher role characteristics, staff development, and school climate variables that may be associated with the use of manipulative materials for mathematics instruction by primary grade elementary teachers. Knowledge of these influential factors may be helpful to staff developers and educational personnel to enable them to support teachers who are using manipulatives in their classrooms and to assist those teachers who are not using them adequately to do so.

**Hypotheses**

The following statistical hypotheses were constructed for this study:

1. There is no relationship between teacher role variables and the use of manipulatives.
2. There is no relationship between staff development variables and the use of manipulatives.
3. There is no relationship between school climate variables and the use of manipulatives.
Variables

This study took into consideration a number of variables that may be related to manipulatives use. The dependent variable was the use of manipulatives. The independent variables that were investigated included:

Teacher Role Variables

1. Educational background, which includes these components:
   A. Beliefs about learning, the role of the teacher, and classroom environment
   B. Level of formal education
   C. Degree major/emphasis
2. Years of experience in teaching, which includes:
   A. Total number of years
   B. Number of years in primary grades
3. Attitude toward mathematics education
4. Attitude toward the usefulness of manipulatives training
5. Current teaching beliefs, which includes beliefs about learning, the role of the teacher, and classroom environment

Staff Development Variables

1. Recency of instruction in use of mathematics manipulatives
2. Manipulatives training:
   A. Type
   B. Quality
3. Follow-up from initial manipulatives training
   A. Subsequent formal training
   B. Interest in subsequent training
School Climate Variables

1. Administrative policy toward manipulatives:
   A. Curricular support
   B. Availability of manipulatives
2. Perceived support of school principal
3. Perceived attitude of other teachers
4. Perceived attitude of students' parents
5. Perceived response from students

Definition of Terms

**Likert-type scale**: This study includes question items based on the research of Renis Likert who developed scales for measuring attitudes. An individual responds by indicating strength of agreement according to a scale, such as strongly disagree (score of 1), mildly disagree (score of 2), neither agree or disagree (score of 3), mildly agree (score of 4), or strongly agree (score of 5).

**Mathematics manipulatives**: "Manipulative materials are concrete models that incorporate mathematical concepts, appeal to several senses, and can be touched and moved around by students" (Hynes, 1986, p. 11). These materials are sometimes referred to as concrete materials, physical objects, concrete objects, or hands-on materials. For the purpose of this study, the use of manipulatives is determined by an instrument constructed by the researcher referred to as Survey B.

**School Climate**: There are political and social components that make up the influences that may affect teachers in their individual teaching situations.
These influences include school administration and curricular policies, building principals, teaching colleagues, students, and students' parents. In this study, these components comprise the school climate.

**Staff development/Inservice education**: Staff development is defined as "any systematic attempt to change school personnel" (Griffin, 1983, p. 414). When the staff development effort is directed toward teachers, it is generally called inservice training or inservice education. In this study, type, quality, and amount of inservice training in the use of manipulatives was determined by three instruments developed by the researcher referred to as Survey A, Survey B, and the Factors Questionnaire.

**Teacher role characteristics**: The components that may influence how an individual performs as a teacher include educational experiences, both preservice and inservice, years of classroom teaching experience, as well as the impact of developmental phases that teachers pass through in their lives and in their teaching careers. In this study, these components are referred to as teacher role characteristics.

**Basic Assumptions**

The following assumptions were made while conducting this research study:

1. The use of mathematics manipulatives in primary grade classrooms contributes to students' knowledge and understanding of mathematics.
2. The teachers who participated in this study did so voluntarily.
3. The teachers' responses to the questions on the surveys and in the questionnaire were stated with candor and honesty.
Limitations

1. The subjects in this study are primary grade classroom teachers. Lists of teachers' names were provided by school district personnel in eight school districts. These teachers were contacted by mail. All teachers who returned the surveys and questionnaires were included in the sample if they qualified according to specified criteria. Therefore, the sample drawn for this study was not random, and this non-randomness may represent a sampling bias.

2. The instruments used in this study were all developed by the researcher. Precautions were taken to establish validity and reliability through field-testing. Also, these instruments depend on self-report. The researcher was not sure of the degree to which the responses of the subjects reflected their actual attitudes and behaviors.
CHAPTER TWO
REVIEW OF THE LITERATURE

Pertinent to this study will be literature related to the three categories of variables, teacher role characteristics, staff development, and school climate, as well as information and research concerning elementary school mathematics. Knowledge of these areas will be used to determine what may influence teachers to use particular teaching practices and materials in their classrooms. Those components which are deemed most influential in terms of manipulatives use will be embedded within the instruments designed to collect the data for this research study. The main sections of this chapter are: staff development; teacher role characteristics; school climate, including the process of change in schools; and elementary school mathematics. The purpose of each subsection will be identified within an introduction.

Staff Development

Literature related to staff development in schools abounds at this time. Staff development is defined as "any systematic attempt to change school personnel" (Griffin, 1983, p. 414). When the staff development effort is directed toward teachers, it is generally called inservice training, and is considered to be an established tradition in the education profession. The need for inservice training is based on two factors: (a) the college education for teachers "is but an introduction to the world of teaching," and (b) "the competent teacher is developed over time and in the crucible of experience . . . Teaching is a dynamic profession in which the individual must continually regenerate to be effective" (Korinek, Schmid, & McAdams, 1985, p. 33).

There are many interactive and overlapping variables that influence any staff development effort (Schiffer, 1979). Knowledge of these influential components will support the development of an instrument to study the impact
of staff development activities. In order to understand how staff development and inservice education affects individuals in their school settings, it will be useful to understand what it is, who is impacted, and how it is delivered and received. In this overview of staff development, these issues will be covered in the following subsections: types of staff development, characteristics of staff development, effective staff development, and evaluation of staff development.

Types of Staff Development

Korinek et al. (1985) found three inservice types, which are: (a) Type I - Information Transmission, whose purpose is to increase the knowledge of a specific group through lecture, demonstration, or panel discussion; (b) Type II - Skill Acquisition, whose purpose is to strengthen existing skills or to impart new ones; and (c) Type III - Behavior Change. This type of inservice is a compilation of many separate elements including those of the two previous types. The purpose is to develop desired behaviors. Active involvement and "participant ownership" are crucial. It is "the most costly, time consuming, and requires the greatest commitment from all concerned" (Korinek et al., 1985, p. 36). Each of these inservice types is further identified by and varied according to time frame, location, content, audience size, presentation style, and evaluation.

Sparks (1983) described general types of staff development training activities. They are:

1. Diagnosing and prescribing. Teachers are assisted in assessing their performance in the classroom and may make changes in their behavior as a result.

2. Giving information and demonstrating. This is the most common type of inservice activity, consisting of lectures and demonstrations, which can include modeling, videotapes, narrative descriptions, and other forms of providing information to teachers.
3. Discussing application. As a part of inservice training, teachers are given opportunities to discuss and reflect upon their beliefs and practices with each other.

4. Practicing and giving feedback. Teachers use the information and skills they have acquired and may modify them based on the feedback received. The most direct form of feedback comes from the reactions students give teachers. This training activity also includes microteaching, role-playing, and peer observation.

5. Coaching. This differs from the previous training activity in that it includes such dimensions as companionship, giving of technical feedback, analysis of applications and adaptations, and support. The "coaches" can be administrators, curriculum supervisors, college professors or teachers.

Other forms of staff development were described in the literature, which included: "A Teacher Center" (Zigarmi, 1979; Swiniarski, 1982); the "Helping Teacher" model (Rauh, 1979); "The Practitioners' Workshop" (Johnson, 1984); and an integrated approach to staff development, supervision, and teacher evaluation (Wood & Lease, 1987).

In summary, there are many different kinds of staff development, but all have the same goal, i.e., to support and enhance teacher growth and improvement in schools. Those types which are particularly useful for teachers take into account their individual needs and situations.

Characteristics of Staff Development

Several major characteristics "have been shown, by research and by careful observation over several decades, to be critical to staff development" (Griffin, 1983, p. 416). They are described as follows:

1. Context. This refers to the complex setting in which staff development occurs. It includes not only physical and/or organizational structure, including the leadership (principal or other change agent) and the interactive nature of the leaders with their staffs, but other influences within
the setting, such as the history of change efforts, the perception of the mission of the school, as well as the capability of the school to effect change by providing necessary resources and support (Griffin, 1983). A major factor affecting the success of staff development programs is administrative support. Research found "that staff development efforts were most likely to be successful where a 'norm of collegiality and experimentation' existed" (Sparks, 1983, p. 66).

2. Assessment. This refers to a careful examination of needs to identify what the members of the institution consider to be important avenues for improvement. The affected individuals can also determine the focus, modes, concerns, utilization, methods, and strategy formulation (Griffin, 1983).

3. Content. This characteristic consists of the body of knowledge and/or skills as well as the attitudes that are to be conveyed to the receivers of staff development and inservice training. There are certain teacher actions which are related to desirable student outcomes. "Studies of teacher effectiveness have identified specific classroom management practices, instructional techniques, and expectations that appear to help many students to raise their . . . test scores" (Sparks, 1983, p. 65).

4. Process. This characteristic includes planning, implementing, and evaluating the delivery of content to participants. The most typical form of staff development is a workshop, usually a one-time event intended to change the behavior and beliefs of the participants. Two process variables specifically discussed as influencing the effectiveness of staff development activities are: (1) Scheduling - single session programs are not as effective as those spaced over time; and (2) Types of training activities - since most staff development activity consists of giving information and demonstrations, this needs to be done well. "Clear, detailed presentations of information with modeling or demonstrations seem to be necessary, but not necessarily sufficient, for the success of staff development efforts" (Sparks, 1983, p. 67).
5. Teacher characteristics and attitudes toward change. Intellectual traits and developmental maturity are related to teacher behavior change. Teachers' cognitive styles influence their adaption to change. When models for innovation and the conceptualization of subject matter fit within a teacher's cognitive repertoire, change was easier and more complete than when the models required too many complex skills that the teachers did not have. Conceptual levels, referring to modes of thinking ranging from concrete, rigid thought and behavior to abstract, more flexible thought and behavior, are related to teacher effectiveness and positive behavior change. "For teachers to use recommended practices in their classrooms, the techniques need to be made clear and explicit and teachers need to become convinced (a) that the practice is worthwhile (in terms of teacher or student outcomes) and (b) that the change can be made without too much work or disruption" (Sparks, 1983, p. 71).

Effective Staff Development

From the research on inservice education, recommendations can be drawn for effective staff development, although the findings contradict each other on some variables. The recommendations are compiled and summarized as follows.

1. Content. Content that has been verified by research to improve student achievement is recommended. A philosophical acceptance of new practices and a rationale for the effectiveness of techniques should be included. For teaching practices that require complex thinking skills, activities that develop conceptual flexibility should be offered. Content should be related to "back home" situations. Assistance in lowering teachers' perception of the difficulties and costs of new practices should be provided, perhaps through detailed discussions which include sharing of experiences (Korinek et al., 1985; Sparks, 1983).
2. Reaction, learning, behavior, results. It was recommended that inservice should be planned in response to assessed needs, and participants should help plan the goals and activities. Both logistical and psychological support from the administration should be provided. Inservice activity should be directed at changing teacher rather than student behavior (Griffin, 1983; Korinek et al., 1985; Sparks, 1983). When effect levels were separated into reaction, learning, behavior, and results, it was determined, ... that inservice teacher education programs reported in the literature are moderately effective ... Attempts to increase participants' learning through inservice teacher training are highly effective; attempts to change participants' behavior and to elicit positive reactions to the training are moderately effective; while attempts to demonstrate results by looking at the students of participants are only mildly effective (Wade, 1985, p. 50).

3. Duration. Training that ranged from a few hours to that which lasted 30 hours or more, as well as programs that were spaced out over several months did not appear to be more or less effective (Wade, 1985). However, it was recommended that inservice should be offered at convenient times for participants, it should be part of a general effort of the school rather rather "single shot" presentations, and training sessions should be spaced two or three weeks apart (Korinek, et al, 1985; Sparks, 1983).

4. Training group characteristics. Groups that involved both elementary and secondary teachers had larger effect sizes. The size of the training group did not produce a highly positive effect either way (Wade, 1985). Administrators should be involved with the training and fully support it, and teachers should be encouraged to visit each others' classrooms (Griffin, 1983; Korinek et al., 1985; Sparks, 1983).

5. Location and Scheduling. No location or scheduling variable had a significant impact (Wade, 1985). However, effective inservice is usually school-based rather than college-based (Korinek et al., 1985).

6. Sponsorship. Contrary to the popular belief held by many staff developers,
teacher-initiated training did not prove to have a significant impact. Rather, "Training programs initiated, developed, or funded by the state or federal government or a university were significantly more effective" (Wade, 1985, p. 51). However, Griffin (1983, p. 423) suggests that it be "designated as a consequence of systematic problem identification by those most directly related to the problem."

7. Participant incentives. The most significant variable in this regard was whether the participant was selected by some competitive process to participate in the training. Incentives such as college credit, increased pay, certificate renewal, and no incentive resulted in small positive effect sizes (Wade, 1985). Korinek et al. (1985) claim that participation should be voluntary rather than mandatory, and that rewards and reinforcement should be an integral part of the inservice program.

8. Structure. Wade (1985) reported that independent study generated the largest effects. Self-instruction produced a large positive effect, perhaps explained by the fact that "any individual who is motivated enough to complete a program of self-instruction is likely to achieve successful results" (p. 53). Wade recommended independent study as an alternative whenever possible. Individualized programs are considered more effective than using the same activities for large groups, whenever appropriate (Korinek et al., 1985).

9. Instructional techniques. These four types of instruction had the greatest influence: observation of actual classroom practices, microteaching, video/audio feedback, and practice. "Practical rather than theoretical instruction, with the instructor taking almost exclusive responsibility for the design and teaching of the class, results in significantly higher effect sizes" (Wade, 1985, p. 53). Support from college and other "experts" produced a mildly positive effect. Instructors should set clear goals and take the major responsibility for the design and teaching of the class rather than
encouraging participants to assume these roles (Griffin, 1983; Korinek et al., 1985; Wade, 1985).

10. Coaching. There was no statistical evidence that coaching produced a highly positive effect. Wade advises caution in expecting that coaching will produce significant positive behavior change, as some researchers claim (Brandt, 1987). "Under some specific circumstances, coaching may be an effective technique, but it does not seem to provide a panacea for staff development programs" (Wade, 1985, p. 52).

In summarizing the findings in these reports, it is apparent that: content must be relevant to and meet the expressed needs of the individuals involved; duration, location and scheduling should encourage rather than inhibit participation; and training activities and group dynamics influence the outcomes of inservice. However, Wade (1985, p. 54) warns, "There is no 'magic formula' for effective inservice programs."

**Evaluation of Staff Development**

Any attempt to determine the value and impact of staff development must take into account the intricacies and the interactive nature of it, as well as its content, context, and structure. In order to accomplish the goals of evaluation, the instruments of evaluation must match, in complexity and breadth, the nature of what they are attempting to evaluate.

One evaluative tool which addresses the issues of comprehensive evaluation is entitled, "A Framework to Determine the Value of Staff Development." In a report which other researchers refer to as a "state-of-the-art review" (Good and Grouws, 1987, p. 783), Fenstermacher and Berliner (1983, 1985) provide the rationale for a process of evaluation which considers the dimensions and components of staff development. These authors emphasize this framework is best used before the inservice takes place, as a "forward-looking evaluation" (1983, p. 27), although they admit that it can be useful in "backward-looking" evaluations, following the staff development
activity. They also concede that "very few staff development activities are likely to meet all of the conditions set forth here" (1983, p. 27). A summary of this report follows.

The Fenstermacher and Berliner framework consists of four main components: a definition, a mapping sentence, participant roles, and an evaluation perspective. The definition of staff development is: "The provision of activities designed to advance the knowledge, skills, and understanding of teachers in ways that lead to changes in their thinking and classroom behavior" (1983, p. 4).

The mapping sentence "locates important features of staff development within the organizational context of schooling" (1983, p. 4) which, when identified for each staff development effort, can be used to predict the value of the activity for its participants. The mapping sentence answers these questions: How is the need for staff development initiated? (Externally or internally?) What is the purpose of this activity? (Compliance, remediation, enrichment?) Who participates? (All teachers, some teachers, one teacher?) How is participation decided? (Mandated or voluntary?) Each factor can be located along a continuum and can then be mapped to provide a profile for that particular activity. The participant roles in staff development include planners, providers, recipients, and evaluators. These authors maintain that, in general, the more that is initiated from the "bottom," i.e., teachers and school staff, the more likelihood there is that it will be valued by the participants.

The evaluation perspective in the Fenstermacher and Berliner framework for staff development answers these questions: Was it worth doing? Did it succeed? Was it done well? In other words, it addresses the issues of worth, success, and merit. What is worthwhile ultimately depends on one's values and principles. The dimension of merit is defined as "The quality of the process in which recipients are engaged during the activity and its subsequent application to the classroom" (1983, p. 21). The conditions for the dimension of merit include: (a) sensibility - the activity is consistent with the
teacher's plans, needs in the classroom, and is valued by the teacher; (b) variability - the activity permits variation in the ways it is presented and used; (c) incentives - it provides positive incentives to the participant both during and following participation; (d) maintenance - the activity provides systemic and clinical support both during and following the event. The dimension of success is defined as an activity that attains the goals set for it. An activity is considered successful if: (a) it has clearly stated objectives known to both providers and recipients and is related to work demands; (b) the instructor is one who demonstrates competence for teaching adults and provides a model of the proposed learnings and/or activities; (c) the diagnosis accounts for the needs, interests, and abilities of the recipients; (d) its application of the content in the classroom is sufficiently concrete and clear; and, (e) time is provided for recipients to learn, practice, master, and apply the content imparted.

This framework provides an effective model for determining the value of staff development and it also gives researchers guidance for evaluating the quality and impact of inservice training activities.

Others have contributed to understanding evaluation of staff development. Popham (1982) warns against using only students' performance on standardized tests as the criterion for determining the success of staff development efforts. Baden (1982) advises that the evaluation of inservice education must be tied to the professional development of educators which involves needs assessment, the setting of measurable objectives, and the delivery of services tied specifically to the objectives. McDonald (1982) outlines an analytic strategy for organizing information and making judgments about the costs and benefits of staff development programs. He emphasizes the political nature of staff development:

Measuring the impact of inservice education programs is as much a political as a technical act... It ought to be a way of telling us whether we are achieving our major mission, improving the quality of the educators working in our schools, the quality of their services, their commitment to and satisfaction
with their work, and their willingness and ability to tackle the difficult and challenging problems of educational change (p. 29).

In conclusion, staff development is one means of affecting the behaviors and beliefs of teachers, and thereby producing change in schools. Knowledge of its types and characteristics, familiarity with the qualities of effective staff development, and an understanding of its evaluation provides the background to engage in meaningful research. This knowledge is useful for designing research tools. However, any instrument that attempts to evaluate the impact of staff development programs must provide for the variability that will naturally result from individuals' responses to the type, format, content, quality, and usefulness of the program and activities that are presented. Consideration of these important components will be made and embedded within the instruments developed for this research study.

A staff development activity, with its attendant goals and purposes, does not occur in a vacuum. The individuals who receive the information and who participate in events to produce behavior change bring with them their own backgrounds and perspectives. This individual context "filters" the information and establishes the impetus for change. Two distinct dimensions of this individual perspective related to teachers in schools are those of teacher role characteristics and school climate. Each set of variables influences how teachers receive and utilize inservice education. The next two sections in this chapter will address the dimensions of teacher role characteristics and school climate.

**Teacher Role Characteristics**

What an individual brings into teaching in many ways defines how that teacher will teach. The impact of an individuals' educational experiences, both preservice and inservice, will determine much of how a person performs
as a teacher. Teachers pass through developmental phases in their lives and in their teaching careers. For the purposes of this study, understanding how teachers are affected by these factors will contribute to the development of an instrument to evaluate how some teacher role characteristics may influence teachers to use particular techniques.

**Teacher Career Stages**

Burke, Fessler, and Christensen (1984) report on Teacher Career Stages, and provide a model detailing how personal and organizational environments affect career cycles. The *personal environment* of the teacher includes categories such as family situations and histories, avocational outlets, and individual dispositions. These categories of influence may have an impact singularly or in combination, and during certain periods they may become the driving force in influencing an individual's job behavior and career cycle. The *organizational environment* of schools includes school regulations, administrative style, atmosphere of public trust present in a community, and professional organizations. Support from these organizational components will reinforce, reward, and encourage teachers as they progress through their career cycles. Alternately, an atmosphere of mistrust and suspicion probably will have a negative impact. A teacher can be distinctly influenced by these environments.

The components of the career cycle are:

1. **Preservice** - the college preparation period or a retraining period when a teacher changes position or role.
2. **Induction** - the first few years of teaching when the teacher is socialized into the system or when he/she shifts to another grade level, building, or district.
3. **Competency building** - the teacher is striving to improve skills and abilities; he/she seeks out new materials, methods, and strategies, and is most
receptive to workshops, conferences, and graduate programs. Teachers view their job as challenging and rewarding.

4. Enthusiastic and growing - the teacher has reached a high level of competence but continues to progress. He/she is enthusiastic and has a high level of job satisfaction. At this stage teachers are often helpful and supportive of growth and professional development for themselves and their peers.

5. Career frustration - this period is characterized by "frustration and disillusionment... Job satisfaction is waning, and teachers begin to question why they are doing this work" (Burke et al., p. 15). The term "burnout" has been used to describe this period, and although it is most often seen at the midpoint in the teacher's career, recently even younger teachers have experienced it.

6. Stable but stagnant - teachers in this stage may be doing an acceptable job but are not committed to excellence or growth. They have often resigned themselves to "a fair day's work for a fair day's pay." They are seldom motivated for professional growth and are passive consumers of inservice. In fact, "they tend to be the most difficult to deal with in terms of professional development programs" (Burke et al., p. 15).

7. Career wind-down - the teacher is preparing to leave the profession. It may be a pleasant period for some or a bitter period for others, depending on their differing views of their careers and the circumstances in which they find themselves.

8. Career exit - this includes not only the years of retirement following a teaching career, but can also be voluntary leaving, such as during the period of child rearing, or it can represent a change in situation while the person explores other career options or moves into a non-teaching position, such as into administration.

These career stages are often viewed as linear, but the authors point out that, "It is more likely to be an ebb and flow, with teachers moving in and
out of stages in response to both personal and organizational environmental influences" (Burke et al., p. 16). Staff developers and change facilitators must consider what activities are appropriate for teachers at various career stages. "It is . . . important to build on the experiences of the learner and to remember that adult learning patterns and needs change throughout their careers" (Burke et al., p. 22).

**Adult Development**

Another distinct component that impacts directly on individual change and improvement is that of adult development. Oja's (1980) study reveals the significance of issues relating to an individual's level of conceptual, ego, and moral development. Considering adult development as it relates to teachers, Oja states:

Teachers who are in the classroom today were trained for far less complex tasks than are being required of them now. Few teachers were prepared to utilize the skills of individual instruction, mastery learning, facilitative teaching, group facilitation, or counseling. Fewer still were found able to integrate all of these skills into their classroom teaching styles. Yet using these skills flexibly is now required. Helping teachers acquire and use these skills is the challenge facing staff developers (p. 46).

Addressing the need to upgrade teacher's technical skills is a focus of many staff development programs. Yet, "Even when teachers have been trained to exhibit high levels of these skills, they have not been able to transfer them to the classroom . . . Apparently, simply improving teaching skills is not enough" (Oja, 1980, p. 9).

Oja (1980) reports on the growing body of literature which indicates that even though most adults seem to stabilize at certain stages in development as defined by models of adult development, intervention may be possible to promote growth toward higher levels of conceptual, ego, and moral maturity.
Some of the considerations and implications put forth in this study are summarized as follows:

1. Common developmental tasks confront adults at specific ages and periods of life. These stages and tasks affect a teacher's performance and attitudes.

2. There are variations in adult's conceptual systems which affect a teacher's ability to function in different kinds of learning environments. For example, in a highly child-centered environment the teacher must be able to use the learner's frame of reference and respond in ways that encourage hypothesizing and questioning. A teacher who conceptualizes at a more abstract level will function more effectively in such an environment, as compared to one whose conceptual system is more concrete.

3. "Each person's perception of the environment reflects and is filtered through his/her own stage of development" (Oja, 1980, p. 29). These factors determine a teacher's response to the stresses of teaching, choice and use of innovations in his/her classroom, conceptualization of issues in teaching and learning, and reaction to different types of staff development programs.

4. Different personality characteristics affect the way teachers respond to students and the teaching tasks, as well as affecting their feelings about themselves and their work. Specifically, response to support, challenge, and incentives to change will vary according to these characteristics. "What is a challenge at one stage may well feel like a support to a person at a subsequent stage. . . . The challenge of change is overwhelming when the description of the change is far from the teacher's own view of the world" (Oja, 1980, pp. 32, 34).

5. There are common elements and focus points in developmental approaches to teacher staff development. They are:

   (a) Opportunities for practical application of new learnings followed by examination and reflection on those experiences in seminars and conferences, and through self-introspection;
(b) Chances to try out more complex roles and responsibilities with stress on learning to take the perspective of others; 
(c) Ongoing, on-site, supervision/advising/consultation among teachers and staff; and 
(d) Provision for a supportive environment to deal with times of cognitive conflict in the acquisition of new learning (Oja, 1980, p. 46).

Encouraging teachers to function at higher levels of conceptual complexity and use interpersonal skills effectively will help them understand students' feelings, use students' ideas, and ask questions which encourage student thinking and decision making. These considerations can help staff developers to understand the ways adults, specifically teachers, change emotionally, morally, and cognitively as they proceed through transitions and stages in their lives.

In summary, researchers must acknowledge that individual characteristics, and teacher role characteristics specifically, can have a great deal of influence as to whether or not changes and improvements are made by teachers. Consideration of adult and teacher role development will be taken into account when designing an instrument to determine what influences teachers to adopt and utilize particular teaching techniques.

**School Climate**

The second distinct dimension of a teacher's individual perspective is related to his or her particular teaching situation, referred to in this study as school climate. The influences that are part of school climate will be addressed in two subsections: political influences and the social realities of teaching. A final subsection will address the process of change in schools. Recognition of these influences will be incorporated into the research instruments for this study, and specific items will be included which relate to the attitudes and decision-making considerations teacher employ for utilizing
certain teaching practices, which are, in this study, the use of manipulatives for mathematics instruction.

**Political influences**

Schiffer (1979, p. 11) discusses "the problem of educational authority." There are three principles of authority: public trust, bureaucratic authority, and colleague authority. Each has evolved throughout the history of education in the United States, and although formal and legal authority are still very much hierarchical in nature, currently these three principles represent points of conflict. "Each of the three sources of authority is claiming a voice in policy decision making and is struggling to establish or retain its own prerogatives" (Schiffer, 1979, p. 13). For boards of education and school administrators to disregard the influence of "parent power" and "teacher power" as each affects the decisions made concerning education in general and staff development in particular is unrealistic. Models of staff development that attend to any one particular principle of authority are "one-sided." The lack of significant improvement through staff development can be attributed to the one-sidedness of most improvement efforts (Schiffer, 1979).

Williams (1979) examined the political issues involved in staff development by describing the comprehensive studies of educational innovation and school renewal conducted by the Kettering Foundation's Institute for the Development of Educational Activities (I/D/E/A) and the Rand Corporation. The recommendations from both groups are consistent with previously mentioned reports (Griffin, 1983; Korinek et al., 1985; Sparks, 1983; Wade, 1985), but further emphasis is put on the involvement of different decision making groups, such as universities and colleges, private consultants, federal and state governments, school districts and school sites, and teacher unions. Williams contends that these . . .

Organizations and groups have both public and private positions on educational reform proposals. The public position generally
is translated into "doing what's best for the kids," but the overt or covert actions of the groups are sometimes motivated more by political and private self-interest, which may or may not coincide with their public position (p. 106).

In a research study designed to investigate organizational supports and the implementation of an innovative school mathematics program, Sharman (1986) found that there was a significant relationship between the amount of organization support received to assist implementation and the degree to which the innovation was implemented. Joslin (1982) studied the effect of school context on the implementation of an innovation and suggested these implications: (a) Administrators should take into account the degree to which target schools are integrated into the school system; they should consider the fit between the initiative they wish to sponsor and initiatives already underway; (b) Practitioners should give attention to the organizational context and fit for proposed innovative strategies; (c) Researchers and evaluators need to be sensitive to the variations between schools and the communities they serve, and carefully consider the way an innovation is introduced and the differences between strategies and school contexts.

The Social Realities of Teaching

Another set of influences are those related to the social realities of teaching. Griffin (1985, p. 13) discusses the "interacting variables that help us understand the school as a workplace." Based on a review of literature in this area, Griffin develops three broad themes, summarized below.

1. Institutional regularities. There are common characteristics of elementary and secondary schools, which include: (a) Teachers typically work in isolation from one another. This is apparent to those familiar with the norms of schooling, and ". . . the isolation of teachers from one another fits the historical pattern of administrators' decisions about teachers, but it does not fit more recent recommendations from teachers, researchers, and
scholars that teachers participate in decisions about their performance" (p. 3); (b) The school systems of this country are hierarchically organized with a top-down policy; (c) Schools and teachers are under enormous pressure to be accountable. The source of the pressure comes from all sides: professional, political, and public; (d) Schools are accused of goal ambiguity and goal overlap. This contributes to the uncertainty teachers have in determining what their job actually entails; (e) Schooling phenomena are more often situation specific than not. In spite of the common belief that "a teacher is a teacher is a teacher" the actuality is that "teachers and students are different in primary classrooms from the ones made in high school classrooms... the knowledge and skill needed to make appropriate instructional decisions differ from situation to situation" (p. 6); and (f) Schools have limited funds that generally remain at fixed levels whether students are educated well or poorly.

2. The nature of teaching. The research base that explains what actually goes on in classrooms is slowly growing. Some of the dimensions of teaching are: (a) Teaching is, in greater measure than many suspect, the management of an uncertain environment; (b) Most lay persons and a surprisingly large number of teachers view teaching primarily as interaction with students. Teachers do have multiple, complex, and persistent interactions with students, but there is much more to the job; (c) A large part of a teacher's work involves planning. Even though there has been a growing tendency for program developers and textbook publishers to mandate highly specific curricula, teachers decide what and how subjects and students will be taught; (d) Teachers should know about students in general and about individual students in particular, and they should know how to act on that knowledge; (e) There is some evidence to support the requirements that teachers work with parents to educate students. Teachers are not usually taught how to do this effectively, however; and (f) A traditional value about teachers is that they work toward
their own growth and improvement. Teachers are given inservice days and other incentives to engage in upgrading their knowledge and skill. However, "Professional development, though, seems in many cases to be a pro forma specification that teachers follow more out of resignation than out of interest or desire, because so many offerings are seen as irrelevant to teachers' real problems" (p. 9).

3. The teacher as semiprofessional. Griffin refers to the teacher as a semiprofessional due to the status characteristics that follow: (a) Teachers tend to depend on craft knowledge rather than a carefully constructed, systematically codified, and widely accepted body of technical knowledge. "Teachers' beliefs tend to override whatever research-based knowledge is available, and demands of a given situation at a particular time are more likely to determine decisions than is technical knowledge available to teachers only. There is, in short, a 'technical core' deficiency" (p. 10); (b) Teachers no longer have the considerable autonomy they once had. Local, state, and federal rules and regulations influence teachers; (c) One hallmark of a professional is his/her education prior to and after joining the work force.

Most sensitive and knowledgeable educators would admit that education courses, preservice and inservice, lack focus and are often ill-articulated and not based on research. . . (although) there is a slowly growing knowledge base, there are methods of teaching that require specialized knowledge and skill, there are ways of working with students in classrooms, and there are different points of view about teaching and learning that appear to have different consequences for providing instruction (p. 11-12);

and (d) Teachers are very vulnerable members of the educational system. They are blamed for poor instruction and resultant poor scores on standardized tests, they have little to say about how they are compensated for their work, and they are the recipients rather than the makers of policy decisions.
Lieberman and Miller (1979) also describe the "nature of teaching" and the "dailiness of teaching," echoing Griffin's (1985) perspective, but also including these characteristics: (a) Teachers must learn, through experience, how to control the environment while at the same time engage the interest and support learning for each student; (b) Rewards are derived from the students; (c) The link between teaching and learning is often uncertain; (d) Teaching is an art, and, as such, difficult to define, describe, and control; (e) Control norms are necessary. Classroom controls as well as those external to the classroom impinge on the teacher's concerns; (f) Schools are governed by rules, both formal and informal. The informal rules influence teacher behavior to a great extent. Two implied rules that seem to pervade the teaching profession are "being practical," which means that ideas must be immediately usable in the classroom, that one must concentrate on products rather than processes, and that one must adapt to the realities of the school as it is rather than trying to change it; and "being private," meaning that teachers often do not share their ideas and perceptions with their co-workers, nor do they usually share their non-school self with their students; and (f) Teachers' interactions, with each other, with students, and with administrators are influenced by expectations of behavior related to the "rules" of school.

Joyce and Clift (1984) comment on the social phenomena of teaching as compared to other occupations in a study of teacher education and the social context of the workplace. From a comparison of teaching with other fields of occupation, such as labor, crafts, and professions (i.e., medical), they draw these, among other, conclusions: (a) There is a low degree of consensus of just what tasks the teacher is expected to perform; there are "conflicting client, organizational and societal demands made upon individual teachers" (p. 126); (b) "The present teacher training scene does not provide the teacher with a strong base from which to enter the profession, or with a secure 'fall-back' position from which to learn on the job" (p. 126); (c) Evidence from research suggests that teachers are "socialized into individualism and
isolation from their first contacts with their career" (p. 126); and (d) Teachers who participate in skills training improvement programs " . . . respond most favorably to the opportunity to work with an 'on-site' colleague . . . Role models who meet problems and who are willing to share their experiences with problem-solving could easily become standard in both inservice programs as well as preservice programs" (p. 127).

The need for growth in professionalism, in terms of providing a support base for novices in the teaching field, is discussed by Wildman and Niles (1987, p. 4): "One of the major misconceptions about teaching, found both inside and outside the profession, is that teaching is a relatively commonplace, easy-to-learn task." They counter this misconception by pointing out that,

. . . research on human learning implies that professional growth in teaching has an emerging quality, that the process takes substantial time, and that complex understanding and skills follow development patterns that have been understood in psychology for years but rarely applied to the training of teachers (p. 5).

In summary, recognizing the political and social aspects of teaching and the typical experiences of teachers as they prepare for and continue working within schools allows staff developers and researchers to gain an empathetic perspective. It also provides background for researchers to understand the impact, or lack of impact, that an improvement program may produce. This knowledge is useful for developing and interpreting the results from research conducted using teachers as subjects, as is the case in the present study.

The Process of Change in Schools

Use of manipulatives for mathematics instruction represents, for many teachers, a change in practice from their teacher training and their
experiences in primary classrooms. Knowledge of how change occurs in schools and how it impacts teachers will provide the background needed to more effectively design research instruments for this study and to interpret the responses teachers give on those instruments. One model of research offers such background. This model and research will be described next.

The Concerns-Based Adoption Model (CBAM)

The Research and Development Center for Teacher Education at the University of Texas at Austin has produced a model to evaluate the adoption of an innovation in schools called "The Concerns-Based Adoption Model" or CBAM (Hall and Loucks, 1979; Loucks and Melle, 1982; Hall and Hord, 1987). "Diagnosing teacher needs and providing relevant staff development activities is a major goal of the research" (Hall and Loucks, 1979, p. 37). CBAM research is based on these assumptions:

1. In educational institutions change is a process, not an event. . .
2. The *individual* must be the primary target of interventions. . . Institutions cannot change until the individuals within them change. . .
3. Change is a highly *personal* experience.
4. The change process is not an undifferentiated continuum. Individuals involved in change go through stages in their perceptions and feelings about the innovation, as well as in their skill and sophistication in using the innovation.
5. Staff development can best be facilitated for the individual by use of a *client-centered diagnostic/prescriptive model*. . .
6. The staff developers or other change facilitators need to work in an adaptive, yet systemic way. (Hall and Loucks, 1979, pp. 37-39).

Three aspects of change form the basic frame of reference for the model: the concerns that users express, the use of the innovation, and the ways the innovation is adapted by the users to meet their needs. The model is, therefore, composed of three diagnostic/prescriptive tools:

1. The Stages of Concern (SoC) conceptualization consists of levels of
concern that people pass through as they encounter and use an innovation. These levels and examples of expressions of concern are: (a) Level 0 - Awareness: I am not concerned about it (the innovation); (b) Level 1 - Informational: I would like to know more about it; (c) Level 2 - Personal: How will using it affect me?; (d) Level 3 - Management: I seem to be spending all my time in getting materials ready; (e) Level 4 - Consequence: How is my use affecting kids?; (f) Level 5 - Collaboration: I am concerned about relating what I am doing with what other instructors are doing; and (g) Level 6 - Refocusing: I have some ideas about something that would work even better (Loucks and Melle, 1982).

2. Accompanying the concerns that people have while implementing an innovation are their Levels of Use (LoU). The CBAM research identified the typical stages of use involved with an innovation. These levels, and indices of typical behavior, are: (a) Level 0 - Nonuse: No action is being taken with respect to the innovation; (b) Level I - Orientation: The user is seeking out information about the innovation; (c) Level II - Preparation: The user is preparing to use the innovation; (d) Level III - Mechanical: The user is making changes to better organize use of the innovation; (e) Level IVA - Routine: The user is making few or no changes and has an established pattern of use; (f) Level IVB - Refinement: The user is making changes to increase outcomes; (g) Level V - Integration: The user is making deliberate efforts to coordinate with others in using the innovation; and (h) Level VI - Renewal: The user is seeking more effective alternatives to the established use of the innovation (Loucks and Melle, 1982).

The third component of the CBAM is the concept of Innovation Configurations (IC). This was identified due to implementation variations demonstrated by users. Educational programs and curricula are designed to be utilized in particular ways; researchers found that what one teacher called use of a program was often distinctly different from the way another teacher used it. This variation greatly influences the impact of the innovation and the
expected results that accompany its use (Hall and Hord, 1987). To analyze these use variations, components of the innovation are identified and described to "summarize the array of possibilities" of use for any particular program (Hall and Hord, 1987, p. 118). A checklist of the innovation configuration can be made. From it, an evaluator can determine the critical features for use of the innovation, and decide when and if the innovation is being implemented appropriately and effectively.

The results of extensive CBAM research have underscored the researchers' beliefs about staff development evaluation, which include:

1. The "proof of the pudding" for staff development efforts aimed at helping teachers develop new skills and/or use new practices lies in whether those practices are then used in the classroom.
2. The only way to find out about change in classroom practice is to interact individually with each teacher to find out.
3. Evaluations are only good if they are useful, and can directly contribute to further improvement in teachers and schools (Loucks and Melle, 1982, pp. 114-115).

The Concerns-Based Adoption Model provides guidance and support for on-going, comprehensive evaluation, and supplies increased understanding of staff development and inservice education for school personnel and for researchers involved in the study of teachers and their behaviors.

In conclusion, school climate encompasses a vast array of interacting influences that may significantly affect how individual teachers behave. To study teachers effectively, researchers must take into account political and social influences, such as administrative policy and curricular support, as well as the impact that school administrators, teaching colleagues, the general public, including students' parents, and the students themselves may have on the decisions and practices teachers employ. Consideration of all of these influences will be made while designing and implementing this research study.
Elementary School Mathematics

In order to understand the teaching of mathematics in the elementary school, it is useful to be familiar with mathematics for this level. In this section, an overview of elementary school mathematics will be presented within these subsections: cognitive learning theory as it relates to mathematics, effective instruction in elementary mathematics, elementary mathematics curriculum, teaching mathematics, staff development in mathematics, and a survey of the recent literature related to mathematics manipulatives. This information about elementary mathematics and manipulatives use will overlay the information presented previously in this chapter to form the knowledge base for the development of appropriate research instruments for data collection, and will also provide the reference base for interpreting the results of this study.

Cognitive Learning Theory

A variety of approaches for teaching mathematics are used in the elementary school. One approach which advocates the use of concrete materials by the learners is supported by cognitive theorists, most notably Jean Piaget and Jerome Bruner, and mathematics educator, Zoltan Dienes. Although differences exist in the schemes describing these three views of the learning process, their frameworks are similar in at least two ways:

1. Each suggests that learning proceeds from the concrete to the abstract. At the concrete stage the learner interacts directly with physical materials within the environment. As concepts are constructed, the learner is capable of thinking based on pictures, images, or other representations. Once concepts are based in experience, learners can mentally manipulate symbols without the presence of physical and representational counterparts.

2. Children pass through characteristic and identifiable stages of thinking as they grow and mature. "Not until adolescence do children grow out of the stage where they are totally dependent of perceptions and concrete
experiences" (Reys, Suydam, and Lindquist, 1984, p. 40). "Meaning arises only to the extent that the symbols are directly linked (physically and/or mentally) to the mathematical knowledges and skills being developed. Concrete materials provide the initial referent, and there are no vicarious substitutes" (Reys et al., 1984, p. 37). Piaget describes the kinds of knowledge gained from manipulation of objects. *Physical knowledge* is acquired from the objects themselves through the senses. *Logico-mathematical knowledge* is created when the learner forms relationships among objects, such as comparing two balls to determine whether they are alike or different. The relationship exists in the mind of the learner and can only be created in the mind. Physical and logico-mathematical knowledge depend on each other and develop together (Kamii, 1982; Labinowicz, 1985).

Direct experience with physical objects is vital to accurate concept development, but simple manipulation is not enough. It must be accompanied by mental activity which has as its goal that of investigating problems, posing solutions, looking for cause and effect, noting results of actions, and/or making generalizations. "What makes an active method 'active' is not the external action, or what a person 'does' or how he 'performs,' but the mental elaborations or constructs that he is able to make from the external actions he has performed" (Copeland, 1984, p. 20). "Children do not learn number concepts with pictures. They do not learn number concepts merely by manipulating objects either. They build these concepts by reflective abstraction as they act (mentally) on objects" (Kamii, 1982, p. 38).

Robert Wirtz, a mathematics educator, further developed this idea when he said that "... Language is a repository of experiences...," and that "... Language grows out of 'real and material action'--its meaning depends exclusively on the experience" (Wirtz, 1985, p. 98). His view of the sequence of cognitive development proceeds from manipulative to representational to abstract, combined with language experience, which begins with
remembering experiences, proceeds to solving problems, and then to that of making investigations.

**Effective Instruction in Elementary School Mathematics**

Effective instruction in mathematics begins with opportunities for the students to manipulate concrete, physical objects as they are encouraged to actively think about and discuss their ideas. With sufficient activity, learners can then be guided towards representational and abstract symbolization. This guidance should be based on these principles:

1. Mathematics learning should be meaningful. "Research has confirmed that teaching for meaning generally leads to greater retention, greater transfer, and increased ability to solve problems" (Reys et al., p. 41). Brownell (1987), a prominent mathematics educator for many years, emphasized the need to balance meaning and skill in mathematics. Kroll and Yabe (1987, p. 39) suggest that ". . . a considerable amount of time must be devoted to introducing each new idea, since students must first attempt to understand the problem and the meaning of the operations involved, and then try to relate it to past understanding." Having a problem-solving attitude encourages learners to apply it to their lives, rather than viewing it as consisting only of operations with numbers and arithmetic calculations (Frank, 1988). Related to this, Good and Grouws (1987) report,

> As we see it, the core of the problem is that teachers and textbooks view mathematics as characterized by certainty. Both teachers and books see their function as helping students to do problems quickly and accurately. These views correlate with and sustain (if they do not cause) the poor student performance documented in recent national assessments (p. 780).

2. Mathematics learning is a developmental process. It takes time to develop understanding of the relationships of mathematics, ". . . Yet this time is well
spent, as it helps develop a lasting facility in mentally manipulating mathematical ideas and recording thought processes" (Reys et al., p. 41). Allowing time and opportunities to discover mathematical concepts encourages a positive, confident attitude toward mathematics (Labinowicz, 1980; Reys et al., 1984).

3. Student motivation affects the learning process and vice versa. Having high expectations for success in mathematics as well as maintaining a supportive environment which accommodates risk taking were characteristic of effective teachers and contribute to student motivation. "Mathematics teaching and learning have deep social and psychological components and no amount of good materials or equipment can substitute for the exemplary teacher who is able to draw on those components to bring mathematical success to children" (Driscoll, 1986, p. 48).

4. Students need to know what is to be learned in mathematics classes. In his research report on effective teaching of mathematics, Driscoll (1986, p. 19) states, "The whole program is structured and understood by staff and students, so that students can and do move flexibly within an array of courses and levels to maximize success."

5. Active involvement should be provided, accompanied with opportunities for verbalization. "Active involvement may provide for physical activity but always demands mental involvement" (Reys et al., p. 42). Kamii and Joseph (1988) emphasize the need for allowing children to develop mathematical understanding by sharing their points of view with teachers and peers, and thereby creating mathematical relationships through their own mental activity.

6. Multiembodiment and mathematical variability aids learning. Since mathematical ideas are, by their nature, abstract, any model that embodies them will be a representation of those abstractions. Therefore, a variety of models are necessary to assist learners in their search for abstract mathematical concepts. A good manipulative will contain many attributes
and characteristics. "Research confirms that students learn more when presented with a combination of examples and non-examples of a mathematical concept" (Reys et al., p. 44). Good and Grouws (1987, p. 780) also suggest that,

The abstract nature of mathematics, which enables it to serve as a model for widely diverse physical phenomena, may also create substantial impediments to learning. This is especially true if the teacher presents a mathematical concept in its abstract form without giving examples of its concrete representation. When development is done well, students are frequently exposed to a variety of representations of the mathematical ideas being learned.

**Elementary Mathematics Curriculum**

Another component which affects instruction in mathematics is the quality and organization of the mathematics curriculum. The sequencing of instruction must be a major consideration. "In no other discipline is the ordering more important and previous learning more critical" (Reys et al., 1984, p. 41). The direction for sequencing the curriculum comes from two distinct perspectives: one perspective grows out the theory of learning hierarchies and relates to logical arrangements of concepts and step-by-step mastery of skills. The other perspective derives mostly from cognitive learning theory and considers child development as it relates to learning mathematical concepts (Driscoll, 1981). It is clear from research, though, that at all elementary school levels the use of purely symbolic treatments of mathematical topics is not as effective as the use of sequences in which manipulative materials are used (Suydam and Higgins, 1977).

The quality of the curriculum also stems the nature of the mathematical experiences students have while learning mathematics. The vast majority of instruction is guided by the textbook. "The overall picture is that to a great extent the textbook defines the content of the mathematics that is taught in
U. S. schools" (Flanders, 1987, p. 18). The quality of those textbooks is in question, however. The majority of the content is that of arithmetic computation (Sherman, 1988), and activities to encourage higher order thinking skills are not present to the extent necessary to achieve higher order intellectual behaviors (Callahan, 1986).

In a report of the results from the Fourth National Assessment of Educational Progress Assessment of Mathematics (Kouba, Brown, Carpenter, Lindquist, Silver, and Swafford; April, 1988; May, 1988), these conclusions were made: (a) Many students perform better on familiar items than on unfamiliar items; (b) Many students perform better on simple items than on more complex or nonroutine items; (c) Many students demonstrate a lack of understanding of underlying concepts; (d) Many students perform better on items that they can relate to their physical or visual experience than on more abstract items, unless the physical or visual experience is misleading.

We should reassess the mathematics curriculum in terms of how much time students are engaged in learning and understanding concepts before practicing procedures. . . .Students may benefit from more time spent on understanding why mathematics works the way it does; more time spent on working with physical and pictorial models and actively discussing how those models are related to the symbolic and abstract procedures of mathematics; and more time spent on thinking about situations before producing answers (April, 1988, p. 16).

Another consideration to be made is the scope of the curriculum. Suydam (1979, p.11) calls for a comprehensive elementary mathematics curriculum which includes more than teaching of computation skills: "School mathematics programs should teach children skills they need and will use throughout their lives. . . We must stop teaching only grocery-store arithmetic to students who will have access to computers and use calculators."

The National Council of Teachers of Mathematics (NCTM) has generated a set of Curriculum and Evaluation Standards for School Mathematics which the Council expects to influence the writing of mathematics curriculum at the state and local levels as well as influencing the
content of textbooks and tests (Thompson & Rathmell, 1988). The NCTM Standards have been based on these five goals for all students: (a) becoming a mathematical problem solver, (b) learning to communicate mathematically, (c) learning to reason mathematically, (d) learning to value mathematics, and (e) becoming confident in one's own ability (Romberg, 1988). Highlights of the Standards for grades K-4 include emphasizing concept development and shifting certain content to higher grade levels, when students are more developmentally ready for it. Other highlights include significantly changing expectations for computational profiency, i.e., not expecting mastery of basic addition and subtraction facts until third grade; expecting proficiency with smaller numbers than is currently done; and balancing the curriculum to introduce and/or emphasize other topics such as problem solving and mathematical reasoning, measurement, geometry, estimation, number and spatial sense, and statistics, probability, relations and functions (Thompson & Rathmell, 1988).

**Teaching Mathematics**

Teachers acquire many beliefs, attitudes, and behaviors throughout their lives and especially during their preservice and inservice education. These beliefs and attitudes influence their performance as teachers. Pertinent to this study are those that affect the teaching of mathematics. There are many studies in the literature concerning the teaching of mathematics. A few representative reports will be summarized in this section.

Subject matter knowledge can significantly affect how a teacher teaches mathematics. Ball (1988, p. 40) contends that "...teachers' subject matter knowledge interacts with their assumptions and explicit beliefs about teaching and learning, about students, and about context to shape the ways in which they teach mathematics to students." If teachers view mathematics as sets of rules and formulas to be memorized, they will teach it much differently than if they view it more comprehensively. The teacher's selection of learning
materials will reflect his/her perspective. If the teacher conceptualizes mathematics from a constructivist framework, the materials and the methods utilized will differ significantly from one who incorporates a more behavioristic perspective.

Lampert (1985; 1986) recommends teaching mathematics in context in order to make sense of the abstract symbols. "... It is important for ... numbers and symbols to have meaning for children if they are going to go on to study higher mathematics with confidence and if they are going to be able to use mathematical ideas to solve problems in the real world" (1986, p. 241). In order to present mathematics concepts effectively, teachers at all levels must understand the principles and concepts of mathematics, and select learning materials which combine effective mathematics teaching with the knowledge of cognitive growth in children. "It is difficult for them [teachers] to judge what is entailed in doing a good job at teaching mathematics because they have so little experience doing mathematics" (1986, p. 280).

Leinhardt (1986) writes extensively about teaching mathematics, contrasting experienced teachers with "novices," such as student- or first-year teachers. She reports that some "experts," or experienced, knowledgeable teachers, display much greater sophistication than novices in several dimensions of teaching, including subject matter presentation, selection of representation systems (when they often include a variety of multi-embodiments in the lessons), explanation of new learning materials, management of lesson time, and judgement of students' understanding of the subject matter. Although the novices may display a high level of competence in the subject matter, they seem unable to access it while teaching. She recommends having novices build and rehearse more cohesive and script-like lessons.

Sherard (1985) reports on preservice training which includes a mathematics laboratory setting, in which the mathematics content is integrated with discussion of teaching methods and materials. This approach to
teaching mathematics methods has proven to be highly successful for several reasons, including, "The math lab approach emphasizes active learning and the use of concrete, manipulative materials. Teachers are much more likely to use this method of teaching in their own classrooms if they have had similar learning experiences as preservice teachers" (p. 49).

Attitudes impact teaching of mathematics. Although one research report found that prospective teachers have unfavorable attitudes toward mathematics (Clark-Meeks, Quisenberry, and Mouw; 1982), Wall (1985) found that they have relatively positive attitudes toward mathematics. She also reported that there is a significant relationship between attitudes toward mathematics and basic understanding of mathematics. Battista (1986) maintains that a preservice mathematics methods course can reduce mathematics anxiety. Another finding in this study is that mathematics anxiety does not inhibit preservice teachers from learning mathematical pedagogy.

In a research study designed to determine the effects on preservice teachers of learning mathematics and means of teaching mathematics through the active manipulation of materials, Fuson (1975) found that student teachers changed their attitudes, abilities, and teaching behavior as a result of instruction and use of manipulative materials in their preservice mathematics education courses.

**Staff Development in Elementary School Mathematics**

Given the need for additional instruction and preparation in order to implement an activity-based mathematics program, practicing teachers often increase their knowledge and skills through inservice training. The literature revealed several forms of inservice that have been developed for mathematics educators. The New Jersey State Department of Education has prepared a manual to help district curriculum leaders improve instruction in mathematical problem solving in middle and junior high schools. It includes the use of
models and manipulative materials (Weiland, 1985). Project SITE (Successful Inservice through Turnkey Education) was developed and implemented in New York to provide training in mathematics content and appropriate methodology to elementary school teachers in grades 2-6. The participants interact with manipulative materials to increase their own concept development and learning of mathematical skills (Berman & Friederwitzer, 1982). Mississippi State Department of Education (1985) prepared training materials to increase the instructional competencies of teachers and assistant teachers of young children. Halperin (1985) addressed the needs of teachers in a private child care center for greater competency in mathematics education and found that the participants increased their knowledge of mathematical content and their ability to plan and present mathematical activities to young children. Hollis (1985, p. 16) describes a "summer professional growth experience" which involved elementary school teachers whose goal was to increase student achievement in mathematics. Five topics were studied: diagnosis and analysis of achievement, designing instructional sequences, concrete manipulative materials, puzzles and games, and problem solving. This experience "gave these teachers both confidence and skill for teaching mathematics" (p. 17).

Good and Grouws (1987) report on the Active Mathematics Teaching model and approach to inservice training for elementary teachers, which addresses the problem that, "Some teachers had difficulty implementing the program, and there was substantial variation in the quality of implementation among users of the program" (p. 781). The inservice training program emphasized mathematics content, methods of teaching, and management issues. The form of inservice consisted of ten half-day sessions held about every two weeks during the school year. Teachers were released from their classroom responsibilities. Sessions consisted of discussion of topics and sharing information. Participants were specially instructed in ways to improve the development part of a mathematics lesson: teachers outlined and wrote a
development lesson, which was then reviewed, discussed, improved, and reproduced for all participants. The findings from this study indicated several changes in teacher behavior: teachers placed more emphasis on the development portion of their lessons, there was an increased emphasis on problem solving and mental estimation, and teachers' attitudes toward mathematics was enhanced. Student performance also improved significantly. It was their recommendation that,

> An inservice training program that combines information about mathematical concepts with recent results from studies of teacher effects and classroom management and that gives teacher time during the instructional day for extended inquiry over several months can improve mathematics instruction and student performance (p. 783).

Other research studies reveal similar findings and recommendations. Friederwitzer (1981) studied the effect of a model inservice program for the teaching of measurement concepts to third and fifth/sixth grade teachers and found that they reported using an active mode for teaching mathematics more frequently as a result of their participation in the inservice program. Bryant (1981) studied the relationship of inservice education to teachers' attitudes and pupil achievement and found that teachers in the inservice program experienced a significant gain in attitude toward mathematics as they grew in knowledge of delivering mathematics instruction. Their pupils also showed significant gains in mathematics. Watson (1981) studied the effects of modes of instruction on the attitudes and knowledge of elementary school inservice teachers. The modes of instruction included audiovisual, workshop, and programmed instruction. The findings seemed to suggest that elementary teachers profited more from the classroom teaching of an instructor. One recommendation of the study was that a variety of instructional approaches in training of teachers should be implemented to effect positive changes in their attitudes and knowledge.
In a study of factors which affect child-centered teaching, Hatch (1984) identified availability of manipulatives and familiarity with programs that demonstrate their use, specifically Mathematics Their Way, as being helpful to teachers. Of the 50 teachers in the study who were identified as being child-centered in their teaching approach, sixty-two percent mentioned as being helpful those workshops and graduate coursework that included demonstration of teaching techniques using hands-on materials, and 22% mentioned Mathematics Their Way and similar materials as enabling them to decrease their dependence on traditional programs.

**Mathematics Manipulatives**

The physical objects used in the explorations and investigations of mathematics can be almost anything from the environment, but special instructional materials, either commercially prepared or teacher-made, which represent mathematical concepts are called manipulatives. "Manipulative materials are concrete models that incorporate mathematical concepts, appeal to several senses, and can be touched and moved around by students" (Hynes, 1986, p. 11).

Mathematics manipulatives are used in many elementary classrooms, but their use is not extensive and is more prevalent in primary grades than in upper grades of elementary school (Kennedy, 1986; Scott, 1983), although research supports the use of manipulatives at all levels. In fact, Scott (1983, p. 62) stated, "It is striking to see how few teachers reported using any materials more than five times a year."

Krug (1988) investigated the relationship of elementary teachers' use of manipulative materials for mathematics instruction. The subjects were randomly selected from all elementary grades, K-5. Their use of manipulatives was determined by classroom observation. The "teacher variables" were investigated using two survey instruments. The "school
variables" were studied using a survey given to school principals. Krug found that of the variables studied, recency and amount of training contributed significantly to classroom use of manipulatives. Other variables that were significantly related to manipulatives use included teacher attitudes toward mathematics and manipulatives, grade level and teaching experience, school district policy and attitude of the building principal.

A factor affecting the use of manipulatives is the availability of such materials. A survey (Scott, 1983) was conducted to determine the use of manipulative materials by elementary teachers. Only rulers and flash cards were used by over 50% of the teachers. Three years later a similar survey was conducted to determine whether certain materials contained in purchased kits were being used by the teachers. The survey revealed that there was an increase in the number of teachers at all grade levels reporting the use of various materials. These conclusions were drawn from the 1981 and 1984 surveys:

1. While no direct cause and effect relationship was tested, the investment in mathematics materials kits and related inservice activities has been accompanied by a dramatic increase in the use of materials in addition to textbooks in the teaching of elementary mathematics.
2. There is apparently no significant correlation between years of teaching experience and the use of math materials.
3. There is no consensus among teachers as to a preferred format for inservice training (Scott, 1987, p. 24).

The literature reveals recent research in the use of manipulatives. Moore (1980) studied classroom teachers' use and modification of instructional materials for mainstreamed, handicapped students and suggested that teachers should use manipulatives to a greater extent with students working at the concrete level of learning. Parham (1983) conducted a meta-analysis of the use of manipulative materials and their relationship to student achievement in elementary school mathematics and found that of
those studies representing use of manipulative materials, students scored at approximately the 85th percentile as opposed to students not using manipulative materials who scored at the 50th percentile. The author's conclusion was that manipulative materials do have a positive effect on student achievement in mathematics. Canny (1983) investigated the relationship of manipulative materials to achievement in computation, concept development, and problem solving and found, using researcher designed tests, a significant difference between control and experimental groups in favor of the use of manipulatives for the introduction and reinforcement of concepts. On standardized tests, the only significant difference resulted on the problem solving portion of the test. In a review of research on the use of materials in elementary school, Suydam and Higgins (1977) found that, in almost half of the studies considered, students who had learned mathematics using manipulatives scored higher on achievement tests than those whose instruction did not include manipulatives. However, Moser (1980) reported that the presence of manipulatives tended to induce children to use simpler and less efficient processes in solving verbal addition and subtraction problems.

According to Driscoll (1981), manipulatives help children develop new concepts and can provide remedial assistance for students at all levels. "If there is any risk related to the use of manipulatives... it derives from their being ignored or abandoned too quickly" (Driscoll, 1981, p. 24). A number of programs and accompanying inservice workshops and resources have been developed for elementary school which place heavy emphasis on the use of manipulative materials. Mathematics Their Way by Baratta-Lorton (1976), The Fabric of Mathematics by Laycock and Watson (1975), Developing Number Concepts Using Unifix Cubes by Richardson (1984), as well as Box It or Bag It Mathematics by Burk, Snider, and Symonds (1988) and A Collection of Math Lessons by Burns (1987) all recommend introducing and developing mathematical concepts through the use of a variety of manipulatives, or
"multiembodiments" (Dienes, 1970). More recently, basal textbook series have included suggestions for the use of manipulatives along with their workbook materials during the introduction phase to new concepts (RealMath, 1985). Addison-Wesley Publishers now have two series, Math In Stride (1988) and Explorations (1988), which advocate and demonstrate the use of manipulatives materials and physical objects for teaching elementary mathematics without extensive use of paper/pencil and worksheet activities.

In summary, teachers bring with them many characteristics that determine how they teach mathematics. These influences include: (a) teachers' preservice and inservice education, which provides them with their knowledge of teaching and contributes to their belief systems, including knowledge of learning theories and classroom practices within theoretical frameworks, and (b) teachers' knowledge of and attitude toward mathematics in general and mathematics education for children in particular. These teacher characteristics must be taken into account when determining what influences individual teachers to incorporate the use of manipulatives into their repertoire of classroom activities for mathematics instruction. This comprehensive understanding of how primary grade teachers teach their students using manipulatives will form the knowledge base for the research conducted in this study.

Review of the Literature - Conclusion

Teachers are affected by many influences. Their educational background may give them the knowledge base to teach, but this knowledge is filtered through with their own individual perspectives, and is further influenced by the school settings in which they teach. Teaching is a dynamic profession, and when teachers know that they need to increase their knowledge and improve their practices in their classrooms, they often find assistance through inservice education. The rapidly increasing need for
scientific and technological knowledge motivates many teachers to take additional training in order to teach mathematics effectively. For the youngest students in schools, developing concepts in mathematics accurately and efficiently involves using a variety of models and representations called manipulatives.

Many elementary teachers have taken courses and workshops that emphasize and demonstrate the use of manipulative materials for mathematics instruction, which most realize are particularly useful for helping their students understand the concepts and principles of mathematics. Some of these teachers are able to utilize what they learn and incorporate mathematics manipulatives into their classrooms. However, there are those who are not able to do so adequately. What differentiates these teachers? What influential factors are associated with the use of manipulative materials? What causes some teachers to use manipulatives, sometimes in spite of the reaction they receive from others within the educational community? What prevents some teachers from using what they have been exposed to through inservice instruction?

Answering these questions may enable staff developers and school personnel to enhance the positive influences and inhibit the negative influences. If staff developers and school personnel can provide support it may encourage many teachers to more effectively put into practice those methods that have shown to be helpful in the development of mathematical concepts by their students. There is a need to determine what factors are associated with use of manipulative materials by teachers in elementary classrooms.
CHAPTER THREE
METHODOLOGY

Design

The intent of this study was to identify and examine the variables that may influence primary grade teachers to use manipulative materials and other physical objects in their classrooms for instruction in mathematics once they have been instructed in the use of such materials. A sample of teachers was located, and each participating teacher’s amount of manipulatives use was determined by a self-report survey instrument developed by the researcher. These same teachers were then asked to complete a questionnaire which solicited information used to examine variables in three categories. The three categories of attribute variables were identified as the independent variables. The dependent variable was the amount of manipulatives use. The independent variables were:

Teacher Role Variables

1. Educational background, which includes these components:
   A. Beliefs about learning, the role of the teacher, and classroom environment
   B. Level of formal education
   C. Degree major/emphasis
2. Years of experience in teaching, which includes:
   A. Total number of years
   B. Number of years in primary grades
3. Attitude toward mathematics education
4. Attitude toward the usefulness of manipulatives training
5. Current teaching beliefs, which includes beliefs about learning, the role of the teacher, and classroom environment

**Staff Development Variables**

1. Recency of instruction in use of mathematics manipulatives:
   A. First course/workshop
   B. Subsequent courses/workshops, if any
2. Manipulatives training:
   A. Type (Specific course/workshop)
   B. Quality of manipulative workshop
3. Follow-up from initial manipulatives training:
   A. Subsequent formal training
   B. Interest in subsequent training

**School Climate Variables**

1. Administrative policy toward manipulatives:
   A. Curricular support
   B. Availability of manipulatives
2. Support of school principal
3. Attitude of other teachers
4. Attitude of students' parents
5. Response from students

Data obtained from the sample of primary grade teachers were analyzed to determine if there was any statistically significant relationship between the independent variables and the dependent variable, use of manipulatives.
Sample

The research population consisted of teachers who are currently teaching in primary grade classrooms (kindergarten, first, and second grades or a combination of these primary grades). The sample was drawn from school districts in Oregon outside of but within a sixty-mile radius of Corvallis, and included teachers from Lincoln County, Eugene, Springfield, McMinnville, Central, Lebanon, Sweet Home, and Crowfoot School Districts.

The sample was further identified as those primary grade teachers who had participated in a course or workshop such as those entitled Mathematics Their Way, Box It or Bag It Mathematics, "Mathematics for Early Childhood," or some similar course/workshop. These workshops and mathematics education courses provide instruction and demonstration of techniques using manipulatives and physical objects which children utilize for learning mathematical concepts. Teachers participate by becoming actively involved with the manipulative materials while receiving instruction as to the rationale for and methods of using such materials. Other requirements of these workshops, besides attendance, often include reading a course book and/or other supporting information, preparing classroom materials (often referred to as "make-and-take"), and writing an instructional plan for implementing a program of instruction which incorporates hands-on use of manipulatives and other physical objects. Although such courses and workshops vary in length and requirements, most are similar as to methods of presentation and theoretical beliefs concerning the use of manipulatives. The amount of instructional time spent at this inservice training was considered adequate if participating teachers were required to attend a minimum of twelve clock hours in four separate sessions.
Sampling and Data Gathering Procedures

The steps that were followed to locate the research sample and to gather the data for this study are described below. Guidelines and recommendations for survey research outlined by Dillman (1978) were followed by the researcher.

Locating the research sample:

(1) Each school district was contacted to obtain permission to conduct the study within the district and to obtain a list of primary grade teachers. Initially, Lincoln County, Eugene, and Springfield School Districts were approached. Since each district had its own particular procedure regarding participation in research studies, several contacts were necessary. Ultimately, a packet of information (Appendix A) was prepared, which included: (1) a cover letter to the administrator in charge of research (usually the superintendent); (2) a prospectus and short version of the research proposal, which explained the study and benefits to participating districts; (3) a copy of the researcher's doctoral committee's signatures approving the research proposal; (4) a copy of the approved application for exemption, Committee for the Protection of Human Subjects; and (5) a copy of each instrument to be used in the study and accompanying cover letters.

The process of obtaining the lists of teachers from the three school districts occurred over two months. It became apparent that these districts would not supply an adequate number of teachers for the sample. As a result, McMinnville and Salem-Keizer School Districts were approached. Salem-Keizer School District declined to participate. Ultimately, three of the participating districts, Lincoln County, Springfield, and McMinnville, provided lists of primary grade teachers totaling 204 names. The research administrator in Eugene School District was unable to provide specific names, but consented to deliver envelopes containing Survey A and its cover letter.
(Appendix B) to each building principal, who was to be asked to deliver these envelopes to his/her primary grade teachers. It is unclear whether or not this actually occurred. The researcher delivered 240 copies of the Survey A packet to the research administrator. However, the response rate from Eugene teachers was 11% on this initial contact, compared to 67% from the other districts. When this low rate of return was determined, the necessity for obtaining more teachers for the sample was obvious. At that point, the researcher approached Lebanon, Sweet Home, Crowfoot, and Central School Districts, which all provided lists of names, totaling 75 additional teachers for the sample.

(2) Each of the primary grade teachers on the school district lists was mailed a copy of Survey A with an accompanying cover letter. The first group of 204 Survey A packets was mailed the first week of December, 1989, along with the 240 packets delivered to Eugene. The additional 75 Survey A packets were mailed the first week of January, 1990. There were 519 packets mailed or delivered altogether. Two hundred fourteen copies of Survey A were returned. The total rate of response equaled 47%. However, the response rate on Survey A excluding Eugene School District was 67%.

(3) When these surveys were returned to the researcher, they were sorted according to research guidelines, i.e., qualifying by grade level and adequate amount of manipulatives training. Of the 214 teachers who returned Survey A, 34 teachers were disqualified. There were 180 teachers who qualified for the research sample.

Gathering the data:

(4) As Survey A was returned and it was determined that the teacher qualified for the sample, he/she was sent another packet of materials. This packet included an instrument designed to collect data to determine the teacher's use of manipulatives referred to as Survey B (Appendix C), an accompanying cover letter which explained the survey and encouraged
participation, and a return envelope. The packet also included a response card (Appendix E), since these teachers were offered the option of having a copy of the results of the study mailed to them when it is completed. Within two weeks following mail-out of the Survey B packet, each teacher was also sent a thank-you/reminder postcard (Appendix E). There were 68 teachers who received a second copy of Survey B and a short cover letter (Appendix C) which repeated the appeal to complete and return the survey. One hundred forty-nine copies of Survey B were eventually returned, making the response rate for Survey B 83%. The time period for this phase of the study occurred from mid-December, 1989, to mid-February, 1990. Three copies of Survey B were received after the cut-off date.

(5) As each copy of Survey B was returned, it was read and scored by the researcher. There were three teachers who were disqualified from the study at this point due to inadequate responses on Survey B.

(6) Beginning February 5, 1990, each qualifying teacher who had returned a completed copy of Survey B was then mailed another packet of materials which included the Factors Questionnaire (Appendix D), an accompanying cover letter which provided more explanation of this final phase of the study, and a return envelope. A response card for the results of the study was included if one had not been returned by that individual. Thank-you/reminder postcards were again sent to each teacher within two weeks of mailing out the Factors Questionnaire packet. Altogether, 145 of these packets were mailed out. The deadline for returning the Factors Questionnaire was March 9, 1990. Ultimately, 110 questionnaires were returned, although nine copies of the Factors Questionnaire were returned after the cut-off date. The response rate for this phase of the study was 75%. In four cases the questionnaires were inadequately completed and were therefore disqualified, leaving 97 individuals whose data were included in the final analysis.
Instrumentation and Field Tests

Three instruments were developed by the researcher to gather the data needed in this study. Another instrument, the Classroom Observation form, was also developed to evaluate amount of manipulatives use for the field testing of Survey B. Guidelines were followed for developing survey and questionnaire instruments (Dillman, 1978; Leedy, 1980; Borg and Gall, 1983; Gay, 1987), as well as utilizing and adapting examples from similar research studies (Hatch, 1984; Wall; 1985; Krug, 1988). Each of these instruments was also subjected to field testing. Since the instruments used in this study have been written and developed by the researcher, concern for reliability and validity exists for each instrument. In order to establish face validity, field tests were conducted in October, November, and December, 1989, on Survey A, Survey B, and the Factors Questionnaire.

The teachers who participated in the field tests all teach primary grades in the Corvallis and Albany school districts, and qualify for the sample according to the same criteria as the research population. The teaching practices of these teachers, and especially their amount of manipulatives use, were known to either this researcher and/or to Jan Heaton, another primary mathematics consultant/primary grade teacher in Albany, Oregon. These two field testers met prior to the distribution of the field tests to discuss, clarify, and establish the procedures to be followed.

A description of each instrument and the results of the field tests follow.

Survey A (Appendix B).

This survey was written to locate those primary grade teachers who had adequate inservice education in the use of mathematics manipulatives. Since only three questions were included, the format for Survey A was a postcard. An explanatory cover letter accompanied this survey. Only face validity assessment was deemed necessary for this instrument.
Field testing for Survey A and Survey B was done on the same group of teachers. It was anticipated that feedback on Survey A would be minimal. Ultimately, 30 copies of this survey were field tested. As a result of the field tests, no changes were made to Survey A.

**Survey B** (Appendix C).

This survey was designed to determine a teacher's amount of use of manipulatives and physical objects in his/her classroom. Questions were written to assess each teacher's beliefs and practices concerning the use of manipulatives for teaching mathematics. Most of the response items utilize Likert-type scales. One set of items asks for responses of agreement or disagreement; another set asks for responses of use ranging from "never" to "always." Some written response was requested. The total scores from Survey B were used to provide data for analysis as the dependent variable, the amount of manipulatives use.

For the field testing of Survey B, it was decided by the field testers that teachers would initially be classified as high, moderate, and low amount of perceived use of manipulatives in order to insure that the instrument would be field tested at a variety of use levels. An equivalent number of high, moderate, and low manipulatives use teachers was located. Initially, each researcher had fifteen copies each of Survey A and Survey B-Version 1 (SBV1) to distribute.

Besides providing feedback to the field testers concerning the wording, style, and clarity of each instrument, the scores on SBV1 were compared. When nineteen copies had been completed and returned to this researcher, total scores were calculated. Items 1 and 2 were not intended to discriminate among levels of use, and were not given any scoring weight. It was determined that item 10 appeared to be confusing and had inconsistent or incomplete responses, and was eliminated from the scoring. Adjustments were also made for the "reversed scoring" items, numbers 4, 6, 8, 12, and 14.
(Reversed scoring means that a score of 1 indicates highest agreement or use, and a score of 5 indicates lowest agreement or use. Scores on these items were adjusted before a final score was calculated.) The total possible score for SBV1 was 95 points. There were differences among the high, moderate, and low use teachers. Those teachers classified as high use by the field testers generally scored between 85 and 95 points; those classified as low use teachers generally scored between 45 and 70 points. The moderate use teachers' scores generally fell between 70 and 85 points. There were two exceptions to the field testers' expectations. One teacher classified as low use actually scored 92 points, and one teacher initially classified as moderate use scored 92 as well. It was decided that these two teachers' use of manipulatives would be evaluated by the field testers using the Classroom Observation form (Appendix C), developed by the researcher, in order to determine if their initial manipulatives use classification was substantially inaccurate.

The results of Survey B-Version 1 were further analyzed according to a procedure entitled "An Index of Item Discrimination" described in Gage and Berliner (1984, pp. 722-723), comparing the scores on each item of highest and lowest participants. It was determined that SBV1 items 4, 5, 6, 9, 10, 16, and 20 were not discriminating sufficiently between high use and low use teachers. It was also determined that item 21, concerning teachers' planning strategies, was not effectively identifying an individual's actual strategies because it seemed to give the teachers a choice they may not otherwise have included. Item 22, concerning classroom use of manipulatives during specific lessons, was also providing teachers more choices and information than they may have initiated on their own, and was therefore thought to be ineffective for the purpose of this survey.

As a result of this analysis, revisions were made to Survey B. Items 1 and 2 were left unchanged; these items serve as an introduction to the survey and are designed to encourage a positive attitude toward it. Items 3, 8, 11, 13,
and 19 were left unchanged. Items 4, 5, 6, and 9, 10, 15, 16, and 20 were eliminated. Items 7, 12, 14, 17, 18 were reworded, reordered, and/or renumbered for clarity and/or emphasis. Some new items were added (items 4, 6, 8, and 16 on Survey B-Version 2 (SBV2). Item 18 concerning planning strategies was reworded. One response option was changed from "I observe the children in my class and base my plans on their needs," to "Other (Please describe)" in order to solicit individual information. The item concerning classroom lessons using manipulatives was redesigned to be a "fill-in" type of question in order to solicit information from the teacher's own experience. Therefore, as a result of the changes made to the original version, SBV2 shortened from 23 to 20 items; the last item on each survey was one for individual comments.

Survey B-Version 2 (SBV2) was then distributed in the same manner as was SBV1, utilizing 12 more teachers considered to be high, moderate, and low manipulatives use teachers. When 11 copies of SBV2 were completed and returned, this researcher and the consultant/teacher assisting with the field testing met again to score and analyze the results. Total scores were calculated for these 11 teachers. No items were eliminated from scoring, but item 19 was calculated separately, as described below. Eighteen items were included in the scoring; each item had a maximum point value of 5. The total possible points for SBV2 was 90 points. After adjusting the reversed scoring items, the total scores ranged from 82 as the highest score to 51 as the lowest. The manipulatives use level anticipated by the field testers for these teachers was basically consistent with their expectations: the "lows" scored low, but the "highs" were somewhat lower than expected, more in the "moderate" range. This is perhaps explained by the fact that most of the high manipulatives use teachers known to the field testers had participated in the previous field test. Another phenomenon noted on both field tests was that kindergarten teachers whom the field testers expected to be in the moderate or low range tended to score moderately high. Two of the teachers from the
field test of SBV2 were also selected to be included in the manipulatives use evaluation using the Classroom Observation instrument.

The item discrimination procedure described previously was again used on items 3 through 17 of Survey B-Version 2. The top five scores were compared item by item with the lowest five scores. As a result of this analysis, it was determined that item 4, a new item on this version, did not discriminate level of manipulatives use and was eliminated. Item 9 was also eliminated because it seemed to ask for the same response as item 3. For the final version, items 4 and 5 from the Survey B-Version 1 were again included; the discrimination score on these two items equaled the score of other items included in the final version. Items 10 through 20 were left unchanged.

Special attention was given to the two items which called for written responses. Item 18, concerning planning strategies, solicited a greater variety of responses when "Other (Please describe)" was included. It was decided that this written response was more indicative of a teacher's actual planning strategies. Item 19, which asked teachers to write an example of a lesson using manipulatives, was specially analyzed by the two field testers. Using the scoring device for item 19 (Appendix C) as their guide, each field tester separately read and scored the written responses and then compared scores. Their scoring turned out to be the same for all except two field test participants, differing by two points on each item; after some discussion, consensus was reached on these two papers as well. From this analysis, it was decided that the score on item 19 would not be included with the total individual score for Survey B, but could be used as descriptive information.

As a result of the field testing and its analyses, it was determined that the final version of Survey B would sufficiently discriminate different amounts of manipulatives use.

Factors Questionnaire (Appendix D).

This questionnaire was designed to collect data for the independent
variables. The instrument was developed in sections which parallel the categories of the independent variables: teacher role characteristics, staff development, and school climate, and also includes sections for written responses and demographics. A variety of questions and response types were utilized.

The field testing of the Factors Questionnaire was conducted in November and December, 1989. Eight primary grade teachers who met the sampling criteria and whose teaching practices were well known to the researcher were asked to participate in the field testing. Four teachers were given the questionnaire to fill out on their own. When these teachers completed the questionnaire, they were interviewed as to its content, wording, clarity, and style. Four of these teachers were asked to complete the questionnaire while the researcher observed them but provided no clarifying information or direction. These four teachers were also interviewed for feedback. From all of these interviews, the teachers' feedback was carefully considered and most of the suggestions were incorporated into the final version of the questionnaire.

As a result of this field testing, some revision was made. Most of the changes were mechanistic for reasons of clarity and/or emphasis. The items in the Final Version were renumbered; items of the same response type were numbered and identified by letters in outline form. This made the questionnaire appear to have fewer items. Some rewording was done to improve the directions, simplify the questions, and/or to eliminate confusion, such as including the words Strongly Disagree, Mildly Disagree, Neither Agree or Disagree, Mildly Agree, and Strongly Agree on the questions which ask for degree of agreement. Factors Questionnaire - Field Test Version items 12, 61, and 64 were eliminated from the final version of the Factors Questionnaire as they were deemed too confusing or repetitive. One question was included (item 32 in the Final Version) which asks for information about the principal's support of manipulatives when the teacher was "first getting into
manipulatives." Several of those field tested expressed concern about this, since their current administrators differed in attitude from their former ones. Item 32 in the Field Test Version was changed from "Do you have anything to say about the manipulatives course or workshop you first took?" to "What impact did this initial manipulatives workshop have on you?" (item 22 in the Final Version) to encourage more written response.

When these revisions were made, the Factors Questionnaire was judged to be sufficiently effective for use in this study. This final version was prepared and mailed to those teachers who qualified for the final phase of the study.

Classroom Observation Form (Appendix C)

Another instrument was developed to evaluate the reliability of Survey B for the field testing. Following the example in Krug's (1988) study, a scoring instrument was devised for verification by classroom observation of amount of manipulatives use. Ten teachers from the field test sample were contacted by the field testers to request permission to visit their classrooms. The Classroom Observation form was used to score the classroom environment for evidence of manipulatives use for mathematics instruction. The results from this classroom observation were compared with the results from the field tests of Survey B. In each case, the results of Survey B compared reliably to the results from the classroom observation. In four cases, the teacher's score on Survey B had differed substantially from the field tester's preconception of that individual's amount of manipulatives use. However, when the classroom observation form was used, the amount of manipulatives use was more evident, and the field tester's perceptions changed to agree with the score on Survey B.
Hypotheses and Analysis

The researcher examined the related literature and arrived at a prediction that there are three categories of variables that are related to and may explain the variance in teachers' use of manipulatives for mathematics instruction. These three categories are: teacher role characteristics, staff development, and school climate. In each category there are several variables, described previously. The research hypotheses were:

1. There is no relationship between teacher role variables and the use of manipulatives.
2. There is no relationship between staff development variables and the use of manipulatives.
3. There is no relationship between school climate variables and the use of manipulatives.

For each independent variable, statistical analysis was performed using one-way analysis of variance (ANOVA) for the categorical variables and Pearson Product Moment correlation for the continuous variables to determine if there were any significant relationships between the independent variables and the dependent variable, use of manipulatives. For those independent variables proving to be statistically significant at the .05 level, multiple regression analysis was performed. Multiple regression is a statistical technique that is used to analyze the relationship between a dependent variable and sets of independent variables. For all of these statistical analysis procedures, a confidence level of .05 was utilized to reject the null hypotheses.
A model of multiple regression for the three categories of independent variables with respect to the dependent variable appears below in Figure 1.

Figure 1. Model of multiple regression

Teacher Role
Variables

Staff Development
Variables

School Climate
Variables

Use of
Manipulatives
CHAPTER FOUR
RESULTS AND ANALYSIS

The purpose of this study was to identify and examine the teacher role variables, staff development variables, and school climate variables that may be associated with the use of manipulative materials for mathematics instruction by primary grade elementary teachers. Data were collected from 97 primary grade teachers in eight school districts in Oregon. These 97 teachers were given Survey B, a self-report survey instrument developed by the researcher, to determine their amount of manipulatives use. The scores on this survey served as data for the dependent variable. These teachers also completed the Factors Questionnaire, another instrument developed by the researcher, to gather the data for the independent variables.

Data analysis was performed using one-way analysis of variance on the categorical variables. Pearson Product Moment correlation coefficients (r) were calculated for the continuous variables. A multiple regression model was used to analyze those independent variables found to be statistically significant. The Statistical Package for the Social Sciences (SPSS/PC+), Version 2.0, was used to perform the data analysis. All statistical analyses used a .05 level of significance.

Results

The first section of this chapter will describe the dependent and independent variables in terms of this sample of primary grade teachers.
Dependent Variable

The dependent variable in this study was the amount of manipulatives use for mathematics instruction by primary grade teachers, measured by a self-report survey instrument developed by the researcher referred to as Survey B. There were 97 teachers whose scores were calculated and included in the data analysis with respect to the independent variables. There were 16 items used in the scoring, items 3 through 18; each item ranged in value from 1 to 5. The highest possible score was 80; the lowest possible score was 16. The range of scores for this sample was from 41 to 80. The mean score was 65.55, with a standard deviation of 8.12. Reliability (internal consistency) analysis was done on Survey B using Cronbach's alpha index of reliability with 147 completed surveys from the population sample (including the 97 used in the analysis of the independent variables). The reliability coefficient for Survey B was .79.

Independent Variables

Each variable will be described as it was defined by the Factors Questionnaire (Appendix D), and results on each variable will be reported.

Teacher Role Variables
1. Educational background
   A. Beliefs about learning, the role of the teacher, and classroom environment

   This variable was defined on the Factors Questionnaire by items 1AB - Beliefs about learning, part 1; 2AB - Role of the teacher, part 1; and 3AB - Classroom environment, part 1. Part 1 in each item asked for the teacher to consider two descriptions of approaches to education and select the one which was advocated in his/her initial teacher training. One approach was
intended to represent child-centered theory and practice; the other approach was intended to be less child-centered. The results in percentage of response were:

<table>
<thead>
<tr>
<th></th>
<th>Child-centered</th>
<th>Not child-centered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beliefs about learning</td>
<td>14.6</td>
<td>85.4</td>
</tr>
<tr>
<td>Role of the teacher</td>
<td>33.0</td>
<td>56.7</td>
</tr>
<tr>
<td>Classroom environment</td>
<td>29.9</td>
<td>58.8</td>
</tr>
</tbody>
</table>

Composite scores were also calculated for this variable. The score was based on an average of three items (beliefs); each score was scaled 0 to 1. Therefore, the possible maximum score was 1.00; the possible minimum score was 0. The results were:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number responding (n)</td>
<td>92</td>
</tr>
<tr>
<td>Mean</td>
<td>.28</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>.34</td>
</tr>
<tr>
<td>Minimum score</td>
<td>0.00</td>
</tr>
<tr>
<td>Maximum score</td>
<td>1.00</td>
</tr>
</tbody>
</table>

B. Level of formal education

This variable was defined by Factors Questionnaire item 4, which asks the teacher to indicate the highest level of formal education he/she had attained. The results were:

<table>
<thead>
<tr>
<th></th>
<th>Percent of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor's degree</td>
<td>17.5</td>
</tr>
<tr>
<td>Bachelor's plus 30 or more credits</td>
<td>18.6</td>
</tr>
<tr>
<td>Bachelor's plus 45 credits or Master's</td>
<td>42.3</td>
</tr>
<tr>
<td>Master's degree plus 30 or more credits</td>
<td>19.6</td>
</tr>
<tr>
<td>Doctorate degree</td>
<td>1.0</td>
</tr>
</tbody>
</table>

C. Degree major/emphasis

This variable was defined on the Factors Questionnaire by item 5ABC, which asked the teachers to indicate degree majors and areas of specialization, if any. Responses were coded as: (1) Education, Elementary
Education, or Curriculum and Instruction as bachelor's degree major; (2) any reference to Early Childhood or Child Development specialization or training; and (3) Other. The results were:

<table>
<thead>
<tr>
<th></th>
<th>Percent of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education, Elementary Ed, C/I</td>
<td>59.8</td>
</tr>
<tr>
<td>Early Childhood/Child Development</td>
<td>23.7</td>
</tr>
<tr>
<td>Other</td>
<td>16.5</td>
</tr>
</tbody>
</table>

2. Years of experience in teaching

A. Total number of years

This variable was defined on the Factors Questionnaire by item 38, which asked the teacher how many years he/she had been teaching. The results were:

<table>
<thead>
<tr>
<th></th>
<th>Percent of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is my first year</td>
<td>0.0</td>
</tr>
<tr>
<td>One-four years</td>
<td>14.4</td>
</tr>
<tr>
<td>Five-ten years</td>
<td>16.5</td>
</tr>
<tr>
<td>Ten-fifteen years</td>
<td>29.9</td>
</tr>
<tr>
<td>Fifteen years or more</td>
<td>38.1</td>
</tr>
</tbody>
</table>

B. Number of years in primary grades

This variable was defined on the Factors Questionnaire by item 39, which asked the teacher how many years he/she had been teaching at the primary grade level (kindergarten, first, second grades or combination of these). The results were:

<table>
<thead>
<tr>
<th></th>
<th>Percent of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is my first year</td>
<td>1.0</td>
</tr>
<tr>
<td>One-four years</td>
<td>22.7</td>
</tr>
<tr>
<td>Five-ten years</td>
<td>22.7</td>
</tr>
<tr>
<td>Ten-fifteen years</td>
<td>20.6</td>
</tr>
<tr>
<td>Fifteen years or more</td>
<td>32.0</td>
</tr>
</tbody>
</table>

3. Attitude toward mathematics education

This variable was defined on the Factors Questionnaire by a composite
score of Likert-type scale responses of strongly disagree (score of 1) to strongly agree (score of 5) on items 8A, 8B, 8C, 8D, 8E, 8F, 8G, 8H, 8I, and 8K. All of these items asked the teachers to evaluate their agreement or disagreement with statements about mathematics and mathematics education. Some of the items (8B, 8C, 8G, 8H, and 8K) were recoded in the analysis to maintain consistency, i.e., a score of 5 represented a highly positive attitude and a score of 1 represented a low attitude towards mathematics. The results of the composite scores were:

<table>
<thead>
<tr>
<th>Number responding (n)</th>
<th>96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.36</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.48</td>
</tr>
<tr>
<td>Minimum score</td>
<td>2.40</td>
</tr>
<tr>
<td>Maximum score</td>
<td>4.50</td>
</tr>
</tbody>
</table>

4. Attitude toward the usefulness of manipulatives training

This variable was defined on the Factors Questionnaire by a composite score of Likert-type scale responses of strongly disagree (score of 1) to strongly agree (score of 5) as well as ordinal scale items ranging from low (score of 1) to high (score of 5). All of these items (14, 19, 8J, 21A, and 27) asked the teachers to either evaluate their agreement or disagreement with statements about the usefulness of their manipulatives training, or their response to the usefulness of the information and materials acquired at their manipulatives workshop. Item 21A was recoded in the analysis to maintain consistency. The results of the composite scores were:

<table>
<thead>
<tr>
<th>Number responding (n)</th>
<th>97</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.87</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.70</td>
</tr>
<tr>
<td>Minimum score</td>
<td>2.33</td>
</tr>
<tr>
<td>Maximum score</td>
<td>5.00</td>
</tr>
</tbody>
</table>

5. Current teaching beliefs

This variable was defined on the Factors Questionnaire by items 1AB -
Beliefs about learning, part 2; 2AB - Role of the teacher, part 2; and 3AB - Classroom environment, part 2. Part 2 in each item asked for the teacher to consider two descriptions of approaches to education and select the one which best describes the way he/she teaches now. Again, one approach was intended to represent child-centered theory and practice; the other approach was intended to be less child-centered. The results in percentage of response were:

<table>
<thead>
<tr>
<th>Beliefs</th>
<th>Child-centered</th>
<th>Not child-centered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beliefs about learning</td>
<td>67.0</td>
<td>23.7</td>
</tr>
<tr>
<td>Role of the teacher</td>
<td>75.3</td>
<td>18.6</td>
</tr>
<tr>
<td>Classroom environment</td>
<td>84.5</td>
<td>8.2</td>
</tr>
</tbody>
</table>

Composite scores were also calculated for this variable. The score was based on an average of three items (beliefs); each score was scaled 0 to 1. Therefore, the possible maximum score was 1.00; the possible minimum score was 0. The results were:

- Number responding (n) = 92
- Mean = .82
- Standard deviation = .27
- Minimum score = 0.00
- Maximum score = 1.00

**Staff Development Variables**

1. Recency of instruction in use of mathematics manipulatives
   
   **A. First course/workshop**

   This variable was defined on the Factors Questionnaire by item 11 which asked the teacher when he/she took his/her first manipulatives course/workshop. The results were:

<table>
<thead>
<tr>
<th>Percent of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the past year</td>
</tr>
<tr>
<td>One-three years ago</td>
</tr>
</tbody>
</table>
Four-six years ago 33.0
Seven-ten years ago 19.6
More than ten years ago 7.2

B. Subsequent courses/workshops, if any

This variable was defined on the Factors Questionnaire by item 24 which asked the teacher when he/she took his/her most recent manipulatives course/workshop subsequent to the first workshop, if any. There were 48 teachers who responded to this item. The results were:

<table>
<thead>
<tr>
<th>Percent of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the past year</td>
</tr>
<tr>
<td>One-three years ago</td>
</tr>
<tr>
<td>Four-six years ago</td>
</tr>
<tr>
<td>Seven-ten years ago</td>
</tr>
<tr>
<td>More than ten years</td>
</tr>
</tbody>
</table>

2. Manipulatives training:
   
   A. Type (Specific course/workshop)

   This variable was defined on the Factors Questionnaire by item 9A, which asked the teacher to list the name of the initial manipulatives course or workshop he/she had attended. The responses were coded as (0) None listed; (1) Mathematics Their Way; (2) Box It/Bag It Mathematics; (3) "Mathematics for Early Childhood"; and (4) Other. The results were:

<table>
<thead>
<tr>
<th>Percent of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>None listed</td>
</tr>
<tr>
<td>Mathematics Their Way</td>
</tr>
<tr>
<td>Box It/Bag It Mathematics</td>
</tr>
<tr>
<td>Math For Early Childhood</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

   B. Quality of manipulative workshop

   This variable was defined on the Factors Questionnaire by a composite score of Likert-type scale responses of strongly disagree (score of 1) to strongly agree (score of 5) as well as ordinal scale items ranging from low
(score of 1) to high (score of 5). All of these items (10, 17, 18, 21B, 21C, 21D, and 21E) asked the teachers to either evaluate their agreement or disagreement with statements about the effectiveness of their manipulatives training (including the instructor's effectiveness), or the quality of the information and activities at their manipulatives workshop. Items 21C and 21E were recoded in the analysis to maintain consistency. Item 20 was also included in the composite score. This item asked teachers whether certain assignments or homework were required, such as reading the course book, articles, and handouts, writing a paper or instructional plan, and/or completing "make-and-take" projects. For the analysis of item 20, the responses were tallied and the score was scaled to fit the 1 to 5 scoring values. The results of the composite scores were:

| Number responding (n) | 97 |
| Mean                  | 3.78 |
| Standard deviation    | .54 |
| Minimum score         | 1.80 |
| Maximum score         | 4.60 |

3. Follow-up from initial manipulatives training

A. Subsequent formal training

This variable was defined on the Factors Questionnaire by item 23 which asked the teacher how many subsequent manipulatives courses/workshops he/she had taken. The results were:

<table>
<thead>
<tr>
<th>Percent of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>No other courses</td>
</tr>
<tr>
<td>No courses/attended &quot;support groups&quot;</td>
</tr>
<tr>
<td>One course</td>
</tr>
<tr>
<td>Two courses</td>
</tr>
<tr>
<td>Three courses</td>
</tr>
</tbody>
</table>

B. Interest in subsequent training

This variable was defined on the Factors Questionnaire by item 28,
which asked the teacher how likely he/she was to take another course that may extend and/or support his/her use of manipulatives. The results were:

<table>
<thead>
<tr>
<th>Percent of response</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all likely</td>
<td>2.1</td>
</tr>
<tr>
<td>Not too likely</td>
<td>5.2</td>
</tr>
<tr>
<td>May or may not take one</td>
<td>13.4</td>
</tr>
<tr>
<td>Somewhat likely</td>
<td>33.0</td>
</tr>
<tr>
<td>Very likely</td>
<td>43.3</td>
</tr>
</tbody>
</table>

**School Climate Variables**

1. Administrative policy toward manipulatives
   
   A. Curricular support
      
      This variable was defined on the Factors Questionnaire by a composite score of Likert-type scale responses of strongly disagree (score of 1) to strongly agree (score of 5) on items 37A, 37B, and 37D. All of these items asked the teachers to evaluate their agreement or disagreement with statements about the degree of curricular support provided by their districts for teaching mathematics using manipulatives. Items 37A and 37D were recoded in the analysis to maintain consistency. The results for the composite scores were:

      |                                 |     |
      | Number responding (n)           | 96  |
      | Mean                            | 3.26|
      | Standard deviation              | 0.64|
      | Minimum score                   | 1.67|
      | Maximum score                   | 5.00|

   B. Availability of manipulatives
      
      This variable was defined on the Factors Questionnaire by a composite score of items 30, 31, and 37C of Likert-type scale responses of strongly disagree (score of 1) to strongly agree (score of 5) as well as ordinal scale items ranging from low (score of 1) to high (score of 5). These items asked the teachers to either evaluate their agreement or disagreement with a statement about the availability of manipulatives, or the amount of
mathematics materials provided by the district. Items 31 and 37C were recoded in the analysis to maintain consistency. The results for the composite scores were:

<table>
<thead>
<tr>
<th>Number responding (n)</th>
<th>96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.79</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>.79</td>
</tr>
<tr>
<td>Minimum score</td>
<td>1.00</td>
</tr>
<tr>
<td>Maximum score</td>
<td>4.67</td>
</tr>
</tbody>
</table>

2. Support of school principal

This variable was defined on the Factors Questionnaire by a composite score of items 32, 33, and 37E of Likert-type scale responses of strongly disagree (score of 1) to strongly agree (score of 5) as well as ordinal scale items ranging from low (score of 1) to high (score of 5). These items asked the teachers to either evaluate their agreement or disagreement with a statement about perceived support from their principal, or their principal's perceived position on the use of manipulatives for mathematics instruction. Item 37E was recoded in the analysis to maintain consistency. The results for the composite scores were:

<table>
<thead>
<tr>
<th>Number responding (n)</th>
<th>97</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.99</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>.66</td>
</tr>
<tr>
<td>Minimum score</td>
<td>2.00</td>
</tr>
<tr>
<td>Maximum score</td>
<td>5.00</td>
</tr>
</tbody>
</table>

3. Attitude of other teachers

This variable was defined on the Factors Questionnaire by a composite score of items 35, 37F, and 37G of Likert-type scale responses of strongly disagree (score of 1) to strongly agree (score of 5) as well as an ordinal scale item ranging from low (score of 1) to high (score of 5). These items asked the teachers to either evaluate their agreement or disagreement with a statement about their perception of other teachers' attitudes toward manipulatives, to
evaluate how much they were influenced by other teachers, or to describe how often they met with other teachers to discuss teaching practices and ideas. The results for the composite scores were:

<table>
<thead>
<tr>
<th>Number responding (n)</th>
<th>97</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.62</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>.76</td>
</tr>
<tr>
<td>Minimum score</td>
<td>1.00</td>
</tr>
<tr>
<td>Maximum score</td>
<td>5.00</td>
</tr>
</tbody>
</table>

4. Attitude of student's parents

This variable was defined on the Factors Questionnaire by a composite score of items 36, 37H, 37I and 37J of Likert-type scale responses of strongly disagree (score of 1) to strongly agree (score of 5) as well as to one ordinal scale item ranging from low (score of 1) to high (score of 5). These items asked the teachers to evaluate their agreement or disagreement with a statement about their perceived support from students' parents toward the use of manipulatives for mathematics instruction, to describe how confident they feel about explaining to parents why manipulatives are useful, or to describe how often they provide parent education about teaching practices and beliefs other than at report card conferences. Items 37H and 37J were recoded in the analysis to maintain consistency. The results for the composite scores were:

<table>
<thead>
<tr>
<th>Number responding (n)</th>
<th>97</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.78</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>.70</td>
</tr>
<tr>
<td>Minimum score</td>
<td>1.75</td>
</tr>
<tr>
<td>Maximum score</td>
<td>5.00</td>
</tr>
</tbody>
</table>

5. Response from students

This variable was defined on the Factors Questionnaire by a composite score of items 37K, 37L, and 37M of Likert-type scale responses of strongly disagree (score of 1) to strongly agree (score of 5). These items asked the teachers to evaluate their agreement or disagreement with statements about
their perceived responses from their students when they used manipulatives for mathematics instruction. Item 37L was recoded in the analysis to maintain consistency. The results for the composite scores were:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number responding (n)</td>
<td>94</td>
</tr>
<tr>
<td>Mean</td>
<td>4.07</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>.56</td>
</tr>
<tr>
<td>Minimum score</td>
<td>2.67</td>
</tr>
<tr>
<td>Maximum score</td>
<td>5.00</td>
</tr>
</tbody>
</table>

**Descriptive Information**

Data were collected by the Factors Questionnaire that was not included as part of the analysis of the independent variables, but provides descriptive information about the sample for this study. This information will be reported in three sections related to the categories of independent variables. A section reporting the results of the written responses follows. Another section which reports the results of the demographic data concludes the descriptive information.

**Teacher Role Characteristics**

Items 6 and 7 on the Factors Questionnaire asked teachers to think about their initial teacher training/education and any subsequent coursework and/or workshops. In item 6 they were to indicate if each the listed items was or was not a significant influence on their current teaching style and practice. Item 6E was "Other (specify)" to allow teachers to fill in any influences not listed. The results, in percentage of response were:

<table>
<thead>
<tr>
<th></th>
<th>Yes, significant</th>
<th>No, not significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>College training/certification</td>
<td>41.2</td>
<td>58.8</td>
</tr>
<tr>
<td>Post-bachelors' college work</td>
<td>57.7</td>
<td>29.9</td>
</tr>
<tr>
<td>Workshops, seminars, etc.</td>
<td>96.9</td>
<td>3.1</td>
</tr>
</tbody>
</table>
When these teachers were asked in item 7 to specify which of the above educational experiences was most influential in developing their current teaching beliefs and practices, the results were:

<table>
<thead>
<tr>
<th>Educational Experience</th>
<th>Percent of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>College training/certification</td>
<td>3.1</td>
</tr>
<tr>
<td>Post-bachelors' college work</td>
<td>9.3</td>
</tr>
<tr>
<td>Workshops, seminars, etc.</td>
<td>70.1</td>
</tr>
<tr>
<td>District-provided instruction</td>
<td>6.2</td>
</tr>
<tr>
<td>Other</td>
<td>7.2</td>
</tr>
</tbody>
</table>

**Staff Development**

Items 12 and 13 asked the teachers to evaluate their motivation for taking the manipulatives workshop. For item 12 they were asked to indicate if each motivation listed was or was not a significant influence for taking the workshop. Item 12E was "Other (specify)" to allow teachers to fill in any motivations not listed. The results, in percentage of response, were:

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Yes, significant</th>
<th>No, not significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal/professional interest</td>
<td>94.8</td>
<td>5.2</td>
</tr>
<tr>
<td>Required for teaching assignment</td>
<td>25.8</td>
<td>74.2</td>
</tr>
<tr>
<td>To improve math teaching</td>
<td>97.9</td>
<td>1.0</td>
</tr>
<tr>
<td>To earn college credits</td>
<td>44.3</td>
<td>54.6</td>
</tr>
<tr>
<td>Other</td>
<td>17.5</td>
<td>82.5</td>
</tr>
</tbody>
</table>

When these teachers were asked in item 13 to specify which of the above motivations was the most influential reason for taking the manipulatives workshop, the results were:

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Percent of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal/professional interest</td>
<td>20.6</td>
</tr>
<tr>
<td>Required for teaching assignment</td>
<td>9.3</td>
</tr>
<tr>
<td>To improve math teaching</td>
<td>64.9</td>
</tr>
<tr>
<td>To earn college credits</td>
<td>1.0</td>
</tr>
<tr>
<td>Other</td>
<td>4.1</td>
</tr>
</tbody>
</table>
Items 15 and 16 on the Factors Questionnaire asked teachers to describe how they found out about the manipulatives workshop. In item 15 they were to indicate if each of the listed items was or was not a source of information. Item 15E was "Other (specify)" to allow teachers to fill in any source not listed. The results, in percentage of response were:

<table>
<thead>
<tr>
<th>Source</th>
<th>Yes, a source</th>
<th>No, not a source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional books or resources</td>
<td>22.7</td>
<td>76.3</td>
</tr>
<tr>
<td>Professional colleagues</td>
<td>79.4</td>
<td>19.6</td>
</tr>
<tr>
<td>Professional conferences/workshops</td>
<td>35.1</td>
<td>63.9</td>
</tr>
<tr>
<td>School district, which promoted it</td>
<td>67.0</td>
<td>32.0</td>
</tr>
<tr>
<td>Other</td>
<td>12.4</td>
<td>86.6</td>
</tr>
</tbody>
</table>

When these teachers were asked in item 16 to specify which of the above sources was most informative or influential for motivating them to take the workshop, the results were:

<table>
<thead>
<tr>
<th>Source</th>
<th>Percent of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional books or resources</td>
<td>8.2</td>
</tr>
<tr>
<td>Professional colleagues</td>
<td>48.5</td>
</tr>
<tr>
<td>Professional conferences/workshops</td>
<td>5.2</td>
</tr>
<tr>
<td>School district, which promoted it</td>
<td>33.0</td>
</tr>
<tr>
<td>Other</td>
<td>4.1</td>
</tr>
</tbody>
</table>

Items 25 and 26 asked the teachers to evaluate their motivation for taking subsequent manipulatives training beyond their initial workshop. For item 25 they were to indicate if each motivation listed was or was not a significant influence for taking subsequent training. Item 25E was "Other (specify)" to allow teachers to fill in any motivations not listed. There were 48 teachers who responded to this item. The results, in percentage of response, were:

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Yes, significant</th>
<th>No, not significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal/professional interest</td>
<td>97.9</td>
<td>2.1</td>
</tr>
<tr>
<td>Required for teaching assignment</td>
<td>21.3</td>
<td>78.7</td>
</tr>
<tr>
<td>To improve math teaching</td>
<td>100.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
To earn college credits 42.6 57.4
Other 6.3 93.8

When these teachers were asked in item 26 to specify which of the above motivations was the most influential reason for taking the subsequent training, the results were:

<table>
<thead>
<tr>
<th>Percent of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal/professional interest 16.7</td>
</tr>
<tr>
<td>Required for teaching assignment 6.3</td>
</tr>
<tr>
<td>To improve math teaching 72.9</td>
</tr>
<tr>
<td>To earn college credits 2.1</td>
</tr>
<tr>
<td>Other 2.1</td>
</tr>
</tbody>
</table>

**School Climate**

Item 29 asked teachers how much release or inservice time per school year is given by their district/building for curriculum and teaching improvement. Item 29F was "Other (specify)" to allow teachers to fill in any amount not listed. The results were:

<table>
<thead>
<tr>
<th>Percent of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>No release time at all 20.6</td>
</tr>
<tr>
<td>Four hours, one-half day, or less 9.3</td>
</tr>
<tr>
<td>One full teaching day, five-eight hours 25.8</td>
</tr>
<tr>
<td>Two-three teaching days, or equivalent 21.6</td>
</tr>
<tr>
<td>More than three teaching days 6.2</td>
</tr>
<tr>
<td>Other 4.1</td>
</tr>
</tbody>
</table>

Item 34 asked teachers to indicate how supportive they felt their principal was of their methods of teaching (not just related to mathematics instruction and manipulatives). The results were:

<table>
<thead>
<tr>
<th>Percent of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not supportive at all 1.0</td>
</tr>
<tr>
<td>Minimally supportive 2.1</td>
</tr>
<tr>
<td>Somewhat supportive 5.2</td>
</tr>
<tr>
<td>Quite supportive 24.7</td>
</tr>
<tr>
<td>Very supportive 66.0</td>
</tr>
</tbody>
</table>
Written responses

There were two items on the Factors Questionnaire which asked for a written response. Most of the teachers wrote something, although there were some who left these questions blank. The teachers' responses were read, categorized, and tallied by the researcher, and in some cases the response was tallied in more than one category. The results of this subjective analysis are reported here.

Item 22 on the Factors Questionnaire followed items related to the initial manipulatives workshop these teachers reported to have taken. This question asked: What impact did this initial manipulatives workshop have on you?

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manipulatives workshop was in some way useful for teaching students; it enabled teacher to help students to understand math better; it changed teacher's approach</td>
<td>42</td>
</tr>
<tr>
<td>Workshop helped the teacher to understand how and why to use manipulatives for mathematics instruction; teacher uses manipulatives instead of text or as a supplement to it</td>
<td>25</td>
</tr>
<tr>
<td>It made math more fun, math concepts were more understandable; problem solving is integrated into teaching</td>
<td>21</td>
</tr>
<tr>
<td>It helped the teacher better understand how children learn</td>
<td>4</td>
</tr>
<tr>
<td>It motivated the teacher to try something new</td>
<td>1</td>
</tr>
<tr>
<td>Workshop was somewhat overwhelming</td>
<td>3</td>
</tr>
<tr>
<td>Still using district approach (workbooks), not totally &quot;sold on it&quot;</td>
<td>2</td>
</tr>
<tr>
<td>Not much impact - already using manipulatives</td>
<td>1</td>
</tr>
</tbody>
</table>
Item 42 on the Factors Questionnaire asked: What do you believe is the most significant factor influencing the way you teach mathematics in your classroom? The categorized responses were:

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students' response to manipulatives: they seem to learn and enjoy math more using manipulatives</td>
<td>35</td>
</tr>
<tr>
<td><em>Mathematics Their Way</em> book, author, and workshop, and the excitement for math generated by it, including other manipulatives workshops</td>
<td>32</td>
</tr>
<tr>
<td>Teacher's beliefs, philosophy, style, and/or experience, including early childhood or special education background</td>
<td>22</td>
</tr>
<tr>
<td>Teacher's study or research about learning, including ITIP training</td>
<td>5</td>
</tr>
<tr>
<td>Teacher's like/dislike of math - desire to help students enjoy it</td>
<td>5</td>
</tr>
<tr>
<td>District curriculum and requirements, including support and availability of materials</td>
<td>14</td>
</tr>
<tr>
<td>Other teachers' influence and support</td>
<td>6</td>
</tr>
<tr>
<td>Classroom realities, including range of student abilities, management, and control</td>
<td>8</td>
</tr>
<tr>
<td>Combination of teacher's ideas, <em>Math Their Way</em>, and district support</td>
<td>1</td>
</tr>
</tbody>
</table>

**Demographic Information**

Item 40 on the Factors Questionnaire asked the teacher to specify to which age group he/she belongs. The results were:
Item 41 on the Factors Questionnaire asked the teacher to identify his/her gender. The results were:

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td>95</td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
</tr>
</tbody>
</table>

Analysis

Results of Pearson Correlations

Pearson Product Moment correlation coefficients (r) were calculated to find significant linear relationships between the dependent variable, teachers' use of manipulatives, and the independent variables whose values were based on continuous data.

Several significant positive correlations can be seen by examining Table 1. In the category of Teacher Role Variables, attitude toward the usefulness of manipulatives training was highly correlated with the teachers' use of manipulatives. This means that if a teacher had a positive attitude toward the usefulness of the manipulatives training, he/she also had a higher score on the dependent variable, use of manipulatives. There was also a highly positive correlation between a teacher's current teaching beliefs and his/her use of manipulatives. Again, this means that if a teacher's current teaching beliefs score was higher (i.e., positive toward child-centered philosophy and practice), then his/her score on the dependent variable, use of
Table 1

Data for Pearson Correlations of teachers' use of manipulatives to teacher role, staff development, and school climate variables

Teachers' use of manipulatives (dependent variable)

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>correlation (r)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teacher Role Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational background - beliefs</td>
<td>-.0601</td>
<td>.293</td>
</tr>
<tr>
<td>Attitude toward mathematics education</td>
<td>.0249</td>
<td>.411</td>
</tr>
<tr>
<td>Attitude toward usefulness of manipulatives training</td>
<td>.4274</td>
<td>.000*</td>
</tr>
<tr>
<td>Current teaching beliefs</td>
<td>.4040</td>
<td>.000*</td>
</tr>
<tr>
<td><strong>Staff Development Variable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manipulatives training - quality</td>
<td>.1689</td>
<td>.062</td>
</tr>
<tr>
<td><strong>School Climate Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administrative policy - support</td>
<td>.0166</td>
<td>.440</td>
</tr>
<tr>
<td>Administrative policy - availability of manipulatives</td>
<td>-.0374</td>
<td>.368</td>
</tr>
<tr>
<td>Support of principal</td>
<td>.1152</td>
<td>.148</td>
</tr>
<tr>
<td>Attitude of other teachers</td>
<td>-.0318</td>
<td>.387</td>
</tr>
<tr>
<td>Attitude of student's parents</td>
<td>.4376</td>
<td>.000*</td>
</tr>
<tr>
<td>Response from students</td>
<td>.1558</td>
<td>.078</td>
</tr>
</tbody>
</table>

*p < .001
manipulatives, was also higher. In the category of School Climate Variables, the attitude of students' parents was highly correlated with teachers' use of manipulatives. This means that if a teacher's score on the measure of parents' attitude was a positive one, that teacher's score on use of manipulatives was also higher.

One variable in the Staff Development Variables category, quality of manipulatives training, was not significant at the .05 level of significance, but since the p-value for this correlation was .062, it may suggest some relationship with the use of manipulatives. This means that the quality of the initial manipulatives workshop may be related to a teacher's ability and motivation to actually use manipulatives in his/her classroom.

Another School Climate Variable, response from students, was found to have a p-value of .078, not significant at the .05 level, but relatively close. This may also suggest that a teacher's use of manipulatives could be related to the response he/she perceives from the students in his/her classroom.

Results of Analysis of Variance (ANOVA)

One-way analysis of variance was calculated on the independent variables whose values were based on categorical data as they relate to the dependent variable, teachers' use of manipulatives. An ANOVA was used to compare several independent variables, based on nominal and ordinal data, with respect to a dependent variable whose value was calculated from continuous data.

An examination of Table 2 reveals that no statistically significant relationship was found for any of the independent variables based on categorical data. However, the p-value on two variables in the Staff Development category was close enough to suggest a trend in each case. Recency of instruction - first workshop was calculated to be at .1027 level of significance, suggesting that the use of manipulatives may be related to how
Table 2

Data for one-way analysis of variance on teachers' use of manipulatives to teacher role and staff development variables

Teachers' use of manipulatives (dependent variable)

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teacher Role Variables</strong></td>
<td></td>
</tr>
<tr>
<td>Educational background - level of formal education</td>
<td>.5260</td>
</tr>
<tr>
<td>Educational background - degree major/emphasis</td>
<td>.2153</td>
</tr>
<tr>
<td>Years of teaching - total</td>
<td>.6230</td>
</tr>
<tr>
<td>Years of teaching - primary grades</td>
<td>.4603</td>
</tr>
<tr>
<td><strong>Staff Development Variables</strong></td>
<td></td>
</tr>
<tr>
<td>Recency of instruction - first workshop</td>
<td>.1027</td>
</tr>
<tr>
<td>Recency of instruction - subsequent</td>
<td>.7867</td>
</tr>
<tr>
<td>Manipulatives training - type</td>
<td>.5069</td>
</tr>
<tr>
<td>Follow-up from initial training</td>
<td>.0716</td>
</tr>
<tr>
<td>Desire for more manipulatives training</td>
<td>.4839</td>
</tr>
</tbody>
</table>

p < .05
recently a teacher had participated in his/her initial training. The manipulatives use score increases with more years of teaching experience.

Another staff development variable, follow-up from initial training, had a p-value of .0716, compared to the selected .05 level of significance. This suggests that if teachers had some follow-up training in the use of manipulatives beyond their initial workshop, they may use manipulatives more in their classrooms.

An ANOVA was calculated for two components of this study that were not part of the hypothesis testing analyses: the relationship of manipulatives use scores with respect to grade level and school district. A statistically significant difference was found for grade level but not for school district. In the analysis of grade level, the mean score for manipulatives use for kindergarten teachers (n = 32) was 71.15, a standard deviation of 5.4, and a range of 56 to 80. For first grade teachers (n = 39) the mean use score was 65.15, a standard deviation of 6.51, and a range of 51 to 78. For second grade teachers (n = 21) the mean use score was 59.04, a standard deviation of 7.43, and a range of 47 to 71. The difference between each group was statistically significant at the .001 level. There was no significant differences for any of the school districts. The frequency ranged from 30 participating teachers in the largest district to 4 participating teachers in the smallest district.

Results of Multiple Regression Analysis

Reported in this section are the statistical findings of the multiple regression analyses for those independent variables found to have a significant relationship at the .05 level with the dependent variable, teachers' use of manipulatives. Multiple regression is a statistical technique used to analyze relationships between sets of independent variables and a dependent variable. $R^2$ is the proportional variance in the dependent variable explained by the independent variables in the regression model. In order to
build a regression model that could be used to explain teachers' use of manipulatives, multiple regression was run on the statistically significant teacher role variables, attitude toward the usefulness of manipulatives training (TR4) and current teaching beliefs (TR5). A regression was also run on the significant school climate variable, attitude of student's parents (SC4). All of these variables were run together as a final regression model. The final model has three independent variables with an $R^2$ of .39 (see Table 3).

By squaring each of the Pearson correlations to get the $r^2$ for each of the pairs, the proportion of shared variance is revealed between teachers' use of manipulatives and each of the significant independent variables. This means that the $r^2$ in each model is the proportion of variability in teachers' use of manipulatives that is accounted for by these independent variables. The $r^2$ value for TR4, attitude toward the usefulness of manipulatives training, is .22, meaning that TR4 alone accounts for 22% of the variability. The $r^2$ value for TR5, current teaching beliefs, is .23, meaning that TR5 alone accounts for 23% of the variability. However, TR4 and TR5 are highly correlated (see Table 4). When TR4 and TR5 are combined in the regression model, the $r^2$ value is .34, meaning that TR4 and TR5 together account for 34% of the variability in the dependent variable, use of manipulatives. The $r^2$ value for SC4, attitude of students' parents, is calculated at .21, meaning that SC4 accounts for 21% of the variability on its own. However, SC4 is highly correlated with TR4 and with TR5 (see Table 4). When, in the final model, SC4 is combined with TR4 and TR5, the combined $R^2$ value is .3936. This means that almost 40% of the variability in teachers' use of manipulatives was accounted for by these three independent variables. Each of these independent variables, although highly correlated, still accounts for some unique proportion of the variability. In the final regression equation, each of these independent variables was found to be statistically significant after adjusting for the effects of the other two independent variables (see Table 3). This means that each of these
Table 3

Regression analysis of teachers' use of manipulatives to teacher and school variables (final model)

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>beta</th>
<th>p-value</th>
<th>Contribution to R²</th>
<th>Combined R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR4</td>
<td>.2694</td>
<td>.0046*</td>
<td>.22</td>
<td></td>
</tr>
<tr>
<td>TR5</td>
<td>.3402</td>
<td>.0002*</td>
<td>.23</td>
<td>.34</td>
</tr>
<tr>
<td>SC4</td>
<td>.2449</td>
<td>.0076*</td>
<td>.21</td>
<td>.39</td>
</tr>
</tbody>
</table>

*p < .01

TR4  Attitude toward usefulness of manipulatives training
TR5  Current teaching beliefs
SC4  Attitude of students' parents

Note: For the dependent variable, the first column (beta) is the standardized regression coefficient. The second column is the p-value given for testing the significance of that independent variable after adjusting for the other two independent variables.
Table 4

Correlations between independent variables in regression analyses

<table>
<thead>
<tr>
<th></th>
<th>TR4</th>
<th>TR5</th>
<th>SC4</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR4</td>
<td>1.000</td>
<td>.3317*</td>
<td>.3601*</td>
</tr>
<tr>
<td>TR5</td>
<td></td>
<td>1.000</td>
<td>.2211*</td>
</tr>
<tr>
<td>SC4</td>
<td></td>
<td></td>
<td>1.000</td>
</tr>
</tbody>
</table>

TR4  Attitude toward usefulness of manipulatives training
TR5  Current teaching beliefs
SC4  Attitude of students' parents

*p < .05
variables, TR4, TR5, and SC4, is contributing a unique component to the variability while still also sharing correlated components of the variability with respect to the dependent variable.

Hypotheses

**Hypothesis One**: There is no relationship between teacher role variables and the use of manipulatives. The researcher rejected the null hypothesis. There are eight variables in the category of teacher role variables, and, therefore, eight sub-hypotheses were tested. Of these eight, two were found to be statistically significant at the .05 level: attitude toward the usefulness of manipulatives training, and current teaching beliefs, which includes beliefs about learning, the role of the teacher, and classroom environment.

**Hypothesis Two**: There is no relationship between staff development variables and the use of manipulatives. The researcher accepted the null hypothesis. Of the six variables in this category, none proved to be statistically significant at the .05 level. However, two of these variables, manipulatives training - quality and follow-up from initial training, were significant at the .10 level. This may suggest that these variables have some relationship to the dependent variable, teachers' use of manipulatives.

**Hypothesis Three**: There is no relationship between school climate variables and the use of manipulatives. The researcher rejected the null hypothesis. In this category there are six variables and, therefore, six sub-hypotheses were tested. Of these, one variable was found to be statistically significant at the .05 level, attitude of students' parents. Another variable in this category, response from students, was significant at the .07 level, and this may also suggest that there is some relationship between it and the dependent variable, use of manipulatives.
Summary

The findings of this study indicate that a teacher's attitude toward the usefulness of manipulatives training, his/her current teaching beliefs, and the perceived attitude of students' parents all have a relationship with a teacher's use of manipulative materials for mathematics instruction. These variables were all highly correlated with manipulatives use. In the final regression model, each of these three variables, although correlated with each other, makes a unique contribution for explaining the variance in teachers' use of manipulatives. Other variables, although not statistically significant at the selected .05 level, may also have some relationship with the use of manipulatives. These variables are: quality of manipulatives training, follow-up from initial manipulatives training, and perceived response from students.
CHAPTER FIVE

SUMMARY, DISCUSSION AND CONCLUSIONS,
IMPLICATIONS AND RECOMMENDATIONS

This chapter consists of three parts: a summary of the study and its procedures; discussion and conclusions based on the findings of the study; and implications of the research findings and recommendations for further research.

Summary

A review of the literature revealed that there are many variables that affect teachers' instructional practices. These influential variables fell into three categories: those related to the teacher, which are referred to in this study as teacher role characteristics; those related to the inservice education and staff development activities of teachers, referred to as staff development variables; and those related to the teachers' individual teaching situations, referred to as school climate variables. It was hypothesized that within each of these categories there may be variables that are related to the use of manipulatives for mathematics instruction by primary grade teachers.

In order to investigate these hypotheses, a population of primary grade teachers was located, and a sample was drawn from those teachers who indicated having some specialized training in the use of manipulatives beyond their initial teacher certification college coursework. One hundred eighty teachers qualified for the research sample and were mailed a survey instrument, designed and field-tested by the researcher, whose purpose was to determine the teacher's amount of manipulatives use in his/her classroom. Following the completion of the manipulatives use survey, there were 145 participating teachers who were then sent a questionnaire, designed and field-
tested by the researcher, which investigated the variables of influence identified as the independent variables. For the final analysis, the data from 97 teachers were included.

For the statistical analysis, Pearson correlations were calculated for the variables based on continuous data, one-way analysis of variance was computed for the variables based on categorical data, and multiple regression analysis was performed for those independent variables that were statistically significant at the .05 level.

Discussion and Conclusions

The findings of this study will be discussed and conclusions will be drawn within the three categories of variables presented as hypotheses for this research, which are Teacher Role Characteristics, Staff Development, and School Climate.

Teacher Role Characteristics

Within this category it was hypothesized that there may be several significant influences on primary grade teachers' classroom practices that could explain varying amounts of manipulatives use for mathematics instruction. Related literature presented earlier confirms that a teacher's formal education and training could influence the practices a teacher employs. The variables investigated were: (a) teaching beliefs, specifically, whether the teacher had been instructed in child-centered philosophy and practice; (b) level of formal education, i.e., advanced degrees and/or amount of subsequent formal education; and, (c) college degree major/emphasis, specifically, whether these teachers indicated having any early childhood or child development education, since these fields typically advocate the use of
manipulatives and concrete experiences for conceptual learning by young children.

The findings revealed that none of these variables explained the variance in manipulatives use. A majority of the teachers indicated that child-centered beliefs about learning (85.4%), the role of the teacher (56.7%), and classroom environment (58.8%) had not been advocated in their teacher training coursework. However, when these same teachers were asked about their current teaching practices related to these same beliefs, a majority revealed that they are now more child-centered. This suggests that those teachers whose beliefs are more child-centered have developed their style in some way other than from their formal educational background. Other descriptive findings in this study support this conclusion. When these teachers were asked on the Factors Questionnaire which educational experiences were influential on their current teaching style and practice, 41.2% reported that their college training/certification was significant and 57.7% said that post-bachelors' college work was significant, but when they were asked which experience was most influential, only 12.4% selected either of these responses.

Having an advanced degree or advanced formal education had no distinguishing relationship with the use of manipulatives. A similar result occurred concerning teachers' degree major/emphasis. Those teachers who had some early childhood or child development education were not significantly different in their manipulatives use from those whose degree was elementary education or curriculum and instruction. It appears that, in this sample, early childhood background has no distinguishing relationship with respect to use of hands-on materials. For all three of the variables related to educational background, there was no significant relationship with manipulatives use.

Another teacher role characteristic that was investigated was years of experience in teaching, and specifically, years of experience in primary
grades. It was predicted that the need for manipulatives for mathematics instruction with young children may be revealed as the teacher had more experience with these young learners. Therefore, teachers with more experience may have a higher score for manipulatives use. This prediction was not confirmed in this study; there was no significant relationship found between years of teaching experience and use of manipulatives.

Studies related to teachers' attitudes toward mathematics, as described in the related literature, are not conclusive concerning the relationship between attitude toward mathematics and mathematics instruction. In this study, it was predicted that a teacher's attitude toward mathematics and mathematics education may be related to the use of manipulatives. The findings revealed no significant relationship. However, there were two notable sub-findings on this variable. On a scale of 1 to 5, in which a score of 5 indicated a highly positive attitude toward mathematics education, the mean score was 3.36 with a standard deviation of .48, indicating that the range of scores was narrow. The highest score was 4.5; no teacher in this sample obtained the maximum possible score of 5. This may suggest that some primary grade teachers are somewhat less confident about their mathematics education than they might be. This is further confirmed by another subfinding. When the teachers were asked whether they agreed that "Mathematics is very interesting and I enjoy taking courses in this subject," a majority (78.4%) agreed that they did, but when they were asked whether they agreed with "I avoided mathematics courses in college if I possibly could," almost half (48.4%) agreed with this statement, 33% disagreed, and 17.5% neither agreed or disagreed. When questioned as to their agreement with the statement: "The classes and workshops I've had since my initial teacher training have enabled me to teach mathematics effectively," a majority (95.9%) agreed. These sub-findings indicate, as before, that these teachers' beliefs and practices with respect to mathematics may be influenced less by their formal college education than by subsequent experiences.
One of the two teacher role characteristics that proved to be highly significant was attitude toward the usefulness of manipulatives training. This variable was a composite of several items on the Factors Questionnaire which asked teachers about their attitude toward features of their manipulatives training. The hypothesis was that if the manipulatives training was deemed useful to teachers, their use of manipulatives would be greater. This relationship was found to exist for this sample. It may be that these teachers' existing needs for an instructional approach that included hands-on experiences lead them to seek out training in the use of manipulatives, and as a result, they were ready and willing to use this approach once they had been instructed. The descriptive results of this study concur with this conclusion.

When the teachers were asked on the Factors Questionnaire to evaluate their motivation for taking their first or only manipulatives workshop, personal/professional interest (94.8%) and desire to improve math teaching (97.9%) were reported as significant influences on their decision. For those teachers who had subsequent manipulatives training (n = 48), a similar result occurred: when asked which motivation was the most influential reason for taking subsequent courses, 72.9% selected "To improve math teaching," and 16.7% chose "Personal/professional interest."

The other statistically significant variable in the category of teacher role characteristics was that of current teaching beliefs. Teachers were asked to determine if their current teaching practices are based on child-centered beliefs about learning, the role of the teacher, and classroom environment. Those teachers whose beliefs were more child-centered also had higher scores on manipulatives use. The hypothesis was that use of hands-on materials may be more typical of those teachers whose beliefs and practices were child-centered, and the findings of this study confirmed this prediction.

These last two teacher role characteristics, attitude toward the usefulness of manipulatives training and current teaching beliefs (child-centeredness), were found to be highly correlated in the multiple regression
analysis. In this study, the teachers who view manipulatives as useful are also child-centered in their teaching approach. These attitudes/beliefs seem to be related and typical of a similar style of teaching. Many college programs in early childhood education advocate these similar approaches and beliefs, but in this sample, the practices of those teachers with an early childhood background have no significant relationship with the use of manipulatives, a child-centered practice.

**Staff Development Variables**

Several variables related to inservice training were investigated, specifically those related to training in the use of manipulatives. The related literature indicated that there are many factors that influence the quality and effectiveness of staff development activities.

Krug's (1988) study established a relationship between recency of instruction and the use of manipulatives. In that study, it is reported that the more recent the manipulatives instruction, the greater was the use of manipulatives. However, the sample in Krug's study was drawn from all elementary teachers, not specifically those who had received specialized training in manipulatives use. Based on Krug's research, recency of initial instruction was also investigated in this study. Although no significant relationship at the .05 level was found, the p-value for this variable was .1027, suggesting that there may be some relationship between recency of instruction and manipulatives use. However, in this study the mean use score increased as the number of years of experience since manipulatives training increased. For those teachers whose training occurred in the past year (n = 13), the mean use score was 62.30; for those whose training occurred one to three years ago (n = 24), the mean use score was 63.95; for those whose training occurred four to six years ago (n = 32), the mean use score was 65.15; and for those whose training was seven to ten years ago (n = 19), the
mean use score was 69.47. There was a decrease in mean use score (66.57) for those whose training occurred more than ten years ago (n = 7). The decrease may be explained by the small sample size for this group. Although no conclusions may be drawn regarding this variable, the results were notable, especially when compared to the findings in Krug's study.

The second staff development variable, recency of instruction - subsequent courses/workshops, was also investigated for those teachers reporting having taken subsequent coursework. No distinguishing relationship was found.

Another set of staff development variables was studied related to the actual manipulatives training activities. The hypothesis stated that the variance of manipulatives use may be related to the type and quality of this training. The first of these variables, type of workshop (specific course/workshop), included workshops entitled Mathematics Their Way, Box It/Bag It Mathematics, "Math for Early Childhood," and others. The majority of teachers (81.4%) had taken the Mathematics Their Way workshop. All other courses are very similar in style, format, and presentation. There was no statistically significant difference in manipulatives use scores related to participation in any type. However, Mathematics Their Way was referred to by 32 teachers in their written responses on the Factors Questionnaire to the question, "What do you believe is the most significant factor influencing the way you teach mathematics in your classroom?" The impact of this approach appears to be important to many of the teachers in the sample. The conclusion that these kinds of inservice experiences have an important impact on teachers is supported by the descriptive information provided on the Factors Questionnaire. When teachers were asked to indicate which educational experiences were influential on their current teaching styles and practices, 96.9% reported that workshops, seminars, and conferences for teachers which are not part of a degree program were significantly influential. When they were asked to specify which educational experience was most
influential in developing their current teaching style, 70.1% selected workshops, seminars, etc., as compared to 12.4% who selected degree-related coursework and 6.2% who selected district-provided instruction.

The variable concerning the quality of the manipulatives workshop was defined by a variety of items making up a composite score on the Factors Questionnaire. Teachers responded to questions evaluating the quality of the training, including the instructor's effectiveness, and the requirements related to the coursework. The hypothesis was that the amount of effort required, the number of hours spent, and the number of activities involved in workshop experiences may significantly relate to the use of manipulatives by these teachers. Although this variable did not prove to be significantly related to manipulatives use at the selected .05 level, the p-value for this variable was calculated at .06, suggesting a trend for this variable. It is possible to speculate that those teachers whose commitment during the manipulatives training was greater may have been able to incorporate workshop practices and ideas into their teaching more often.

Another set of staff development variables was studied. These variables were concerned with follow-up training from the initial manipulatives workshop. Again, no statistically significant relationship was revealed for either of two variables, subsequent formal training or interest in subsequent training. Of the 97 teachers in this study, 48 responded as having taken subsequent manipulatives coursework. The p-value for this variable (subsequent training) was .07. For those teachers who indicated that they had taken one subsequent course the mean use score was 64.68; the mean use score for those having taken two subsequent courses the mean use score was 67.35; and the mean use score for those who reported taking three subsequent courses was 67.53. This may indicate that follow-up training is related to increased use of manipulatives, although no conclusive inferences are supported by the statistical data.
For the staff development variable concerning interest in subsequent training, there was no significant relationship, and therefore no differences can be reported between those who had subsequent training and those who had not taken extra coursework with respect to amount of manipulatives use.

**School Climate Variables**

Based on a review of the literature, a third hypothesis investigated was that there may be specific variables of influence related to the school and to teachers' individual teaching situations, referred to in this study as school climate variables.

Two variables studied were those related to the school district's administrative policy toward manipulatives. The first, curricular support, was defined on the Factors Questionnaire by items which asked teachers to evaluate their district's policy toward using hands-on materials for mathematics instruction. The researcher predicted that teachers may be influenced by a district's advocacy, or lack of it, towards manipulatives. In this sample, the teachers reported a positive degree of curricular support (on the 1 to 5 scale, the mean score for this variable was 3.26), with no significantly different relationship with respect to use of manipulatives. For the second variable in this set, availability of manipulatives, it was predicted that if districts supplied the materials, use of manipulatives would be greater. The items which defined this variable asked teachers to describe the availability of manipulatives, including whether they were individually compelled to purchase the equipment they believed was needed. Again, no statistically significant relationship was reported, although the mean score on this item was 2.79 (on a 1 to 5 scale), perhaps indicating that teachers are somewhat less positive about their districts' support financially than about curricular support. On the written responses, 14 teachers mentioned the district curriculum and requirements, including support and availability of materials,
as being the most significant factor influencing the way they teach mathematics in their classrooms. However, when teachers were asked about their agreement with the statement, "My use of manipulatives is not dependent on support, or lack of it, from my district," there were 75.2% who either mildly or strongly agreed. Although there was no statistical data to confirm a conclusion about the district's support, there is some evidence that this set of variables is important in some way. Krug (1988) reported finding that the district policy did make a significant difference in teachers' use of manipulatives, correlating with school climate as defined in her study.

The support of the school principal was identified in the literature as being particularly influential with respect to the teaching practices and activities teachers utilize in their classrooms. The prediction was that this support would influence teachers' use of manipulatives. In this study, there was no significant difference in manipulatives use found related to the principals' support. The teachers in this sample reported positive support from their principals; the mean score for this variable was 3.99, on which a score of 5 indicates highly positive support. This conclusion is further confirmed in the descriptive results. When asked on the Factors Questionnaire to indicate how supportive their principal was of their methods of teaching in general, 66% reported feeling that he/she was very supportive, and 24.7% selected "quite supportive" on this item.

The school climate variable, attitude of other teachers, was investigated to determine if there was a significant relationship between use of manipulatives and the attitudes and practices of teaching colleagues. Although no statistically significant relationship was found on this variable as it was defined on the Factors Questionnaire, there is evidence that the attitudes and practices of other teachers have some impact on a teacher's teaching activities. When teachers were asked to specify how they found out about the manipulatives workshop, almost 80% (79.4) of the sample reported that professional colleagues were a source of information. When asked which
source was most informative or influential for motivating them to take the workshop, 48.5% selected "professional colleagues," and 33% chose "school district, which promoted it." When the teachers were asked how often they get with other teachers specifically to discuss teaching practices and ideas, other than at regular staff meetings, the response was "about once a month" by 37.1% and "about once a week or more" by 28.9%. On the written response, six teachers in the sample mentioned other teachers as being the most significant factor influencing their mathematics teaching. There is evidence that the impact of other teachers is important in some way, but the findings in this study do not support any specific conclusion.

Another school climate variable, attitude of students' parents, was investigated. The prediction was that there is a significant influence on teachers as to the response teachers feel from the parents of their students related to the use of manipulatives for mathematics instruction. On the Factors Questionnaire teachers were asked to evaluate the support they perceived from parents for using manipulatives, and to describe how confident they felt explaining the usefulness of hands-on materials. This variable proved to be highly correlated with manipulatives use, and accounted for 21% of the total variance in the multiple regression model. This variable was highly correlated with the two significant teacher role characteristics, attitude toward the usefulness of manipulatives training and current teaching beliefs (child-centeredness), in the final regression model, but still accounted for a unique contribution on its own in the regression analysis. Together, these three variables explain almost 40% of the total variance with respect to manipulatives use. These findings indicate that these attitudes/beliefs may be similar and typical of a particular teaching style.

The last school climate variable that was studied was that of response from students. The researcher hypothesized that teachers are influenced by the behaviors and reactions of their students and there may be a relationship between this variable and manipulatives use. Response from students was
defined on the Factors Questionnaire by items which asked teachers to
describe and evaluate the students' responses to classroom instruction using
manipulatives. Although this variable was not significant at the selected .05
level, the p-value was .078, suggesting that some relationship may exist. This
conclusion is further supported by the descriptive results of this study. A
majority of teachers (64.9%) reported that improvement of their math teaching
was the most influential reason for taking the manipulatives workshop. On the
written response, 42 teachers mentioned that the manipulatives workshop
was in some way useful for teaching their students when they were asked to
describe the impact that the workshop had on them. Twenty-five teachers
mentioned that the workshop helped them understand how and why to use
manipulatives for instructing their students in mathematics. When these
teachers were asked "What do you believe is the most significant factor
influencing the way you teach mathematics in your classroom?" there were 35
teachers who wrote that the students' response was the most significant factor.
Twenty-one teachers mentioned that manipulatives made math more fun and
made math concepts more understandable. The variable, students' response,
was, by far, the most commonly reported influence affecting teachers'
practices in mathematics on the written response. Although the statistical
findings did not demonstrate that a relationship between students' response
and manipulatives use exists, it appears that teachers are influenced in
important ways by the responses they perceive from the students they teach.

Implications and
Recommendations for Further Research

Based on the findings and conclusions presented in this research
study, implications and recommendations for further research will be
presented as the final section of this chapter.
There were several variables studied concerning the behaviors and beliefs of teachers which are referred to in this study as teacher role characteristics. Three of these variables are related to teachers' formal education. None of these variables proved to be statistically significant with respect to manipulatives use. The teachers in this sample indicated that their teacher education coursework had some influence on their current teaching practices and styles, but they did not consider it to be the most influential factor affecting their mathematics instruction. Nor was having advanced coursework and/or degree a factor that differentiated these teachers. Neither was there any distinguishing factor based on having child development or early childhood specialization. The question is: why are these variables not more influential? It is certainly possible that the instruments utilized in this study were unable to effectively assess these variables. However, it is reasonable to ask why teachers do not deem their teacher education programs to be of more influence on them. In fact, in this study, experiences outside of teacher training and university coursework appear to be much more useful and relevant with respect to the development of teachers' beliefs about learning, the role of the teacher, and classroom environment. How did these teachers acquire their child-centered beliefs and practices? Further research may reveal how teachers' formal training and education influences their actual teaching beliefs and behaviors.

It seems reasonable to assume that the effects of having years of experience, and specifically, years of experience with young children, would show up as somehow differentiating the more experienced teachers from their less experienced counterparts, as suggested in Leinhardt's (1986) work. No such relationship was found in this study, and the question is: why not? Further investigation into the effects of the amount of teaching experience may find some distinguishing factor which could explain the variability in teaching practices.
Research (Clark-Meeks, et al., 1982; Wall, 1985; Ball, 1988) has revealed that there is a relationship between teachers' knowledge and attitudes toward mathematics education and their teaching of it, but in this study no significant relationship was found. Although some of the teachers in this sample indicated that they had avoided mathematics coursework and may be less confident about their own mathematical abilities, they seemed to have a positive attitude about their teaching of mathematics and enjoyed mathematics education workshops that advocate the use of manipulatives. The findings of this study revealed that teachers' attitude toward the usefulness of the manipulatives training was significantly related to manipulatives use, concuring with Krug's (1988) findings and Griffin's (1983) contentions. A question to be addressed is: from what source or experience does this attitude come? In this study it did not appear to come from the teachers' educational background. It may be related to their experiences as teachers, although number of years teaching did not differentiate these teachers.

The conclusions drawn in this study suggest that there may be a particular teaching style based on factors such as educational training for particular teaching techniques combined with particular teaching experiences. These findings provide evidence which could be used in the development of a teaching style model which includes beliefs in child-centeredness and practices that incorporate the use of concrete materials for teaching mathematics. Further research investigation could possibly reveal how these variables are related, determine other components of this particular teaching style and approach, provide more evidence to define and describe this model, and explore how this teaching style is developed.

Staff development issues were studied. In particular, recency of instruction was included as a variable in this category since Krug (1988) found it to be a factor affecting manipulatives use. Krug's findings were that the more recent the instruction, the greater was the use of manipulatives. The
results of the study presented here contrast with her results and revealed that use scores went up with number of years of manipulatives experience. This result was more consistent with this researcher's experience and observations as an elementary school teacher. It may be that as teachers become more familiar and adept with this teaching approach, they may not use it more frequently, but they may use it more effectively, as Leinhardt (1986) suggests. The issue may be one of quality rather than quantity. The findings revealed that use scores increased slightly, though not significantly, with the number of subsequent manipulatives courses. It may be that once this particular teaching style is acquired, it is enhanced rather than increased. Further research into the issues of recency and subsequent coursework may reveal how these variables are related.

Another set of staff development variables studied was that of type and quality of manipulatives training. The findings indicate that there is something about the manipulatives training, and specifically, Mathematics Their Way training, that is very important to many teachers, which concurs with Hatch's (1984) study of child-centered teaching. The question for further study is: what is there about this program and/or training that makes it important? Several teachers wrote that the Mathematics Their Way or similar workshop was the most influential factor for developing their current teaching approach. Concerning the quality of the training, there is some evidence to support a conclusion that when teachers are required to do more during their manipulatives training experience, they tend to use manipulatives more, i.e., have higher manipulatives use scores. Is this an issue of commitment? Or do the findings suggest that when teachers come away with something more, either in terms of more actual training experiences or even in terms of more classroom materials, they are able to implement this approach to a greater degree? Again, further research is required to answer these questions.

There was sufficient evidence in the related literature (Williams, 1979; Joslin, 1982; Griffin, 1985; Sharman, 1986; Krug, 1988) to support the
researcher's contention that school climate issues may be related to teachers' classroom practices, and specifically, the use of manipulatives. Several variables in this category were studied. There was no statistical evidence that differentiated the teachers with respect to administrative support. There was, however, a notable result related to the first administrative support variable, curricular advocacy of manipulatives. During the field testing, the researcher observed a phenomenon related to grade level, in that the kindergarten teachers seemed to use manipulatives more and scored higher on Survey B, even though the field testers expected that a few of these teachers would not be high use teachers. The same result, higher use scores, was also evident on Survey B from the kindergarten teachers in the research sample. A statistical analysis was performed comparing use scores by grade level, and at each level the use scores are statistically different, decreasing from kindergarten to second grade. Several of the kindergarten teachers wrote on their copies of Survey B that some of the items did not apply to them since no workbook or pencil/paper tasks were required in kindergarten by their district. This finding was noted in other reports (Wiebe, 1981; Scott, 1983; Kennedy, 1986; Krug, 1988). Manipulatives use appears to be an expected practice in kindergarten, although not, perhaps, the result of the teacher's belief in their efficacy. Further analysis may determine that differences exist with respect to curricular advocacy of manipulatives when the scores of kindergarten teachers are separated out of the findings. Analysis by grade level could reveal greater variation in manipulatives use related to this and other independent variables.

Concerning the administrative support variable, availability of manipulatives, it was noted that the teachers were positive about their districts' financial support for the purchase of classroom materials, but there may be a compounding variable. A majority (75.2%) indicated that their use of manipulatives was not dependent on support, or lack of it, by their school districts. Perhaps further research would determine whether this attitude for
using manipulatives on the part of some teachers is another dimension of the child-centered teaching style mentioned previously.

Regarding the school climate variable, support of school principal, the researcher had anticipated that this might be significant since the staff development literature refers to it as being particularly influential (Griffin, 1983; Sparks, 1983; Korinek, et al., 1985). The results of this study did not find principal support to differentiate these teachers. Again, the instruments used to collect the data may have been ineffective on this variable, although the researcher included several questions which probed for this information on the questionnaire. During manipulatives workshops for which this researcher was the instructor, some participating teachers had expressed concern about their principal's willingness to support this approach. These teachers often said something like, "They won't let me do this." The question to be asked is: who are "they"? The administration and the school principals are not identified as such in this study.

It is obvious to anyone within the educational community, and supported in the related literature (Joyce & Clift, 1984; Wildman & Niles, 1987), that teachers are influenced in many ways by each other. The researcher anticipated that this influence may extend to use of manipulatives, since so many of her teaching colleagues rely on one another for information, guidance, and support for their teaching practices. In this study, the questionnaire items were unable to determine the differences observed among teachers related to their influence on each other. Further refinement of the instruments may assist researchers to more effectively study this variable.

The attitude of students' parents proved to be statistically significant with respect to manipulatives use. That this was the only significant school climate variable was somewhat surprising to the researcher, but it does explain a phenomenon she has observed in her teaching career. Some teachers seem particularly confident about their classroom practices and interact frequently with students' parents, involve parents in classroom
activities and communicate often through newsletters. Is this confidence another dimension of the teaching style model referred to previously? In the multiple regression analysis, the three statistically significant variables were highly correlated: attitude toward the usefulness of manipulatives training, current teaching beliefs (child-centeredness), and attitude of students' parents. Further research may determine how these variables are related.

How students affect their teachers is another issue for further study. That they do is evident, but measuring that impact may be difficult. In this study, the school climate variable, response from students, did not prove to be statistically significant at the .05 level, although the p-value was .07 for this variable, suggesting that this is a notable phenomenon. These teachers referred to their interactions with students more often than any other source of influence. Another area for further research is that of student achievement in mathematics as related to manipulatives use. Research has been conducted in this area, but continued study at the primary grade level may more fully describe how concrete experiences develop mathematical knowledge and what role the teachers' use of manipulatives plays in this development.

Another area for further research is that of instrumentation refinement. All of the instruments utilized in this study were developed by the researcher. These devices may be useful for continued study in teacher education, but development and refinement of them would provide more credibility for their use.

And, finally, there is a need for qualitative data. The researcher decided to evaluate quantitative rather than qualitative use of manipulatives, but the more important issue may be that of how well teachers use concrete materials with their students, not how often they use them. Research conducted using fewer teachers, studying their practices and beliefs more intently and systematically, may provide the evidence that develops the model for the teaching style that includes child-centered beliefs and practices, the use of hands-on materials, and an individual confidence that enables the
teacher to respond effectively to students, students' parents, teaching colleagues, and administrators.
BIBLIOGRAPHY


APPENDIX A:

School District Packet of Information

(1) Research prospectus
(2) Dissertation research proposal
(3) Sample cover letter to school district personnel
(4) Committee signatures from proposal meeting
(5) Approved application, Committee for the Protection of Human Subjects
Title: The Relationship of Teacher Role Characteristics, Staff Development, and School Climate with the Use of Manipulatives in Primary Grade Mathematics

Methods: Primary grade teachers who have had specialized training in the use of mathematics manipulatives will be surveyed to determine their degree of use of such materials for mathematics instruction. A sample of these teachers will be drawn for further study using a questionnaire to identify factors which influence amount of manipulatives use. The primary grade teachers involved will be contacted by direct mail to their schools. All instruments have been developed by the researcher. Since the instruments utilize self-report, a small subsample of teachers (fewer than 10) will be selected for classroom visitation for the purpose of checking the reliability of the manipulatives use survey. No elementary students are involved in this study.

Justification of the Problem: School districts spend a large amount of money on staff development and on specialized materials for instructional use. Mathematics is an area of the curriculum that has received a great deal of such attention. The use of physical objects called manipulatives has proven to be particularly useful for assisting young children to learn mathematical concepts. Many primary grade teachers have been trained to use manipulatives and these materials have been provided to teachers for classroom use. Yet, research reveals that manipulative materials are not used to the degree that mathematics educators have recommended, when they are used at all. This research study is designed to (1) determine the degree of use of manipulative materials in primary grade classrooms, and (2) to identify those factors which influence manipulatives use. Knowledge of these influential factors may enable staff developers and school administrators to encourage more use of manipulative materials for mathematics instruction by primary grade teachers.

Delimitations: Although this study deals with mathematics and with manipulatives, it is not designed to evaluate mathematical achievement by students, nor will it assess the effectiveness of manipulatives use.

Researcher: Karen C. Smith, Doctoral Student in Education; Oregon State University, College of Education, Education Hall, P.O. Box 220, Corvallis, Oregon 97331-3502
Home address: 2205 NW 11th Street, Corvallis, Oregon 97330
Home phone: 752-0310 (answer machine will record messages)
Work phone: 757-5955 (Lincoln Elementary School)
Title: THE RELATIONSHIP OF TEACHER ROLE CHARACTERISTICS, STAFF DEVELOPMENT, AND SCHOOL CLIMATE WITH THE USE OF MANIPULATIVES IN PRIMARY GRADE MATHEMATICS

Researcher: Karen C. Smith, Doctoral Student in Education; Oregon State University, College of Education, Education Hall, P.O. Box 220, Corvallis, Oregon 97331-3502
Home address: 2205 NW 11th Street, Corvallis, Oregon 97330
Home phone: 752-0310 (answer machine will record messages)
Work phone: 757-5955 (Lincoln Elementary School)

Purpose of the Study
The purpose of this study is to identify and examine the common teacher role variables, staff development variables, and school variables that are associated with the use of manipulative materials for instruction in mathematics by primary grade elementary teachers. Knowledge of these influential factors may be helpful to staff developers and educational administrators to enable them to support teachers who are using manipulatives in their classrooms and to assist those teachers who are not using them to do so.

Hypotheses
The following hypotheses were constructed for this study:
1. Associated with the use of manipulative materials for mathematics instruction by primary grade elementary teachers, there are common teacher role, staff development, and school climate variables.
2. There are differences among teachers as to their degree of use of manipulatives related to teacher role variables, staff development variables, and school climate variables.

Design
The intent of this study is to identify and examine the variables that influence primary grade teachers as to their degree of use of manipulative materials and other physical objects in their classrooms for instruction in mathematics once they have been instructed in the use of such materials.
Three categories of variables will be identified as the independent (attribute) variables. The dependent variable is the degree of use of mathematics manipulatives. The independent variables are:

**Teacher Role Variables**
1. Educational background
2. Years of experience in teaching
3. Attitude toward/understanding of/background in mathematics education
4. Attitude toward/use of manipulatives
5. Motivation for taking manipulatives workshop and any subsequent courses

**Staff Development Variables**
1. Recency of instruction in use of mathematics manipulatives
2. Type of course/workshop in use of mathematics manipulatives
3. Usefulness of manipulatives training
4. Follow-up from initial coursework/training

**School Climate Variables**
1. Administrative policy and support
2. Availability of manipulatives
3. Perceived attitude and support of school principal
4. Perceived attitude and support of other teachers
5. Perceived attitude and support of student's parents
6. Perceived response from students

Data obtained in this study will be compared to determine if there is a statistically significant difference among primary grade teachers related to the independent variables.

**Sample**
The research population consists of those teachers who are currently teaching in primary grade classrooms (kindergarten, first, and second grades or a combination of these primary grades). The sample will be drawn from teachers in school districts in Oregon outside of the Corvallis area, but within a sixty-mile radius of Corvallis, such as Lincoln County
School District, Eugene School District, Springfield School District, McMinnville School District, and/or Salem School District. The sample will further be identified as those primary grade teachers who have participated in a course or workshop such as those entitled Mathematics Their Way, Box It or Bag It Mathematics, "Mathematics for Early Childhood," or some similar course/workshop.

These workshops and mathematics education courses provide instruction and demonstration of techniques using manipulatives and physical objects which children utilize for learning mathematical concepts. Teachers participate by becoming actively involved with the manipulative materials while receiving instruction as to the rationale for and methods of using such materials.

**Sampling and Data Gathering Procedures**

This study will utilize two surveys, a classroom observation, and one questionnaire developed by the researcher. The steps that will be followed to locate the research sample and to gather the data for this study are as follows:

1. Contact school district administration to obtain permission to conduct the study and a list of primary grade teachers.

2. Mail the first survey (Survey A), consisting of three questions (on a postcard) and an explanatory cover letter, to all primary grade teachers in the participating school districts.

3. When an adequate number of survey A postcards is returned, they will be sorted according to population guidelines, i.e., qualifying by grade level and appropriate amount of manipulatives training.

4. Select the research population to further survey as to degree of use of manipulatives. At least 200 surveys will be sent to teachers in the research population.

5. Mail out the second survey, entitled "Survey of Methods of Mathematics Instruction in Primary Grades" (Survey B), to locate those teachers to be classified as to degree of use of manipulatives, along with an accompanying cover letter which explains the survey and solicits cooperation from these teachers.
6. The results of Survey B will be analyzed to determine degree of manipulatives use. Respondents will be scored and categorized into three groups: high use, moderate use, and low use. Since in each group the number to be statistically analyzed equals 30, to account for experimental mortality there will be 50 respondents selected in each group, totaling 150 teachers as the research sample.

7. These 150 teachers will each be mailed a questionnaire entitled, "Factors Influencing Instruction in Mathematics in Primary Grades" (referred to as Factors Questionnaire), along with an accompanying cover letter which provides some explanation of the study and encourages them to participate. Reminders will be issued if an adequate number of surveys is not returned.

Instrumentation

Three instruments have been developed by the researcher to gather the data needed in this study. Guidelines were followed for developing survey and questionnaire instruments (Dillman, 1978; Leedy, 1980; Borg and Gall, 1983; Gay, 1987), as well as utilizing and adapting examples from similar research studies (Hatch, 1984; Wall, 1985; Krug, 1988). Each instrument and accompanying cover letter is attached to this document.

Another instrument was developed to verify the reliability of Survey B. Since this survey depends on self-report, it was decided by the researcher that a sample of primary grade teachers would be drawn for further investigation. Following step six of Sampling and Data Gathering Procedures above, a subsample of 10 teachers in each group will be drawn. Each of these teachers will be contacted by the researcher to request permission to visit his/her classroom. The Classroom Observation form will be used to score the classroom environment and look for evidence of use in mathematics lessons of manipulatives and other physical objects. This instrument is also attached.

Data Analysis

A multiple regression model will be used to analyze the data.
Multiple regression is a statistical technique that is used to analyze the relationship between a dependent variable and a number of independent variables. A model of multiple regression using the three categories of independent variables appears below. A confidence level of .05 will be used to reject the null hypotheses.

**School Involvement and Benefits**

Each school district involved in this study will be asked to provide the researcher a list of primary grade teachers and their school addresses. The project is designed to gather all data without direct involvement by the administration and/or school principals. Teachers will be contacted through the mail. Some teachers (fewer than 10) will be asked for permission to visit their classrooms as a reliability verification of Survey B. This classroom visit will be done at the teacher's convenience and should last no longer than 15 minutes.

As a benefit to the school district for participating in this study, the researcher will provide a copy of the completed project and its results, if requested. Also, the researcher will be prepared to make a presentation of the results of the study and its implications to any appropriate group, such as school administrators, school board members, or similar organizations.
References


(3) Sample cover letter to school district personnel

December 9, 1989

Mr. John Dracon, Superintendent
Central School District
1610 Monmouth St.
Independence, Oregon 97351-10%

Dear Mr. Dracon,

I am a doctoral student in Elementary Education at Oregon State University. My dissertation project involves surveying elementary teachers to find out what influences them to use, or not to use, specialized materials for mathematics instruction. I need to find teachers who have had training in the use of such materials. I would appreciate it very much if you would take the time to consider the enclosed materials which describe this research project.

Enclosed you will find the following items:

(a) One copy of the research prospectus and proposal. Since this is only a summary of the full proposal, further related literature review and reference information is available upon request.

(b) One copy of the formed signed by my committee members at the time of my proposal meeting. My major professor, Dr. Jo Ann Brewer, is now in Flagstaff, Arizona. Dr. Wayne Haverson in the College of Education at Oregon State University can be contacted as Dr. Brewer's representative. His telephone number is 737-4661. Also, a member of my doctoral committee, Dr. Jerry Girod at WOSC, is well acquainted with my study and can answer any questions you may have.

(c) One copy of each instrument utilized in this project, and the accompanying cover letters. As you can see, the instrumentation is quite extensive. I am in the process of field testing the longer questionnaire and it is, therefore, currently in draft form. Changes to be made to it will involve form and style adjustments. No further questions will be added, although some may be reworded or deleted.

(d) One copy of the application for exemption, Committee for the Protection of Human Subjects. If you have further questions, contact Mary Perkins, representative of the Human Subjects Committee at OSU, 737-3437.

The timeline of this project includes four phases: an initial contact of individuals to locate the sample population, the second phase, when the qualifying teachers are sent a survey to determine their degree of manipulatives use; a third phase which begins as soon as the survey is returned, wherein I visit classrooms to verify the survey's reliability; and the final phase, involving a longer questionnaire sent to selected teachers.
As you will see in the proposal, **what I need from you is a list of the primary grade teachers (grades K, 1, and 2, or combination of these grades), and a school address for each of these teachers**. The project is designed to gather all other information. I will contact these teachers through the mail. It is unnecessary for me to contact the principals except in a few cases (fewer than five teachers) where I may need to visit classrooms to verify the reliability of one survey. It may be easier for you to cooperate with me on this project by supplying me with a list of all elementary teachers, their schools, and each teacher's grade assignment, and I will locate the group of teachers I need. Of course, I am ready and willing to follow any other procedure you may require.

There is some urgency involved in this request. Due to circumstances beyond my control, the initial phase has been delayed by about two months, and I need to know very soon if you are able to supply to me the needed list of primary grade teachers' names and school assignments. I will need the list by December 20, 1989. I will call you before December 15, 1989, to discuss it.

In the proposal I have specified how the results of this study may be valuable to Central School District, and what I am ready to do when the project is completed. Please let me know if you would like more information.

Thank you for your consideration. I am looking forward to talking about this project with you.

Sincerely,

Karen C. Smith
Elementary Education
Oregon State University
Committee signatures from proposal meeting

August 8, 1989

Following the proposal meeting on this date, the undersigned committee members have approved Karen Clark Smith's thesis proposal, which is attached to this letter.

Redacted for Privacy

Committee Chair

Redacted for Privacy

Redacted for Privacy

Graduate School Representative

Redacted for Privacy

Redacted for Privacy

Redacted for Privacy
(5) Approved application, Committee for the Protection of Human Subjects

APPLICATION FOR EXEMPTION

COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS

Principal Investigators: Dr. Jo Ann Brewer/Dr. Wayne Haverson Phone 4641/4651

Student’s Name (if any): Karen Clark Smith Phone 752-0310

Department: Elementary Education

Source of Funding:

Project Title: The Relationship of Teacher Role Characteristics, Staff Development, and School Climate with the Use of Manipulatives in Primary Grade Mathematics

Certain categories of research are exempt from human subjects review. These categories are reproduced for your information on the back of this form. Feel free to call the Research Office, 754-3437, if you have questions.

The following information should be attached to this form and two copies of the complete Application for Exemption should be submitted to the Research Office, AdS A312:

1. A copy of any questionnaire, survey, testing instrument, etc. to be used in this project.

2. A copy of the informed consent document, survey cover letter, or other informed consent information, and a description of the methods by which informed consent will be obtained from the subjects.

3. A brief description of the methods and procedures to be used during this research project, including:
   (a) A short paragraph describing the objectives of this research,
   (b) A description of the methods by which anonymity of the subjects will be maintained,
   (c) A description of the subject population, and
   (d) Information regarding any other approvals which have been or will be obtained (e.g., school districts, hospitals, cooperating institutions).

Signed

Principal Investigator

*Note: Student projects should be submitted by the Major Professor as Principal Investigator.

7-87

Redacted for Privacy
To: Committee for the Protection of Human Subjects - Application for Exemption

From: Karen Clark Smith

Project Title: The Relationship of Teacher Role Characteristics, Staff Development, and School Climate With the Use of Manipulatives in Primary Grade Mathematics

1. Copies of the cover letters as well as the instruments to be used in this study are attached, which include a postcard survey, Survey B, and the Factors Questionnaire. (All are in draft form.)

2. The subjects in this study will be informed of the requirements of participation through the cover letters. Their consent will be evidenced by their return of the surveys.

3. (a) The purpose of this study is to identify and examine the common teacher role variables, staff development variables, and school variables that are associated with the degree of use of manipulative materials for instruction in mathematics by primary grade elementary teachers.

(b) Subjects' anonymity will be maintained by coding each survey instrument and using the codes in the collection and analysis of data. A list of the subjects and their codes will be kept only by the researchers involved and the subjects' names and positions will never be used in the results of the study.

(c) The research population consists of those teachers who are currently teaching in primary grade classrooms (kindergarten, first, and second grades or a combination of these primary grades). The sample will be drawn from teachers in school districts in Oregon outside of the Corvallis area, but within a sixty-mile radius of Corvallis, such as Lincoln County School District, Eugene School District, Springfield School District, Salem School District, and/or McMinnville School District. The sample will further be identified as those primary grade teachers who have participated in a course or workshop such as those entitled Mathematics Their Way, Box It or Bag It Mathematics, Mathematics for Early Childhood, or some similar course/workshop.

(d) Each school district will be contacted to obtain permission for conducting the study and to obtain a list of primary grade teachers. Each district's requirements for research studies will be met.
Principal Investigator:

It has been determined that the following project is exempt from review by Oregon State University's Committee for the Protection of Human Subjects under guidelines from the U.S. Department of Health and Human Services:

Principal Investigator: Jo Ann Brewer and Wayne Haverson

Student's Name (if any): Karen C. Smith

Department: Elementary Education

Source of Funding:

Project Title: The Relationship of Teacher Role Characteristics, Staff Development, and School Climate with the Use of Manipulatives in Primary Grade Mathematics

Comments:

A copy of this information will be provided to the Chair of the Committee for the Protection of Human Subjects. If questions arise, you may be contacted further.

Redacted for Privacy

Mary E. Jerkins
Research Development Officer

cc: CPHS Chair
7-87
APPENDIX B:
Survey A and cover letter
Survey A

1. What grade are you currently teaching?

2. Since you became a teacher, have you taken a class or workshop which advocates the use of manipulative materials for instruction in mathematics, such as *Mathematics Their Way*, *Box It or Bag It Mathematics*, *Mathematics for Early Childhood,* or some similar course/workshop? (Circle 1 or 2.)

   1. YES, I HAVE TAKEN SUCH A COURSE OR WORKSHOP
   2. NO, I HAVE NOT TAKEN SUCH A COURSE OR WORKSHOP

3. If you answered YES above, how many days involving at least 3 hours of instruction were you required to attend?

   1. ONE DAY OR LESS
   2. TWO OR THREE DAYS
   3. FOUR OR FIVE DAYS
   4. SIX - NINE DAYS
   5. TEN DAYS OR MORE
   6. OTHER (specify) ____________
Dear Primary Grade Teacher,

A study of mathematics instruction is being conducted by researchers in elementary education at Oregon State University. It is vital that we have information from teachers like you in order to get a true picture of what is currently happening in Oregon schools related to instruction of mathematics. Your participation in this project will help further knowledge for effective teaching.

Since mathematics is such an important subject, we need to know what content and techniques are most essential for teaching mathematics. Information related to mathematics exists, but information related to the practices and beliefs of teachers who are currently teaching mathematics is not adequately available. This research project will gather this vital information. The results of this study may have a real impact on school administrators and staff developers who make decisions about what to encourage and support within elementary schools.

This research project has several phases. In this first phase, we need to locate primary grade teachers who have had some specialized training in the use of hands-on, manipulative materials for use in mathematics instruction. Enclosed is a self-addressed, stamped postcard which asks three questions. Although you are busy at this time of year, it would be extremely helpful if you would fill it out and return it to us as soon as possible. We must have it by December 10, 1989, to meet our deadlines.

Your cooperation is very much appreciated.

Sincerely,

Dr. Jo Ann Brewer
Associate Professor
Elementary Education

Karen C. Smith
Doctoral Student
Elementary Education
APPENDIX C:

Survey B

(1) Cover letter - final version
(2) Final version of Survey B
(3) Reminder letter
(4) Survey B - Version 1
(5) Survey B - Version 2
(6) Scoring device for item 19 - SBV2
(7) Classroom Observation Form
December 11, 1989

Dear Primary Grade Teacher,

As a continuation of the project concerning mathematics instruction in which you participated earlier, you have been selected for further in-depth survey. You may recall that the purpose of this study is to determine what teaching practices are currently used in primary grades.

Much of the time teachers make decisions about their practices without being completely confident that what they do is most effective for quality instruction. Information about what teachers really do and how they really think is not adequately available at this time but is very much needed to help researchers determine what is most effective for teachers and their students. In this phase of the project, primary grade teachers like you can provide valuable information about their beliefs and practices for teaching mathematics. This information may ultimately have a great deal of influence on the decisions curriculum developers and school administrators make regarding classroom practices.

This survey is designed to gather the needed information, and we need your help. Keep in mind that your confidentiality is totally guaranteed. Each survey is coded with an identification number, but your name and position will never be included in the results of the study and are known only to the researchers involved. It is important that the information we receive is completely accurate. You can help most by being as honest as you can about what you truly believe and what you actually do when teaching mathematics to your students.

When this project is completed, the results will be summarized and available. If you would like to have a copy of the results mailed to you, sign your name on the enclosed request card and return it with the completed survey in the postage-paid envelope provided.

Please take a few minutes to fill out this survey. Most teachers have completed it in fifteen minutes or less. Our deadline for this phase of the study is the first week of January, so we need to receive your copy by that time.

Once again, thank you so much for participating in this important study.

Sincerely,

Karen C. Smith
Doctoral Student
Elementary Education
(2) Final version of Survey B

Please answer these questions about your beliefs and practices in your classroom as clearly and honestly as you can. Circle one answer for each question.

1. How important is mathematics instruction in primary grades?

   1. NOT IMPORTANT AT ALL
   2. SOMEWHAT IMPORTANT
   3. QUITE IMPORTANT
   4. VERY IMPORTANT
   5. EXTREMELY IMPORTANT

2. How often do you provide activities and instruction in mathematics?

   1. HARDLY EVER
   2. ONE OR TWO DAYS PER WEEK
   3. THREE OR FOUR DAYS PER WEEK
   4. EVERY DAY
   5. SEVERAL TIMES EVERY DAY

For each of the following statements, please indicate your agreement or disagreement by circling the appropriate number, according to this scale:

1 means you STRONGLY DISAGREE
2 means you MILDLY DISAGREE
3 means you NEITHER AGREE NOR DISAGREE
4 means you MILDLY AGREE
5 means you STRONGLY AGREE

3. I believe the use of 'hands-on' equipment and manipulative materials is necessary for effective mathematics instruction

   YOUR RESPONSE

4. It seems like there isn't enough time to use manipulatives for mathematics instruction

   YOUR RESPONSE

5. It is important to use manipulative materials only with the slower children in the classroom

   YOUR RESPONSE

6. I think that manipulative materials are appropriate for mathematics instruction for all children in my class

   YOUR RESPONSE

7. When the students use manipulatives they often seem to play with them and not much real work gets done

   YOUR RESPONSE

8. My students need to use manipulatives only when they are learning new mathematical concepts or when they require extra help

   YOUR RESPONSE

9. I believe mathematics can be taught and learned effectively without using 'hands-on' kinds of materials

   YOUR RESPONSE
In the following section, indicate how much you use each instructional practice for teaching mathematics, according to this scale:

1 means you ALMOST NEVER do this  
2 means you SOMETIMES do this  
3 means you FREQUENTLY do this  
4 means you do this MOST OF THE TIME  
5 means you ALMOST ALWAYS do this  

<table>
<thead>
<tr>
<th>Prompt</th>
<th>Scale</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. When introducing mathematical concepts to children I have them manipulate physical objects</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>11. I use the textbook lesson from the adopted math series to introduce new mathematical concepts</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>12. When developing concepts in math I have my students use manipulatives or other physical objects</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>13. My students use textbook or workbook pages as practice for each concept they have been introduced to in mathematics</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>14. I conduct lessons which focus on mathematical concepts other than during the regular math time, such as calendar-centered lessons, graphs, or group sorting activities</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>15. Types of mathematical work that the children have done, such as graphs, geometric designs, or number work, are on display in my classroom</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>16. I integrate mathematics into every area of the curriculum, including reading, language arts, P.E., and art</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>17. I have mathematics learning centers or stations available which use manipulatives and 'hands-on' materials</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
| 18. What guides your planning for mathematics instruction with your students? How do you decide what to teach and when? |       | 1 THE TEACHER'S GUIDE FROM THE ADOPTED TEXTBOOK SERIES  
2 MY OWN PLANNING SCHEDULE AND MY OWN DISCRETION  
3 A PLANNING GUIDE FROM A MANIPULATIVES WORKSHOP THAT I ATTENDED  
4 THE DISTRICT'S CURRICULUM GUIDE AND ITS GRADE LEVEL OBJECTIVES  
5 OTHER (Please describe) |   | |

Do you have any comments concerning your planning strategies? 

(Continue on to the last page)
19. When you use manipulatives for mathematics instruction, **how do you** use them? How do the students use them? In the space below, briefly describe a typical teaching/learning sequence in which manipulatives are used.

20. Do you have any further clarifying comments about the way you teach mathematics in your classroom?

Please return this completed survey in the postage-paid envelope provided. Be sure to include the request card with your signature if you would like to receive a copy of the results of this study when it is completed.

Thank you for your cooperation.
Dear

Once again I would like to thank you for initially participating in the Primary Mathematics Project by returning the postcard that was mailed to you some weeks ago. Shortly after that you should have received a letter and a short survey. Since I have not yet received that survey back from you, I thought something may have happened to the first copy. Enclosed is another survey and a return envelope.

The deadline for this phase of the study has been extended. Since it is so important that we have information from a cross section of primary grade teachers from a variety of school districts, your participation in each phase of this study is necessary. Please take a few minutes to complete this survey, and mail it back to us as soon as possible.

Sincerely,

Karen C. Smith
Doctoral Student
Elementary Education
Survey B - Version 1

Survey of Methods of Mathematics Instruction in Primary Grades

Please answer these questions about your beliefs and practices in your classroom as clearly and honestly as you can.

1. How important is mathematics instruction in primary grades?
   
   1 NOT IMPORTANT AT ALL  
   2 SOMEWHAT IMPORTANT  
   3 QUITE IMPORTANT  
   4 VERY IMPORTANT  
   5 EXTREMELY IMPORTANT

2. How often do you provide activities and instruction in mathematics?
   
   1 HARDLY EVER  
   2 ONE OR TWO DAYS PER WEEK  
   3 THREE OR FOUR DAYS PER WEEK  
   4 EVERY DAY  
   5 SEVERAL TIMES EVERY DAY

For each of the following statements, please indicate your agreement or disagreement by circling the appropriate number, according to this scale:

1 means you STRONGLY DISAGREE
2 means you MILDLY DISAGREE
3 means you NEITHER AGREE NOR DISAGREE
4 means you MILDLY AGREE
5 means you STRONGLY AGREE

3. I believe the use of 'hands-on' equipment and manipulative materials is very important for mathematics instruction .............................................................. 1 2 3 4 5

4. It seems like there isn't enough time to use manipulatives for mathematics instruction .......................................................... 1 2 3 4 5

5. I make the time to use manipulative materials even when time is limited .......................................................... 1 2 3 4 5

6. It is important to use manipulative materials only with the slower children in my class .......................................................... 1 2 3 4 5

7. I think that manipulative materials can be used effectively for mathematics instruction for all children in my class .......................................................... 1 2 3 4 5

8. I believe mathematics can be taught and learned effectively without using 'hands-on' kinds of materials .......................................................... 1 2 3 4 5

9. I feel that I have had adequate instruction with manipulative materials to use them effectively in my classroom .......................................................... 1 2 3 4 5

10. If I had more instruction in the use of manipulatives I would use them more often .......................................................... 1 2 3 4 5
In the following section, indicate how much you use each instructional practice for teaching mathematics, according to this scale:

1 means you ALMOST NEVER do this
2 means you SOMETIMES do this
3 means you FREQUENTLY do this
4 means you do this MOST OF THE TIME
5 means you ALMOST ALWAYS do this

**YOUR RESPONSE**

11. When introducing mathematical concepts to children I have them manipulate physical objects. ........................................... 1 2 3 4 5

12. When introducing mathematical concepts to children I usually teach the concept using the textbook lesson. ...................... 1 2 3 4 5

13. When developing concepts in math I have my students use manipulatives or other physical objects ........................................ 1 2 3 4 5

14. My students use textbooks, workbooks, or paper-pencil tasks for practice in learning mathematics ................................. 1 2 3 4 5

15. The students in my classroom may use ‘hands-on’ materials at times other than during math lessons ..................................... 1 2 3 4 5

16. The manipulative materials are stored where the children can have independent access to them at appropriate times, or during free time. .......................................................... 1 2 3 4 5

17. I conduct lessons which focus on mathematical concepts other than during the regular math time, such as when we do ‘daily opening’ calendar-centered lessons, graphs, or group sorting activities .......................................................... 1 2 3 4 5

18. Types of mathematical work that the children have done, such as graphs, geometric designs, or number books, are usually on display in my classroom .......................................................... 1 2 3 4 5

19. I have mathematics learning centers or stations available which use manipulatives and ‘hands-on’ materials ....................... 1 2 3 4 5

20. I use physical objects and mathematics manipulatives for teaching mathematics in my classroom ........................................ 1 2 3 4 5

21. What guides your planning for mathematics instruction with your students? How do you decide what to teach and when? Circle the one item which most closely describes what you usually do.

1  I USE THE TEACHER’S GUIDE FROM THE ADOPTED TEXTBOOK SERIES
2  I HAVE DEVISED MY OWN PLANNING SCHEDULE AND USE MY OWN DISCRETION
3  I USE A PLANNING GUIDE FROM THE MANIPULATIVES WORKSHOP THAT I ATTENDED
4  I FOLLOW THE DISTRICT’S CURRICULUM GUIDE
5  I OBSERVE THE CHILDREN IN MY CLASS AND BASE MY PLANS ON THEIR NEEDS
Do you have any comments concerning your planning strategies?

22. If you have manipulatives in your classroom, what do you do while the children are using them? Circle the one item which most closely describes what you usually do.

1. WHILE DEMONSTRATING TECHNIQUES I ASK THE STUDENTS QUESTIONS TO DETERMINE WHAT THEY ARE THINKING; WHEN THE STUDENTS ARE WORKING I CIRCULATE, OBSERVE, QUESTION
2. I DEMONSTRATE TECHNIQUES FOR USING THE MANIPULATIVES AND STUDENTS MODEL THESE TECHNIQUES WHILE WORKING; I RESPOND TO THEIR QUESTIONS WHILE THEY WORK
3. I SHOW THE STUDENTS WHAT TO DO AND THEY REPLICATE WHAT I DEMONSTRATE (TEACHER LEADS-STUDENTS FOLLOW)
4. I OBSERVE THE STUDENTS WHILE THEY WORK AND ANSWER THEIR QUESTIONS WHEN ASKED
5. THE STUDENTS COMPLETE THEIR ASSIGNMENTS INDEPENDENTLY WHILE I ATTEND TO OTHER TASKS, SUCH AS CHECKING PAPERS

Do you have any comments concerning the use of manipulatives in your classroom?

23. Do you have any further clarifying comments about the way you teach mathematics in your classroom?

Please return this questionnaire in the envelope provided. Also return the signed cover letter if you want a copy of the results. Thank you for your cooperation.
(5) Survey B - Version 2

Survey of Methods of Mathematics Instruction in Primary Grades

Please answer these questions about your beliefs and practices in your classroom as clearly and honestly as you can. Circle one answer for each question.

1. How important is mathematics instruction in primary grades?
   1 NOT IMPORTANT AT ALL
   2 SOMEWHAT IMPORTANT
   3 QUITE IMPORTANT
   4 VERY IMPORTANT
   5 EXTREMELY IMPORTANT

2. How often do you provide activities and instruction in mathematics?
   1 HARDLY EVER
   2 ONE OR TWO DAYS PER WEEK
   3 THREE OR FOUR DAYS PER WEEK
   4 EVERY DAY
   5 SEVERAL TIMES EVERY DAY

For each of the following statements, please indicate your agreement or disagreement by circling the appropriate number, according to this scale:

1 means you STRONGLY DISAGREE
2 means you MILDLY DISAGREE
3 means you NEITHER AGREE NOR DISAGREE
4 means you MILDLY AGREE
5 means you STRONGLY AGREE

YOUR RESPONSE

3. I believe the use of 'hands-on' equipment and manipulative materials is necessary for mathematics instruction .................. 1 2 3 4 5
4. I wish there was more time for games and manipulatives, but the students have too much computation and arithmetic to learn ..... 1 2 3 4 5
5. I believe mathematics can be taught and learned effectively without using 'hands-on' kinds of materials ........................ 1 2 3 4 5
6. When the students use manipulatives they often seem to play with them and not much real work gets done .................... 1 2 3 4 5
7. I think that manipulative materials are appropriate for mathematics instruction for all children in my class ............. 1 2 3 4 5
8. My students only need to use manipulatives when they are learning new mathematical concepts or when they require extra help .... 1 2 3 4 5
9. I use physical objects and mathematics manipulatives for all teaching of mathematics in my classroom ..................... 1 2 3 4 5
In the following section, indicate how much you use each instructional practice for teaching mathematics, according to this scale:

1 means you ALMOST NEVER do this  
2 means you SOMETIMES do this  
3 means you FREQUENTLY do this  
4 means you do this MOST OF THE TIME  
5 means you ALMOST ALWAYS do this

<table>
<thead>
<tr>
<th>Practice</th>
<th>Your Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. When introducing mathematical concepts to children I have them manipulate physical objects.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>11. I use the textbook lesson from the adopted math series to introduce new mathematical concepts.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>12. When developing concepts in math I have my students use manipulatives or other physical objects.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>13. My students use textbook or workbook pages as practice for each concept they have been introduced to in mathematics.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>14. I conduct lessons every day which focus on mathematical concepts other than during the regular math time, such as calendar-centered lessons, graphs, or group sorting activities.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>15. Types of mathematical work that the children have done, such as graphs, geometric designs, or number work are on display in my classroom.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>16. I integrate mathematics into every area of the curriculum, including reading, language arts, P.E., and art.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>17. I have mathematics learning centers or stations available which use manipulatives and 'hands-on' materials.</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

18. What guides your planning for mathematics instruction with your students? How do you decide what to teach and when? Circle the one item which you believe is most influential when you plan for mathematics instruction.

1 THE TEACHER'S GUIDE FROM THE ADOPTED TEXTBOOK SERIES  
2 MY OWN PLANNING SCHEDULE AND MY OWN DISCRETION  
3 A PLANNING GUIDE FROM A MANIPULATIVES WORKSHOP THAT I ATTENDED  
4 THE DISTRICT'S CURRICULUM GUIDE AND ITS GRADE LEVEL OBJECTIVES  
5 OTHER (Please describe)  

Do you have any comments concerning your planning strategies?
19. When you use manipulatives for mathematics instruction, how do you use them? How do the students use them? In the space below, briefly describe a typical teaching/learning sequence in which manipulatives are used.

20. Do you have any further clarifying comments about the way you teach mathematics in your classroom?

Thank you for your cooperation.
Scoring device for item 19 on Survey B-Version 2

1 - Children complete assignments; teacher is not involved
2 - Teacher observes; answers questions if asked
3 - Teacher shows children what to do; children replicate what teacher demonstrates (teacher leads - children follow)
4 - Teacher demonstrates techniques for using manipulatives; children model after demo, and use manipulatives as modeled
5 - Teacher demonstrates and asks questions soliciting thoughtful responses from children which indicate children's understanding of use of manipulatives; children use manipulatives while teacher circulates and observes, questions

? - Explanation:
(7) Classroom Observation Form

Classroom Observation - Field Test

Observer ___________________________ I.D. Code ____________

Classroom Environment

Rating scale:
0 = No manipulatives available at all (texts only)
1 = None in this classroom; some evidence of use
   (in building)
2 = Stored away in classroom closet or available
   somewhere in building (some use; not often)
3 = Available for use by teacher in classroom
   (demonstrations)
4 = Available for use by students with teacher's
   direction
5 = Available for independent student use

1. Manipulative materials

--pattern blocks, parquetry, other shape/pattern blocks, frames
--unifix cubes, multilinks, or similar connecting cubes
--geoboards and bands, geostrips, geoblocks
--"junk" boxes or similar
--attribute blocks or other sorting materials
--Counting/place value equipment such as cuisenaire rods, base
   ten blocks, chip trading, grouped sticks or blocks, place
   value boards
--'Number' equipment such as wooden cubes, tiles, toothpicks,
   two-sided beans, jewels, other objects for counting
--measurement equipment - clocks, measuring cups/spoons,
   scales, rulers, trundle wheel, volume measures, pan
   balance, etc.
--fraction tiles, tangrams, or similar
--money, play money, cash register, etc.
--pegboards, colored cubes, design blocks (perceptual-motor)
--boxed games and game equipment (dice, spinners, etc., such as
   Box It/Bag It materials)
--commercially prepared arithmetic games; dominoes
--Cooking equipment
--construction materials
--Teacher demonstration materials (overhead projector pieces)

Comments about quantities and qualities of materials:
2. **Math Their Way** types of work displayed, i.e. graphs, recordings of patterns or number work (toothpick configurations, or similar); tiny jewel books, small group number books; charts

Rating scale:

0 = None in building
1 = None in this classroom
2 = Outside of classroom (hallway display, etc)
3 = Few (1-2 types, categories)
4 = Moderate amount (2 - 3 types)
5 = Quite a lot (more than 3 types)

Describe:

3. A **Math Their Way** (MTW) "Calendar" or "Daily Opening" bulletin board within easy view; kept up to date; teacher and students interact concerning this activity

Rating scale:

0 = None
1 = Traditional calendar on display (not MTW)
2 = MTW Calendar present, with perhaps one or two other items (weather graph, number line, days of week, etc.); done sporatically; not discussed with students
3 = A calendar display present with some other items; not done daily but 2 or 3 times a week; discussed/done by teacher or students with some students participating and observing
4 = A MTW calendar display present with several concepts/activities displayed and completed daily; discussed/done by teacher or students with other students participating and/or observing
5 = A complete, up-to-date MTW calendar display with a variety of concepts/activities represented; teacher and students complete and discuss concepts with all classroom students observing, participating

5. Classroom teacher can be questioned to determine if the current status of classroom environment is typical. Adjust rating if teacher can describe qualifying evidence and greater frequency of use than is currently observable. Describe adjustments:
APPENDIX D:
Factors Questionnaire

(1) Cover letter - final version
(2) Factors Questionnaire - final version
(3) Factors Questionnaire - field test version
(1) Factors Questionnaire - Cover letter

February, 1990

Dear Primary Grade Teacher,

Thank you so much for participating in the first two phases of the Primary Mathematics Project. Information from teachers like you is enabling us to get a better picture of what is currently happening in Oregon schools. It is our belief that this project will help further knowledge for teaching mathematics.

In this final phase of the project, we are investigating those things that influence primary grade teachers for teaching mathematics. As you are well aware, there are many factors involved in making decisions about how we will teach, what will be taught, and why we do what we do. Many of the variables are interrelated, and it is difficult to sort out what is most influential in instructional matters. This questionnaire is designed to identify these influential factors. Because there are many influences on the how's, what's, and why's in teaching, the investigation of these matters will necessarily have to match that complexity.

As before, it is absolutely essential that the information you provide be as accurate and honest as possible. Again, your complete confidentiality is totally guaranteed.

When this questionnaire was pretested, it took the teachers who completed it about a half an hour, and they told us that it was interesting to do. We hope you will agree that the time you spend passes quickly.

Thank you so much for assisting us to gain valuable information about teaching behaviors and beliefs.

Sincerely,

Karen C. Smith
Doctoral Student
Elementary Education

As you were informed in the previous phase of the project, a summary of the results will be available. One of the following statements will apply to you:

☐ Please complete the enclosed request card and return it with the questionnaire if you would like to have a copy mailed to you.

☐ Your request card is already on file, and you will receive the results when the project is completed, probably in late spring.
This survey contains questions about influences on primary grade teachers for mathematics instruction. Your cooperation and insights are greatly appreciated.
PRIMARY MATHEMATICS QUESTIONNAIRE

I. The first section of this questionnaire asks about your college education and/or teacher training . . .

For each of the following three questions, you will first read two descriptions of approaches to education. Consider both descriptions and indicate which approach, to the best of your recollection, was advocated in your teacher training. Then indicate which approach best describes your own teaching approach now. (The responses to each question may be the same or different.)

1. Beliefs about learning

   A. There is a fairly well established sequence for learning academic skills and concepts. Children need instruction in order to proceed through these sequences. The teacher is responsible for moving children successfully through these sequences.

   B. Children are desirous of learning. The curriculum should reflect the students' interests. The teacher's responsibility is to understand child development and fit the curriculum to the students in her/his classroom.

   Please respond by writing A or a in each box below.

   [ ] THIS APPROACH WAS ADVOCATED AT THE COLLEGE OR UNIVERSITY WHERE YOU RECEIVED YOUR TEACHER TRAINING AND/OR EDUCATION

   [ ] THIS APPROACH REPRESENTS THE WAY YOU TEACH NOW

2. Role of the teacher

   A. The teacher is the facilitator of learning, providing experiences and materials that will initiate children's thinking in divergent ways. Although children may produce something, it is the processes of learning that are more important.

   B. The teacher is a source of knowledge and learning. The teacher motivates the children to be interested in learning. The products of learning are very important, demonstrating the child's understanding of what she/he learned.

   Please respond by writing A or a in each box below.

   [ ] THIS APPROACH WAS ADVOCATED AT THE COLLEGE OR UNIVERSITY WHERE YOU RECEIVED YOUR TEACHER TRAINING AND/OR EDUCATION

   [ ] THIS APPROACH REPRESENTS THE WAY YOU TEACH NOW
3. Classroom environment

A. The classroom is organized to facilitate teacher-directed instruction. Students have their own workspaces, and class assignments are usually done individually, following some initial instruction/demonstration by the teacher. The preferred classroom atmosphere is one of quiet. Most of the classroom materials are stored away (such as in desks or cupboards) and taken out for specific lessons.

B. The classroom environment is set up to be a source of learning. There are areas for small group work, large group instruction, and individual work. The materials and equipment are organized for independent student access and use, such as in learning centers or stations. The students set up and put away the materials they need. The classroom atmosphere often consists of noise and activity.

Please respond by writing A or B in each box below.

☐ THIS APPROACH WAS ADVOCATED AT THE COLLEGE OR UNIVERSITY WHERE YOU RECEIVED YOUR TEACHER TRAINING AND/OR EDUCATION

☐ THIS APPROACH REPRESENTS THE WAY YOU TEACH NOW

4. Please indicate the highest level of formal education you have attained. [Circle the appropriate number.]

1 BACHELOR'S DEGREE
2 BACHELOR'S DEGREE PLUS 30 OR MORE COLLEGE CREDITS
3 BACHELOR'S DEGREE PLUS 45 CREDITS AND/OR MASTER'S DEGREE
4 MASTER'S DEGREE PLUS 30 OR MORE COLLEGE CREDITS
5 DOCTORATE DEGREE

5. Indicate your degree majors and any area(s) of specialization, if appropriate.

A. BACHELOR'S DEGREE MAJOR __________________________
   AREAS(S) OF SPECIALIZATION __________________________

B. POST-BACHELOR'S DEGREE MAJOR(S) __________________
   AREAS(S) OF SPECIALIZATION __________________________

C. Do you have any clarifying comments about your educational background and/or teacher training?
6. Think now about your initial teacher training/education and any subsequent coursework and/or teacher workshops. For each type of educational experience stated below, indicate if it is or is not a significant influence on your current teaching style and practice. [Circle one number for each item]

A. College/university teacher training coursework (Bachelor’s degree and certification) ........................................ 1 2
B. Post-bachelor’s degree coursework at a college/university (Master’s degree coursework or beyond) ........................................ 1 2
C. Workshops, seminars, and conferences for teachers which are not a part of a degree program ........................................ 1 2
D. District-provided instruction in curriculum and teaching methods ........................................ 1 2
E. Other (specify) ........................................ 1 2

7. Looking again at those educational experiences in question 6 above, which one has been most influential in developing your current teaching beliefs and practices? [Write A, B, C, D, or E]

[ ] MOST INFLUENTIAL EDUCATIONAL EXPERIENCE

II. In this section, think about mathematics in general, and your own teaching of mathematics in particular...

8. For each statement in the following section, please indicate your strength of agreement or disagreement by circling the appropriate number for each item.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Strongly Disagree</th>
<th>Neither Agree or Disagree</th>
<th>Mildly Agree</th>
<th>Mildly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Mathematics is very interesting and I enjoy taking courses in this subject.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B. I avoided mathematics courses in college, if I possibly could.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C. Formal mathematics makes me feel uneasy and confused.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D. Mathematics helps to develop a person’s mind and teaches him/her to think.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>E. It’s important to be capable doing mathematics in order to be an effective teacher of it, even in primary grades...</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>F. I understand all strands of the elementary mathematics curriculum and what concepts are specified in each strand...</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>G. I need more course work in mathematics to enable me to be a better teacher of it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>H. I need more courses or workshops in methods of teaching mathematics to elementary students...</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I. My initial coursework adequately provided me with the skills and understandings I need to teach math effectively...</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>J. The classes and workshops I’ve had since my initial teacher training have enabled me to teach mathematics effectively...</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>K. Mathematics is not one of my favorite subjects; I probably minimize the amount of time spent teaching it in my classroom...</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
III. The questions in the following section are concerned with your first (or only) manipulatives class/workshop, such as *Mathematics Their Way*, *Box It/Bag It Mathematics*, "Mathematics for Early Childhood," or some similar course/workshop, but not courses you may have taken in college as part of your teacher training.

9. Please give the name of the course you took and the instructor's name (if you can remember it).
   A. NAME OF COURSE
   B. INSTRUCTOR

10. How many college credits were offered for this course?
   1. NONE
   2. ONE CREDIT
   3. TWO OR THREE CREDITS
   4. FOUR OR FIVE CREDITS
   5. MORE THAN FIVE CREDITS

11. When did you take your first manipulatives course/workshop?
   1. IN THE PAST YEAR
   2. ONE-THREE YEARS AGO
   3. FOUR-SIX YEARS AGO
   4. SEVEN-TEN YEARS AGO
   5. MORE THAN TEN YEARS AGO

12. What motivated you to take this manipulatives course/workshop? Following each statement, indicate whether it *was* or *was not* a significant influence. [Circle one number for each item]

<table>
<thead>
<tr>
<th>Motivation</th>
<th>YES, SIGNIFICANT</th>
<th>NO, NOT SIGNIFICANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Personal/professional interest</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>B. Required for your teaching assignment</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>C. To improve your knowledge and methods of teaching math to your students</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>D. To earn college credits</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>E. Other (specify)</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

13. Looking again at the motivations listed in question 12, what was the most influential reason for taking the manipulatives workshop? [Write A, B, C, D, or E]

   ☐ MOST INFLUENTIAL MOTIVATION
14. Indicate if you have been able to use the information and techniques provided during this course in your own teaching of mathematics.

1. I HAVE NOT USE IT AT ALL
2. I HAVE USED IT A MINIMAL AMOUNT
3. I HAVE USED IT A MODERATE AMOUNT
4. I HAVE USED IT QUITE A LOT
5. I HAVE USED IT A GREAT DEAL

15. How did you find out about the manipulatives workshop? Following each statement, indicate whether it was or was not a source of information. [Circle one number for each item]

<table>
<thead>
<tr>
<th></th>
<th>YES, A SOURCE</th>
<th>NO, NOT A SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Professional books or other resources</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>B. Professional colleagues</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>C. Professional conference or workshop</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>D. School district, which promoted the program and/or workshop</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>E. Other (specify)</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

16. Which source, of those listed in question 15, was most informative or influential for motivating you to take the workshop? [Write A, B, C, D, or E]

☐ MOST INFLUENTIAL SOURCE OF INFORMATION

17. During the workshop itself, what percentage of the time were you actually involved in hands-on use of materials?

1. HARDLY SPENT ANY TIME
2. 25% OF THE TIME
3. 50% OF THE TIME
4. 75% OF THE TIME
5. 100% OF THE TIME

18. Did you do "make-and-take" (construct materials for classroom use) as a part of the course? [Circle one response only, please]

1. THERE WAS NO "MAKE-AND-TAKE"
2. THERE WAS A MINIMAL AMOUNT OF "MAKE-AND-TAKE"
3. THERE WAS SOME "MAKE-AND-TAKE"
4. THERE WAS A LOT OF "MAKE-AND-TAKE"
5. THERE WAS DAILY "MAKE-AND-TAKE"
6. OTHER (specify) ________________________________

19. If you did "make-and-take," how useful have these materials been to you in teaching mathematics to primary grade students?

0. THERE WAS NO "MAKE-AND-TAKE"
1. NOT USEFUL AT ALL
2. MINIMALLY USEFUL
3. SOMEWHAT USEFUL
4. VERY USEFUL
5. EXTREMELY USEFUL
20. Please indicate whether or not each of the following was required as homework or assignments for this course.

<table>
<thead>
<tr>
<th>YES, REQUIRED</th>
<th>NO, NOT REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Reading the course book</td>
<td>1</td>
</tr>
<tr>
<td>B. Reading articles and handouts</td>
<td>1</td>
</tr>
<tr>
<td>C. Writing a paper or an instructional plan</td>
<td>1</td>
</tr>
<tr>
<td>D. Completing &quot;make-and-take&quot; projects</td>
<td>1</td>
</tr>
<tr>
<td>E. Other (specify)</td>
<td>1</td>
</tr>
</tbody>
</table>

21. For each of the following statements, please indicate your strength of agreement or disagreement by circling the appropriate number.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Mildly Disagree</th>
<th>Neither Agree</th>
<th>Mildly Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. It seems like I have forgotten much of what I learned at the manipulatives workshop, and I could use a refresher course</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>B. I think the type of workshop I took enabled me to use manipulatives effectively in my classroom</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C. I wish I had taken a different workshop, one that would have enabled me to use hands-on mathematics instruction more effectively</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>D. The instructor of the workshop I took was knowledgeable and motivated me to use the ideas presented in my own teaching</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>E. The instructor of the workshop did not have a significant impact on my response to it</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

22. What impact did this initial manipulatives workshop have on you?

23. How many other subsequent mathematics courses/workshops have you had that emphasize hands-on instruction and use of manipulative materials?

1. NO OTHER COURSES [Now skip to question 28]
2. NO COURSES, BUT HAVE ATTENDED INFORMAL ‘SUPPORT GROUP’ MEETINGS [Now skip to question 28]
3. ONE COURSE [Go on to question 24]
4. TWO COURSES [Go on to question 24]
5. THREE COURSES OR MORE [Go on to question 24]
24. When did you take your most recent manipulatives course/workshop (subsequent to your first course/workshop)?

1. IN THE PAST YEAR
2. ONE-THREE YEARS AGO
3. FOUR-SIX YEARS AGO
4. SEVEN-TEN YEARS AGO
5. MORE THAN TEN YEARS AGO

25. What motivated you to take subsequent manipulatives courses? Following each statement, indicate whether it was or was not a significant influence. [Circle one number for each item]

<table>
<thead>
<tr>
<th>YES, Signific*</th>
<th>NO, NOT Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Personal/professional interest</td>
<td>1</td>
</tr>
<tr>
<td>2. Required for your teaching assignment</td>
<td>1</td>
</tr>
<tr>
<td>3. To improve your knowledge and methods of teaching math to your students</td>
<td>1</td>
</tr>
<tr>
<td>4. To earn college credits</td>
<td>1</td>
</tr>
<tr>
<td>5. Other (specify)</td>
<td>1</td>
</tr>
</tbody>
</table>

26. Looking again at the motivations listed in question 25, what was the most influential reason for taking another manipulatives workshop? [Write A, B, C, D, or E]

☐ MOST INFLUENTIAL MOTIVATION

27. Which of the following statements best describes your response to the subsequent manipulatives course(s)?

1. SUBSEQUENT COURSES HAVE NOT BEEN USEFUL TO ME AT ALL
2. SUBSEQUENT COURSES HAVE BEEN SOMEWHAT USEFUL TO ME
3. SUBSEQUENT COURSES WERE EQUALLY USEFUL TO ME AS THE FIRST COURSE I TOOK
4. SUBSEQUENT COURSES WERE MORE USEFUL TO ME THAN MY INITIAL COURSE
5. SUBSEQUENT COURSES HAVE BEEN MUCH MORE USEFUL

28. How likely are you to take another course that may extend and/or support your use of manipulatives for mathematics instruction?

1. NOT AT ALL LIKELY
2. NOT TOO LIKELY
3. I MAY OR MAY NOT TAKE ONE
4. SOMEBEWHAT LIKELY
5. VERY LIKELY

IV. For the next set of questions, think about the school climate that surrounds your teaching situation . . .

29. How much release or inservice time per school year is given by your district/building for curriculum and teaching improvement?

1. NO RELEASE TIME AT ALL
2. FOUR HOURS, ONE-HALF DAY, OR LESS
3. ONE FULL TEACHING DAY, FIVE - EIGHT HOURS
4. TWO - THREE TEACHING DAYS, OR EQUIVALENT HOURS
5. MORE THAN THREE TEACHING DAYS, OR EQUIVALENT
6. OTHER (specify)
30. What percent of the materials needed for teaching mathematics in your classroom, excluding textbooks/workbooks, were provided by your district/building?

1. NONE
2. 25% OF THE MATERIALS NEEDED
3. 50% OF THE MATERIALS NEEDED
4. 75% OF THE MATERIALS NEEDED
5. 100% OF THE MATERIALS NEEDED

31. How much of your own money (not reimbursed) has been spent on mathematics materials for your classroom, excluding books?

1. NONE
2. $25 OR LESS
3. $25 - $75
4. $75 - $150
5. MORE THAN $150

32. When you were first getting into manipulatives, how supportive was your building principal about the use of manipulatives for teaching mathematics?

1. NOT SUPPORTIVE AT ALL
2. MINIMALLY SUPPORTIVE
3. SOMEWHAT SUPPORTIVE
4. QUITE SUPPORTIVE
5. VERY SUPPORTIVE

33. How does your current building principal seem to feel about the use of manipulatives? [Select the one answer which best describes your principal's position.]

1. MY PRINCIPAL PREFERS A TEXTBOOK/WORKBOOK APPROACH, EMPHASIZING ARITHMETIC COMPETENCY
2. MY PRINCIPAL ADVOCATES A TEXTBOOK APPROACH BUT MANIPULATIVES CAN SUPPLEMENT IT
3. MY PRINCIPAL DOES NOT ENCOURAGE OR DISCOURAGE ANY APPROACH; SHE/HE LEAVES THAT UP TO THE TEACHERS
4. MY PRINCIPAL ENCOURAGES THE USE OF MANIPULATIVES FOR MATHEMATICS INSTRUCTION
5. MY PRINCIPAL IS VERY SUPPORTIVE OF MANIPULATIVES-BASED TEACHING AND PROVIDES MATERIALS TO DO SO

34. How supportive is your building principal of your methods of teaching in your classroom?

1. NOT SUPPORTIVE AT ALL
2. MINIMALLY SUPPORTIVE
3. SOMEWHAT SUPPORTIVE
4. QUITE SUPPORTIVE
5. VERY SUPPORTIVE

35. How often do you get with other teachers specifically to discuss teaching practices and ideas, other than at regular staff meetings?

1. NOT AT ALL
2. ONCE OR TWICE A YEAR
3. ABOUT ONCE EVERY THREE MONTHS OR SO
4. ABOUT ONCE A MONTH
5. ABOUT ONCE A WEEK OR MORE
36. How often do you offer parent meetings, informal discussions, and/or parent newsletters specifically to communicate about teaching practices and beliefs, other than at report card conferences?

1 NEVER
2 ONCE A YEAR OR LESS
3 ONCE OR TWICE A YEAR
4 TWO OR THREE TIMES EACH YEAR
5 MORE THAN THREE TIMES EACH YEAR

37. For each statement in the following section, please indicate your strength of agreement or disagreement by circling the appropriate number.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Mildly Disagree</th>
<th>Neither Agree</th>
<th>Mildly Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>My district's curriculum advocates a workbook approach for teaching mathematics.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>B.</td>
<td>My district supports the use of 'hands-on' teaching for mathematics, especially in the primary grades.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C.</td>
<td>If my district/building supplied them, I would use manipulatives and physical objects more.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>D.</td>
<td>My use of manipulatives is not dependent on support, or lack of it, from my district.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>E.</td>
<td>If my building principal were more supportive, I would use 'hands-on' techniques more often.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>F.</td>
<td>The practices and attitudes of other teachers in my building are a significant influence on me in regard to teaching mathematics.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>G.</td>
<td>Most of the teachers at my grade level are enthusiastic about using math manipulatives.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>H.</td>
<td>The parents of my students seem to want their children to spend math time mostly doing computations and memorizing 'math facts'.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I.</td>
<td>My students' parents seem supportive of hands-on methods for learning mathematics.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>J.</td>
<td>I find it difficult to explain to parents why a teacher should use manipulatives and physical objects for teaching mathematics.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>K.</td>
<td>I can see a difference in understanding when my students have used manipulatives along with their paper/pencil or workbook assignments.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>L.</td>
<td>The effects of using manipulatives don't seem to show up well on formal measures of achievement (such as standardized tests).</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>M.</td>
<td>I plan to continue to use manipulatives with the students for mathematics instruction even if I am not supported for doing so.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
V. Finally, a few questions about you to help clarify and summarize the results...

38. How many years have you been teaching?
   1  THIS IS MY FIRST YEAR
   2  ONE-FOUR YEARS
   3  FIVE-TEN YEARS
   4  TEN-FIFTEEN YEARS
   5  FIFTEEN YEARS OR MORE

39. How many years have you taught at the primary grade level (kindergarten, first, second grades or combination of these)?
   1  THIS IS MY FIRST YEAR
   2  ONE-FOUR YEARS
   3  FIVE-TEN YEARS
   4  TEN-FIFTEEN YEARS
   5  FIFTEEN YEARS OR MORE

40. What is your age?
   1  20-25 YEARS OLD
   2  26-30 YEARS OLD
   3  31-40 YEARS OLD
   4  41-50 YEARS OLD
   5  51 YEARS OR OLDER

41. Please identify your gender:
   1  MALE
   2  FEMALE

42. What do you believe is the most significant factor influencing the way you teach mathematics in your classroom?
   (Use the back of this page if you need more space)

Please return this questionnaire in the envelope provided.

Thank you so much for your cooperation!
Dear Primary Grade Teacher,

Thank you so much for participating in the first phase of the primary grades mathematics project. It is absolutely vital that we information from teachers like you in order to get a true picture of what is currently happening in Oregon schools related to mathematics instruction. Your participation in this project will help further knowledge for teaching mathematics. Without help from people like you, essential information is simply not available for educational research.

This final phase of the project involves an investigation of the factors that influence what primary grade teachers do when teaching mathematics to their students. As you are well aware, there are many factors involved in making decisions about how we will teach, what will be taught, and why we do what we do. Many of these variables are interrelated, and it is difficult to sort out what is most influential in instructional matters.

This questionnaire is designed to identify these influential factors. As you can see, it is somewhat lengthy. Because there are many influences on the why's, how's, and what's in teaching, the investigation of these matters will necessarily need to match that complexity. Although you may not be able to believe it as you complete this questionnaire, most teachers have finished in about half an hour. As before, it is essential that the information you provide be as accurate and honest as possible. Again, your complete confidentiality is totally guaranteed. The deadline for this phase of the study is

When this project is complete, the results will be summarized and available. Please indicate on the enclosed card if you would like to have a copy mailed to you, and return the card with this questionnaire.

Thank you so much for enabling us to gain valuable information about teaching behaviors and beliefs.

Sincerely,

Karen C. Smith
Doctoral Student
Elementary Education
Oregon State University
I. The first section of this questionnaire asks about your college education and/or teacher training . . .

For each of the following three questions, you will first read two descriptions of approaches to education. Consider both descriptions and indicate which approach, to the best of your recollection, was advocated in your teacher training. Then indicate which approach best describes your own teaching approach now. (The responses to each question may be the same or different.)

1. Beliefs about learning

A. There is a fairly well established sequence for learning academic skills and concepts. Children need instruction in order to proceed through these sequences. The teacher is responsible for moving children successfully through these sequences.

B. Children are desirous of learning. The curriculum should reflect the students' interests. The teacher's responsibility is to understand child development and fit the curriculum to the students in her/his classroom.

Please respond by writing A or B in each box below.

☐ THIS APPROACH WAS ADVOCATED AT THE COLLEGE OR UNIVERSITY WHERE YOU RECEIVED YOUR TEACHER TRAINING AND/OR EDUCATION

☐ THIS APPROACH REPRESENTS THE WAY YOU TEACH NOW

2. Role of the teacher

A. The teacher is the facilitator of learning, providing experiences and materials that will initiate children's thinking in divergent ways. Although children may produce something, it is the processes of learning that are more important.

B. The teacher is a source of knowledge and learning. The teacher motivates the children to be interested in learning. The products of learning are very important, demonstrating the child's understanding of what she/he learned.

Please respond by writing A or B in each box below.

☐ THIS APPROACH WAS ADVOCATED AT THE COLLEGE OR UNIVERSITY WHERE YOU RECEIVED YOUR TEACHER TRAINING AND/OR EDUCATION

☐ THIS APPROACH REPRESENTS THE WAY YOU TEACH NOW
3. **Classroom environment**

   A. The classroom is organized to facilitate teacher-directed instruction. Students have their own workspaces, and class assignments are usually done individually, following some initial instruction/demonstration by the teacher. The preferred classroom atmosphere is one of quiet. Most of the classroom materials are stored away (such as in desks or cupboards) and taken out for specific lessons.

   B. The classroom environment is set up to be a source of learning. There are areas for small group work, large group instruction, and individual work. The materials and equipment are organized for independent student access and use, such as in learning centers or stations. The students set up and put away the materials they need. The classroom atmosphere often consists of noise and activity.

Please respond by writing A or B in each box below.

- □ THIS APPROACH WAS ADVOCED AT THE COLLEGE OR UNIVERSITY WHERE YOU RECEIVED YOUR TEACHER TRAINING AND/OR EDUCATION
- □ THIS APPROACH REPRESENTS THE WAY YOU TEACH NOW

4. Please indicate the highest level of formal education you have attained. (Circle the appropriate number.)

   1. BACHELOR'S DEGREE
   2. BACHELOR'S DEGREE PLUS 30 OR MORE COLLEGE CREDITS
   3. BACHELOR'S DEGREE PLUS 45 CREDITS AND/OR MASTER'S DEGREE
   4. MASTER'S DEGREE PLUS 30 OR MORE COLLEGE CREDITS
   5. DOCTORATE DEGREE

5. Indicate your degree majors and any area(s) of specialization, if appropriate.

   A. BACHELOR'S DEGREE MAJOR ____________________________
      AREAS(S) OF SPECIALIZATION ____________________________

   B. POST-BACHELOR’S DEGREE MAJOR(S) ____________________
      AREAS(S) OF SPECIALIZATION ____________________________

   C. Do you have any further clarifying comments about your formal educational background?
6. Think about your initial teacher training/education and any subsequent coursework and/or teacher workshops. For each type of educational experience stated below, indicate (by circling 1 or 2) if it is or is not a significant influence on your current teaching style and practice.

<table>
<thead>
<tr>
<th></th>
<th>THIS IS A SIGNIFICANT INFLUENCE</th>
<th>NOT A SIGNIFICANT INFLUENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A.</strong> College/university teacher training coursework (Bachelor's degree and certification)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>B.</strong> Post-bachelor's degree coursework at a college/university (Master's degree coursework or beyond)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>C.</strong> Workshops, seminars, and conferences for teachers which are not a part of a degree program</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>D.</strong> District-provided instruction in curriculum and teaching methods</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>E.</strong> Other (specify)</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

7. Looking again at those educational experiences in question 6 above, which one has been most influential in developing your current teaching beliefs and practices? (Write A, B, C, D, or E)

   - MOST INFLUENTIAL EDUCATIONAL EXPERIENCE

II. In this section, think about mathematics in general, and your own teaching of mathematics in particular...

For each statement in the following section, please indicate your strength of agreement or disagreement by circling the appropriate number according to this scale:

1 means you STRONGLY DISAGREE
2 means you MILDLY DISAGREE
3 means you NEITHER AGREE NOR DISAGREE
4 means you MILDLY AGREE
5 means you STRONGLY AGREE

<table>
<thead>
<tr>
<th>Statement</th>
<th>Your Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Mathematics is very interesting and I enjoy taking courses in this subject.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>9. I avoided mathematics courses in college, if I possibly could.</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>10. Formal mathematics makes me feel uneasy and confused.</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
11. Mathematics helps to develop a person's mind and teaches him/her to think.

12. Mathematics basically consists of formulas and rules.

13. It's important to be capable doing mathematics in order to be an effective teacher of it.

14. I understand the strands of the elementary mathematics curriculum and what concepts are specified in each strand.

15. If I was more capable doing mathematics I would be a better teacher of it.

16. I need more coursework in mathematics and methods of teaching mathematics to elementary students.

17. My college coursework adequately provided me with the skills and understandings I need to teach math effectively.

18. The classes and workshops I've had since my initial teacher training have enabled me to teach mathematics effectively.

19. Mathematics is not one of my favorite subjects; I probably minimize the amount of time spent teaching it in my classroom.

III. The questions in the following section are concerned with your initial (or only) manipulatives class/workshop, such as Mathematics Their Way, Box It/Bag It Mathematics, “Mathematics for Early Childhood,” or some similar course/workshop, but not courses you may have taken in college.

20. Please give the name of the course and the instructor's name (if you can remember it).

A. NAME OF COURSE

B. INSTRUCTOR

21. How many college credits were offered for this course?

1. NONE
2. ONE CREDIT
3. TWO OR THREE CREDITS
4. FOUR OR FIVE CREDITS
5. MORE THAN FIVE CREDITS

22. When did you take the manipulatives course/workshop?

1. IN THE PAST YEAR
2. ONE-THREE YEARS AGO
3. FOUR-SIX YEARS AGO
4. SEVEN-TEN YEARS AGO
5. MORE THAN TEN YEARS AGO
23. What motivated you to take this manipulatives course/workshop? Circle 1 or 2 following each statement to indicate whether it was or was not a significant influence.

<table>
<thead>
<tr>
<th></th>
<th>THIS WAS A SIGNIFICANT INFLUENCE</th>
<th>NOT A SIGNIFICANT INFLUENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Personal/professional interest</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>B. Required for your teaching assignment</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>C. To improve your knowledge and methods of teaching math to your students</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>D. To earn college credits</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>E. Other (specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

24. Looking again at the motivations listed in question 23, what was the most influential reason for taking the manipulatives workshop? (Write A, B, C, D, or E)

☐ MOST INFLUENTIAL MOTIVATION

25. How did you find out about the manipulatives workshop? Circle 1 or 2 following each statement to indicate whether it was or was not a source of information.

<table>
<thead>
<tr>
<th></th>
<th>YES, A SOURCE</th>
<th>NO, NOT A SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Professional books or other resources</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>B. Professional colleagues</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>C. Professional conference or workshop</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>D. School district, which promoted the program and/or workshop</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>E. Other (specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

26. Which source, of those listed in question 25, was most informative or influential for motivating you to take the workshop? (Write A, B, C, D, or E)

☐ MOST INFLUENTIAL SOURCE OF INFORMATION

27. Indicate if you have been able to use the information and techniques provided during this course in your own teaching of mathematics.

1  I HAVE NOT USED IT AT ALL
2  I HAVE USED IT A MINIMAL AMOUNT
3  I HAVE USED IT A MODERATE AMOUNT
4  I HAVE USED IT QUITE A LOT
5  I HAVE USED IT A GREAT DEAL
28. During the workshop itself, what percentage of the time were you actually involved in hands-on use of materials?

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HARDLY SPENT ANY TIME</td>
</tr>
<tr>
<td>2</td>
<td>25% OF THE TIME</td>
</tr>
<tr>
<td>3</td>
<td>50% OF THE TIME</td>
</tr>
<tr>
<td>4</td>
<td>75% OF THE TIME</td>
</tr>
<tr>
<td>5</td>
<td>100% OF THE TIME</td>
</tr>
</tbody>
</table>

29. Did you do "make-and-take" (construct materials for classroom use) as a part of the course?

<table>
<thead>
<tr>
<th>Amount of Make-and-Take</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>THERE WAS NO &quot;MAKE-AND-TAKE&quot;</td>
</tr>
<tr>
<td>2</td>
<td>THERE WAS A MINIMAL AMOUNT OF &quot;MAKE-AND-TAKE&quot;</td>
</tr>
<tr>
<td>3</td>
<td>THERE WAS SOME &quot;MAKE-AND-TAKE&quot;</td>
</tr>
<tr>
<td>4</td>
<td>THERE WAS A LOT OF &quot;MAKE-AND-TAKE&quot;</td>
</tr>
<tr>
<td>5</td>
<td>THERE WAS DAILY &quot;MAKE-AND-TAKE&quot;</td>
</tr>
<tr>
<td>6</td>
<td>OTHER (specify) ________________________________</td>
</tr>
</tbody>
</table>

30. If you did "make-and-take," how useful have these materials been to you in teaching mathematics to primary grade students?

<table>
<thead>
<tr>
<th>Usefulness</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>THERE WAS NO &quot;MAKE-AND-TAKE&quot;</td>
</tr>
<tr>
<td>1</td>
<td>NOT USEFUL AT ALL</td>
</tr>
<tr>
<td>2</td>
<td>MINIMALLY USEFUL</td>
</tr>
<tr>
<td>3</td>
<td>SOMEWHAT USEFUL</td>
</tr>
<tr>
<td>4</td>
<td>VERY USEFUL</td>
</tr>
<tr>
<td>5</td>
<td>EXTREMELY USEFUL</td>
</tr>
</tbody>
</table>

31. Please indicate whether or not each of the following was required as homework or assignments for this course. (Circle 1 or 2 for each statement.)

<table>
<thead>
<tr>
<th>Requirement</th>
<th>YES, REQUIRED</th>
<th>NO, NOT REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Reading the course book</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>B. Reading articles and handouts</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>C. Writing a paper or an instructional plan</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>D. Completing &quot;make-and-take&quot; projects</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>E. Other (specify)</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

32. Do you have anything to say about the manipulatives course or workshop you first took?
For each of the following statements, please indicate your strength of agreement or disagreement by circling the appropriate number according to this scale:

1 means you STRONGLY DISAGREE
2 means you MILDLY DISAGREE
3 means you NEITHER AGREE NOR DISAGREE
4 means you MILDLY AGREE
5 means you STRONGLY AGREE

YOUR RESPONSE

33. It seems like I have forgotten much of what I learned at the manipulatives workshop, and I could use a refresher course .................................................. 1 2 3 4 5
34. I think the type of workshop I took enabled me to use manipulatives effectively in my classroom .................................................. 1 2 3 4 5
35. I wish I had taken a different workshop, one that would have enabled me to use hands-on mathematics instruction more effectively .................................................. 1 2 3 4 5
36. The instructor of the workshop I took was knowledgeable and motivated me to use the ideas presented in my own teaching .................................................. 1 2 3 4 5
37. The instructor of the workshop did not have a significant impact on my response to it .................................................. 1 2 3 4 5

38. How many other mathematics methods courses have you had that emphasized hands-on instruction and use of manipulative materials?

1 NO OTHER COURSES [Now skip to question 43]
2 NO COURSES, BUT HAVE ATTENDED INFORMAL ‘SUPPORT GROUP’ MEETINGS [Now skip to question 43]
3 ONE COURSE [Respond to questions 39 - 42]
4 TWO COURSES [Respond to questions 39 - 42]
5 THREE COURSES OR MORE [Respond to questions 39 - 42]

39. When did you take your most recent manipulatives course/workshop (subsequent to your first course/workshop)?

1 IN THE PAST YEAR
2 ONE-THREE YEARS AGO
3 FOUR-SIX YEARS AGO
4 SEVEN-TEN YEARS AGO
5 MORE THAN TEN YEARS AGO

40. What motivated you to take subsequent manipulatives courses? Circle 1 or 2 following each statement to indicate whether it was or was not a significant influence.

<table>
<thead>
<tr>
<th>THIS WAS A SIGNIFICANT INFLUENCE</th>
<th>NOT A SIGNIFICANT INFLUENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Personal/professional interest</td>
<td>1 2</td>
</tr>
<tr>
<td>B. Required for your teaching assignment</td>
<td>1 2</td>
</tr>
<tr>
<td>C. To improve your knowledge and methods of teaching math to your students</td>
<td>1 2</td>
</tr>
<tr>
<td>D. To earn college credits</td>
<td>1 2</td>
</tr>
<tr>
<td>E. Other (specify)</td>
<td>1 2</td>
</tr>
</tbody>
</table>
41. Looking again at the motivations listed in question 40, what was the **most** influential reason for taking another manipulatives workshop? (Write A, B, C, D, or E)

☐ MOST INFLUENTIAL MOTIVATION

42. Which of the following statements best describes your response to the subsequent manipulatives course(s)?

1. Subsequent courses have not been useful to me at all
2. Subsequent courses have been somewhat useful to me
3. Subsequent courses were equally useful to me as the first course I took
4. Subsequent courses were more useful to me than my initial course
5. Subsequent courses have been much more useful

43. How likely are you to take another course that may extend and/or support your use of manipulatives for mathematics instruction?

1. Not at all likely
2. Not too likely
3. I may or may not take one
4. Somewhat likely
5. Very likely

IV. For the next set of questions, think about the school climate that surrounds your teaching situation, and specifically, what influences the way you teach mathematics . . .

44. How much release or inservice time per school year is given by your district/building for curriculum and teaching improvement?

1. No release time at all
2. Four hours, one-half day, or less
3. One full teaching day, five - eight hours
4. Two - three teaching days, or equivalent hours
5. More than three teaching days, or equivalent
6. Other (specify)

45. What percent of the materials needed for teaching mathematics in your classroom were provided by your district/building?

1. None
2. 25% of the materials needed
3. 50% of the materials needed
4. 75% of the materials needed
5. 100% of the materials needed
46. How much of your own money (not reimbursed) has been spent on mathematics materials for your classroom, excluding books?

1. NONE  
2. $25 OR LESS  
3. $25 - $75  
4. $75 - $150  
5. MORE THAN $150

47. How supportive is your building principal of your methods of teaching mathematics in your classroom?

1. NOT SUPPORTIVE AT ALL  
2. MINIMALLY SUPPORTIVE  
3. SOMEWHAT SUPPORTIVE  
4. QUITE SUPPORTIVE  
5. VERY SUPPORTIVE

48. How does your building principal seem to feel about the use of manipulatives for teaching mathematics? (Select the one answer which best describes your principal's position.)

1. MY PRINCIPAL PREFERS A TEXTBOOK/WORKBOOK APPROACH, EMPHASIZING ARITHMETIC COMPETENCY  
2. MY PRINCIPAL ADVOCATES A TEXTBOOK APPROACH BUT MANIPULATIVES CAN SUPPLEMENT IT  
3. MY PRINCIPAL DOES NOT ENCOURAGE OR DISCOURAGE ANY APPROACH. SHE/HE LEAVES THAT UP TO THE TEACHERS  
4. MY PRINCIPAL ENCOURAGES THE USE OF MANIPULATIVES FOR MATHEMATICS INSTRUCTION  
5. MY PRINCIPAL IS VERY SUPPORTIVE OF MANIPULATIVES-BASED TEACHING AND PROVIDES MATERIALS TO DO SO

49. How often do you get with other teachers specifically to discuss teaching practices and ideas, other than at regular staff meetings?

1. NOT AT ALL  
2. ONCE OR TWICE A YEAR  
3. ABOUT ONCE EVERY THREE MONTHS OR SO  
4. ABOUT ONCE A MONTH  
5. ABOUT ONCE A WEEK OR MORE

50. How often do you offer parent meetings, informal discussions, and/ or parent newsletters specifically to communicate about teaching practices and beliefs, other than at report card conferences?

1. NEVER  
2. ONCE A YEAR OR LESS  
3. ONCE OR TWICE A YEAR  
4. TWO OR THREE TIMES EACH YEAR  
5. MORE THAN THREE TIMES EACH YEAR
For each statement in the following section, please indicate your strength of agreement or disagreement by circling the appropriate number according to this scale:

1 means you STRONGLY DISAGREE
2 means you MILDLY DISAGREE
3 means you NEITHER AGREE NOR DISAGREE
4 means you MILDLY AGREE
5 means you STRONGLY AGREE

51. My district’s curriculum advocates a workbook approach for teaching mathematics. ................................................................. 1 2 3 4 5

52. My district supports the use of ‘hands-on’ teaching for mathematics, especially in the primary grades. .................. 1 2 3 4 5

53. I want to use more physical objects and mathematics manipulatives, but the district/ building does not supply them and I cannot afford to buy them. ................................................................. 1 2 3 4 5

54. My use of manipulatives is not dependent on support, or lack of it, from my district. ................................................................. 1 2 3 4 5

55. If my building principal were more supportive, I would use hands-on techniques more often. .................................................. 1 2 3 4 5

56. The practices and attitudes of other teachers in my building do not influence me significantly in regard to teaching math ................................................................. 1 2 3 4 5

57. Most of the teachers at my grade level are enthusiastic about using math manipulatives. ................................................................. 1 2 3 4 5

58. The parents of my students seem to want their children to spend math time doing computation and memorizing ‘math facts’. ................................................................. 1 2 3 4 5

59. My students’ parents are supportive of hands-on methods for learning mathematics. ................................................................. 1 2 3 4 5

60. I find it difficult to explain to parents why a teacher should use manipulatives and physical objects for teaching mathematics. ................................................................. 1 2 3 4 5

61. The children prefer using physical objects and manipulatives for math ................................................................. 1 2 3 4 5

62. I can see a difference in understanding when my students have used manipulatives along with their paper/pencil or workbook assignments. ................................................................. 1 2 3 4 5

63. The effects of using manipulatives don’t seem to show up well on formal measures of achievement (such as standardized tests). ................................................................. 1 2 3 4 5

64. I am convinced that my students do better in math because they have used manipulatives. ................................................................. 1 2 3 4 5

65. I plan to continue to use manipulatives with the students for mathematics instruction even if I am not supported for doing so. ................................................................. 1 2 3 4 5

(Continue on to last page)
V. Finally, a few questions about you to help clarify and summarize the results...

68. How many years have you been teaching?
   1. THIS IS MY FIRST YEAR
   2. ONE-FOUR YEARS
   3. FIVE-TEN YEARS
   4. TEN-FIFTEEN YEARS
   5. FIFTEEN YEARS OR MORE

69. How many years have you taught at the primary grade level (kindergarten, first, second grades or combination of these)?
   1. THIS IS MY FIRST YEAR
   2. ONE-FOUR YEARS
   3. FIVE-TEN YEARS
   4. TEN-FIFTEEN YEARS
   5. FIFTEEN YEARS OR MORE

70. What is your age?
   1. 20-25 YEARS OLD
   2. 26-30 YEARS OLD
   3. 31-40 YEARS OLD
   4. 41-50 YEARS OLD
   5. 51 YEARS OR OLDER

71. Please identify your gender:
   1. MALE
   2. FEMALE

72. Please provide any comments you may have about the factors influencing the way you teach mathematics in your classroom.

Please return this questionnaire in the envelope provided. Also, if you want a copy of the results of this study, please return the enclosed card with your signature along with this questionnaire.

Thank you so much for your cooperation!
APPENDIX E:

Participant Response Card and

Thank you/Reminder Card
Participant Response Card

I would like to receive a copy of the results of the Primary Mathematics Project when it is completed. I understand that my name and position will not be included in the results of this study and is known only to the researchers involved.

YOUR NAME __________________________

MAILING ADDRESS __________________________

ZIP __________________________

Thank you/Reminder Card

Thank you for completing the Primary Mathematics Project survey that was mailed to you last week. Your participation enables us to gather important information about teaching beliefs and practices.

If you have not yet had a chance to complete the survey, please do so as soon as possible. The information you can provide is vital to this study.

Again, your participation in this project is very much appreciated.

Sincerely,

Karen C. Smith
Elementary Education
Oregon State University