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AN ANALYSIS OF STUDENT MATH SCORES BASED UPON TEACHER TRAINING IN THE INSTRUCTIONAL THEORY INTO PRACTICE MODEL

by

Martha O'Kray

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Education
Department of Education Leadership

Western Michigan University
Kalamazoo, Michigan
December 1992

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AN ANALYSIS OF STUDENT MATH SCORES BASED UPON TEACHER TRAINING IN THE INSTRUCTIONAL THEORY INTO PRACTICE MODEL

Martha O'Kray, Ed.D.

Western Michigan University, 1992

The main purpose of this study was to determine if teacher participation in Instructional Theory Into Practice (ITIP, Hunter, 1978) training resulted in any difference in student achievement. Student outcomes were measured by scores received on the district's Exit Level Mathematics Test (Roseville Community Schools, 1986).

The study took place in Roseville Community Schools. Six hundred forty-nine students and 32 teachers in Grades 3, 4, and 5 participated.

Fourteen teacher observations were included to confirm the appropriateness and frequency of ITIP strategies in classroom instruction. Observers using the Instructional Skills Observation Instrument (ISOI, Wolfe, 1984) scored non-ITIP-trained teachers higher than ITIP-trained teachers.

An analysis of variance (ANOVA) was used to determine if differences existed in student achievement between students who had been taught by teachers who participated in ITIP training and students who had been taught by teachers who had not participated in ITIP training. Data were presented on the number of years students had been exposed to teachers with ITIP training.

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The results of the data were determined to be significant at the .05 alpha level.

The findings supported the following hypothesized relationships between the degree of ITIP training for teachers and their students' performance on an Exit Level Mathematics Test: (a) ITIP training versus no ITIP training, (b) ITIP 1-year contact versus no ITIP training, (c) ITIP consecutive contact versus no ITIP training, (d) ITIP intermittent contact versus no ITIP training, and (e) ITIP consecutive contact versus ITIP 1-year contact.

The findings failed to support the following hypothesized relationships between (a) ITIP intermittent contact versus ITIP 1-year contact and (b) ITIP intermittent contact versus ITIP consecutive contact.

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DEDICATION

This study is dedicated to my husband, Norman, and children, Katherine and Mark. Their love and support for each family member's endeavor is a continued source of pride.

Martha O'Kray

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Many people have contributed to the completion of this study. Without their help, this project would not have been possible. Professional gratitude is extended to my committee, Dr. David Cowden, chair; Dr. Patrick Jenlink; and Dr. Linda Voit, for the time, effort, and guidance they provided on my behalf. Linda, especially, rekindled the flame.

The Roseville administration and staff were also instrumental. They encouraged, participated, and helped whenever asked. I value and appreciate the special friendships of my colleagues.

Last, but not least, I would like to thank Addamae Akin for her gentle prodding, optimistic cheerleading, and camaraderie. She kept me on track.

Martha O'Kray

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CHAPTER I

INTRODUCTION

At the beginning of the decade of the 1990s, there is growing concern that public education is not preparing students to meet the challenge of the future. The effectiveness of education is a matter of concern to parents, the private sector, and the federal government. School officials are on the firing line to be more accountable and produce maximum student achievement. One method often used by school districts to improve student outcomes is teacher in-service. In-service is viewed as a practical process for updating teachers on educational trends and research. This method of helping teachers become more effective must be evaluated and is the focus of this study.

Researchers have long sought information to discriminate between more or less effective teachers in an effort to maximize student achievement. Teacher effectiveness has been a subject of research for almost a century. By the mid 1970s, more than 10,000 studies had been conducted and reported. Reviews by Good, Biddle, and Brophy (1975); Brophy and Evertson (1976); and Forman and Chapman (1979) identified concerns in teacher effectiveness research. Due to serious weaknesses in experimental designs or in the types of variables studied, most earlier findings did not contribute much to the understanding of what constitutes effective teaching.

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Teacher effectiveness research has evolved in four phases, forming the basis for the development of concepts and assumptions that underlie present practice.

In the first phase, early studies assumed teacher effectiveness to be a consequence of personality traits or characteristics of the teacher. Research attempted to identify those traits that differentiated good from poor teachers. A variety of factors, including satisfaction with teaching, authoritarian personality structure, and psychological adjustment, was examined. Teacher characteristics measured were teachers' eye color, voice quality, clothing style, and musical ability. A review of these studies by Getzels and Jackson (1963) failed to lend support to the "trait" theory, concluding that "very little is known for certain . . . about the relation between teacher personality and teacher effectiveness. The regrettable fact is that many of the studies so far have not produced significant results. Many others have produced only pedestrian findings" (p. 340).

In the 1960s and 1970s, the second phase of research emerged. Teacher effectiveness was conceived as a function of teaching methods. Bloom (1972) moved away from trait hypotheses to behavior hypotheses. Observations of classroom teaching behavior sought to identify teaching behaviors that were associated with increases in student achievement in regular classroom settings. Once identified, these behaviors were combined into principles of teaching, teaching practices, or behavioral profiles.

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Unconvinced that the conclusions reached would improve the understanding of teacher effectiveness, reviews by Gage (1978), Medley (1979), and Rosenshine (1977) suggested directions for new research. The third phase of teacher effectiveness focused on the relation of teaching behaviors, classroom climate, and pupil learning. Teacher effectiveness was dependent on the climate the teacher created and maintained in the classroom. Results of these studies identified the learning environment of more effective teachers' classrooms. These classrooms were more effectively managed and led to the further identification and distinction of teaching variables. Brophy and Evertson (1978) and Brophy (1981) asserted the need to consider the context within teaching behaviors and the intent and perceived meaning of behaviors.

Recent cycles of research on teacher effectiveness have been dependent on the mastery of a repertoire of competencies and the ability to use these competencies appropriately on professional decision making. Teaching behaviors derive meaning from the context in which they are embedded. Most of the things teachers do in their classroom are done for some purpose, some goal, or desired outcome. Effectiveness is determined by student outcomes.

As educational research continued to examine how teacher behaviors impacted on students, contradictory studies received a great deal of publicity and public acceptance. Coleman et al. (1966) and Jencks et al. (1972) failed to identify specific teacher behaviors which consistently affect student learning in predictable ways. Evaluation data from compensatory education, particularly Head

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Start, by Jensen (1969) was overwhelmingly negative. Popham (1971) concluded that teacher training and the presumed expertise it produces in teachers does not make a measurable difference in student learning. In addition, a review of educational intervention studies (Averch, Carroll, Donaldson, Kiesling, & Pincus, 1974) concluded that no particular strategy for improving education was effective enough to guide any national policy on schooling.

Although earlier findings remain substantially intact, a different direction emerged. Studies looked much more carefully at the processes embodied in educational interventions as opposed to the labels and formal prescriptions attached to them (Cooley & Leinhardt, 1980). Research on instruction turned away from the conceptions of teaching as a rationally predetermined sequence of steps and toward a developmental interaction with learners.

A review by Brophy and Good (1974) reported:

> We now know much more about teacher effects on achievement than we did in 1963 or even 1973. . . .
>
> The fund of available information on producing student achievement (especially the literature related to the general area of classroom management and to the subject areas of elementary reading and mathematics instruction) has progressed from a collection of disappointing and inconsistent findings to a small but well established knowledge base. (p. 390)

Conclusions about effective teacher-student relationships cut across differing methods of instruction and forms of classroom organization. Attention focuses on the variations in process and implementation within educational innovations (Kiesling, 1971; Mann, 1978; Stallings, 1975; Stallings & Kaskowitz, 1974). These process

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models provide a flexible, theoretical base for program evaluation (Cooley & Leinhardt, 1980). Constructs such as learning time, readiness, and likelihood of success help to specify the "alterable variable" within the school environment (Bloom, 1986). Such constructs enable educators to act, in large measure, on what they have known all along about how to teach well (Edmonds, 1979; Powell, 1979). But the basic premises for their common sense activity can be qualified and selectively reinforced by a large volume of process-oriented research (Denham & Lieberman, 1980).

Given the effective teaching research to date, the challenge school administrators now face is how to utilize the findings to improve classroom instruction. In-service education is the most widely accepted process to help teachers become more effective. "Broadly conceived, in-service education includes all activities engaged in by the professional personnel during their service and designed to contribute to (professional) improvement" (Hass, cited in Mitzel, 1982, p. 883). New labels for in-service include staff development, continuing teacher education, and professional development. Staff development is viewed by many as a potent and economical method of improving instructional programs (McLaughlin & Berman, 1977). The intent is the same--provide a method for teachers to acquire new skills that "fine tune" their competencies and new teaching strategies.

In-service education is provided in a variety of formats. The content of in-service can be in the form of introduction of a topic (awareness) to the mastery stage (application). The length of

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in-service is also a variable. The time may vary from one-hour, one-time only programs to an intensive series over a specified time schedule. The format of presentations also differ. Videos, outside consultants, peer training, and make-it, take-it workshops are just a few examples of varying formats.

The most practical staff development programs integrate the same strategies identified in effective teaching research. Essential elements include: (a) meaningful and purposeful content, (b) maximum learner involvement, (c) successful practice built in the program, and (d) active teaching, especially in the developmental portion of the lesson. Gage (1978), Rosenshine (1979), Ebmeier and Good (1979), Evertson and Brophy (1978), Good and Grouws (1979), and Hunter (1978) have developed process-product models of instruction that contain these elements of instruction.

The Instructional Theory Into Practice (ITIP) model developed by Hunter (1978) is representative of the process-product models of instruction. In a nonconsecutive 5-day program, all of the effective teaching strategies are employed. The workshop includes presentations of theory, modeling by the presenter, and an opportunity for demonstration teaching by the participants. Participants practice the objectives back in their classroom between sessions. Feedback is provided by peers and presenters. ITIP has been utilized frequently by school districts across the country. This study examined how ITIP impacts student learning.

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Statement of the Problem

Local teacher involvement in the ITIP program began with a small number of participants. Participants reported back to their buildings, and other teachers enthusiastically requested to participate. With this grass-roots enthusiasm, the district incorporated ITIP as a major part of their staff development program.

Concurrent with ITIP implementation, the district began review of all areas of the curriculum to improve student outcomes. Mathematics was the first area to be studied. Objectives were identified at each grade level and exit tests were developed. Mathematics committee members who participated in ITIP recommended that ITIP inservice would provide the teacher training needed to implement the new mathematics program.

ITIP training for the staff involves a major investment in resources and time. One suburban Michigan district, Roseville Community Schools, annually spends $6,000 on ITIP training, which represents 60% of the staff development budget. In addition, instructional time is lost and/or interrupted when the teacher attends inservice training. ITIP training has been a commitment of this district since 1982. Two hundred fifty-five teachers have participated in this training. This investment of resources and time has never been evaluated at the district level. At the national level, evaluation of ITIP training is limited. If teacher effectiveness should be assessed by the behaviors of pupils rather than the behaviors of teachers, staff development must also be evaluated by student

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outcomes.

The main purpose of this study was to determine if teacher participation in ITIP training results in any difference in student achievement. Student outcomes were measured by scores received on a district Exit Level Mathematics Test (Roseville Community Schools, 1986).

Specific objectives of this study were:

1. To determine whether there is improvement in student Exit Level Mathematics Test scores if their teachers have been trained in ITIP.

2. To determine whether there is improvement of Exit Level Mathematics Test scores of students who for 1 year have had teachers trained in ITIP as compared to those students whose teachers have not been trained in ITIP.

3. To determine whether there is improvement of Exit Level Mathematics Test scores of students who in consecutive years have had teachers trained in ITIP as compared to those students whose teachers have not been trained in ITIP.

4. To determine whether there is improvement of Exit Level Mathematics Test scores of students who in consecutive years have had teachers trained in ITIP as compared to those students who for 1 year have been exposed to a teacher with ITIP training.

5. To determine whether there is improvement of Exit Level Mathematics Test scores of students who in intermittent years have had teachers trained in ITIP as compared to those students whose teachers have not been trained in ITIP.

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6. To determine whether there is improvement of Exit Level Mathematics Test scores of students who in intermittent years have had teachers trained in ITIP as compared to those students who for 1 year have been exposed to a teacher with ITIP training.

7. To determine whether there is improvement of Exit Level Mathematics Test scores of students who in consecutive years have had teachers trained in ITIP as compared to those students who in intermittent years have had teachers trained in ITIP.

Significance of the Study

Increasing amounts of state and local monies are spent by school districts on teacher in-service training. The need to evaluate training effectiveness is necessary for educational accountability. One method of verification is to measure student outcomes.

While numerous in-service programs are available, major funding, at the district, state, and national level, has been given to Hunter's (1978) model, ITIP. ITIP provides educators with a self-contained, research based in-service program. ITIP organizes and reinforces existing independent teaching skills. This model has national appeal, but there is little research to validate its effectiveness. This study investigated if ITIP-trained teachers who utilize the strategies improve student outcomes.

This study will be presented to the Macomb County, Michigan, consortium on staff development. The process utilized can serve as a model for other districts in their evaluation of in-service training.

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Definition of Terms

In this study the independent variable is elementary teachers who have had ITIP training. The dependent variable is improved student mathematics test scores as measured by the district's Exit Level Mathematics Test.

The following terms are defined operationally:

Teaching strategies: Patterns of teaching practices which significantly influence student learning. These practices are determined by subject matter, grade level, and the ability to use these practices appropriately in professional decision making.

In-service: Courses or programs designed to provide employee/ staff growth in job related competencies or skills often sponsored by employers to provide for the best operation of the school. For the purposes of this study, the terms in-service and staff development are used interchangeably.

Student outcomes: Student group gains or lack of gains in achievement as measured by the district's grade level Exit Level Mathematics Test.

Instructional Theory Into Practice (ITIP): An in-service program based on a systematic organization of the elements of effective instruction developed by Hunter (1978).

Statement of Assumptions

For the purposes of this study, the following assumptions were made:

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1. Classroom assignments represent heterogeneous grouping.

2. The selection of subject matter in and of itself would not affect the treatment significantly.

3. Mathematics content is basically the same in elementary grades.

4. The Exit Level Mathematics Test is a measure of student mathematics achievement.

5. The reliability and validity factors of the instrumentation and procedures used are sufficient for meeting the purposes of this study.

6. The 3-year period between testing negates the halo effect of the pretest-posttest method.

Limitations of the Study

1. Subjects: Only third-, fourth-, and fifth-grade students and their teachers in one selected suburban school district comprise the population of this study.

2. Selection of the test: The district's Exit Level Mathematics Test was locally developed and normed.

3. Test scores: The results and implications from the data are restricted to Exit Level Mathematics Test scores as the determining factor of achievement.

Organization of the Study

The following chapters for this paper have been organized in this manner:

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Chapter II--Review of Literature: This chapter presents an historical overview of teacher in-service. The specific model of in-service discussed is Hunter's (1978) Instructional Theory Into Practice.

Chapter III--Methodology: This chapter includes the subjects who participated, the instrument used, and an explanation of the data collection and the method of analysis for this study.

Chapter IV--Analysis of Data: Explained in this chapter are the matching techniques that were utilized, the analytical techniques used, and the statistical analysis with tables showing the results.

Chapter V--Summary, Conclusions, and Recommendations: This chapter contains a brief review of the study, the conclusions resulting from the study, and recommendations for further research.

Chapter Summary

This chapter gives an overview of the study. Included is a history of teacher effectiveness research and the relationship of teacher effectiveness in in-service training. Also included is a statement of the problem, the significance of the study, definition of terms, statement of assumptions, limitations of the study, and organization of the study. Presented in Chapter II is a background for in-service education and in-service evaluation. Examined in greater depth is one specific staff development program, ITIP.

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CHAPTER II

REVIEW OF LITERATURE

Studies have been done to acknowledge that teacher effectiveness can relate positively to student achievement. In-service education is the most effective vehicle to produce this outcome. The purpose of this chapter is to review the literature that supports the various aspects of in-service research.

Provided in this chapter is a review of literature in four topical areas: (1) historical background of teacher effectiveness and in-service education, (2) discussion of research relating to in-service evaluation, (3) review of process-product models including the Instructional Theory Into Practice (ITIP, Hunter, 1978) model, and (4) examination of research validating the ITIP model.

This chapter culminates with a summary of literature review. A description of how the findings relate to teacher participation in the ITIP in-service model and student outcomes is detailed.

Historical Background

Teacher Effectiveness

While research on teacher effectiveness has been ongoing for almost 100 years, the 10,000 plus studies have produced few conclusive results of what constitutes effective teaching. Early examination focused on teacher characteristics, teaching methods, and

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classroom climate.

The most recent research has been in the area of identification of teaching competencies and the ability to use these competencies appropriately on professional decision making. As a result, process-product models of instruction have evolved. These models cut across differing methods of instruction and forms of classroom organization. They identify effective teaching strategies that provide a developmental interaction with learners.

In-Service

In-service education has a long history. From the beginning of public education, teacher competence has been the object of scrutiny and regulation. Town fathers provided the first in-service for teachers in the form of advice and direction. In the mid-19th century a more formal program, known as institutes, was developed. Institutes were designed to supplement inadequate teacher training. These institutes failed to keep up with changing times and the needs of teachers. As a result, newer approaches began to appear. Teachers began to continue professional development through teachers' reading circles, summer schools, and extension courses sponsored by universities and normal schools.

From 1900 until the early 1960s, the aim of in-service education was "filling in the gaps of college requirements" (Tyler, cited in Mitzel, 1982, p. 883) and providing for degree completion and certification requirements. The launching of Sputnik in 1957 changed the focus. The American education system, particularly the

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mathematics and science programs, were widely criticized. In-service programs were designed to assist teachers in developing the skills necessary to implement packaged mathematics and science programs. During the 1980s, emphasis shifted from packaged programs to identifying and reinforcing effective teaching strategies in a multidisciplinary curriculum.

Research on In-Service Evaluation

Overview

Evaluation of in-service education has often been neglected. Even though there is rapidly growing research on staff development, few accounts present concrete evidence on its effects on teachers and students. Research reviews and integrative works on in-service education continue to be largely a pattern of reviewers' personal judgments, individual creativity, and preferred styles (Jackson, 1978). Loucks and Melle (1982) concluded that most staff development reports are simply statements of participant satisfaction, which are then used to determine the success of a program.

There is general agreement that in-service education should become a systematic effort to create a behavior change in teachers and, eventually, students (Baden, 1982). While participant satisfaction and local support are invaluable to in-service programs, there is a need to determine their efficacy systematically. Effectiveness should be measured not only at the level of teacher participant, but also at the level of the students with whom teachers

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interact. Medley (1977) cautioned that there is a need for demonstrated learning on the part of teachers before measures of teacher training can affect improved student learning.

Effects of Training

The effects of teacher training programs in research literature do not provide definitive conclusions. Joyce and Showers (1980) looked specifically at the effects of training programs on the behavior of teachers. In a review of more than 200 studies, they concluded that teachers can utilize feedback in training to develop simple and complex teaching skills and strategies, and to implement curricula; teachers are also able to respond to auto-instructional methodologies quite rapidly. Good (1979) and McCormick (1979) concluded that teachers do make a difference in student learning and that through in-service teachers can be trained in such a way that students' performance can be increased. Gage (1984) determined that in eight out of nine studies reviewed, in-service education was fairly effective--not with all teachers and not with all teaching practices--but effective enough to change teachers and improve student achievements, attitudes, or behaviors. Contrary to these studies, McDonald (1978) questioned if it is possible for teachers to integrate the skills learned by in-service training into their repertoire of classroom behaviors so they can use them over a long period of time. Dunkin and Biddle (1974), in their analyses of research on teaching, pointed to the fact that specific training programs improved teachers' performances in classrooms, even though

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this training has not always been shown to be related to improved student learning.

Wade (1985) examined 91 studies to evaluate in-service effectiveness. Using meta-analysis, the findings indicate that in-service teacher education programs reported in the literature are moderately effective. In-service treatment of any kind, on the average, resulted in .52 of a standard deviation greater change than the control groups. Further examination concluded that attempts to increase participants learning through in-service teacher training are highly effective (.90 mean effect size); attempts to change participants' behavior and elicit positive reactions to the training are moderately effective (.60 and .42 mean effect size, respectively); while attempts to demonstrate result by looking at students of participants are only mildly effective (.37 mean effect size).

Meta-analysis provides an objective technique for research synthesis. Emphasis on qualification eliminates personal bias. Wade's (1985) findings are consistent with meta-analysis of in-service training by Joslin (1980) and Lawrence and Harrison (cited in Wade, 1985).

Models for Teacher Effectiveness

Overview

Given the hundreds of staff development programs available, choosing the most effective program for a given site is often difficult. A staff development effort must take into account the

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curriculum (content) and delivery system of the model, the level of teacher expertise, feelings and attitudes of teachers, the social context of the school, and a myriad of other connecting parts (Griffin, 1982). Administrators need to know specific strategies for improving teaching and also need to identify the requirements and characteristics for successful integration of these strategies.

Process-Product Models

Process-product models of instruction have evolved from teacher effectiveness research. These models have been organized into a strategy or model of teaching, characterized by a pattern of teaching behaviors called direct instruction. Good (1979) described direct instruction as "active teaching": "A teacher sets and articulates the learning goals, actively assesses student progress, and frequently makes class presentations illustrating how to do work" (p. 57).

Gage (1978), Rosenshine (1979), Ebmeier and Good (1979), Evertson and Brophy (1978), Good and Grouws (1979), and Hunter (1978) have developed process-product models. The models may vary among researchers, but essentially all contain these four elements: (1) Instructional activity is initiated and reviewed in the context of meaning; (2) students are prepared for each lesson stage to enhance involvement and minimize errors; (3) the principles of distributed and successful practice are built into the program; and (4) active teaching is present, especially in the developmental portion of the lesson.

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The Beginning Teacher Evaluation Study, Phase II (1973-74) reached the conclusion that no single teaching skill significantly influences learning, but if an organizational context or a teaching performance provides for direct instruction, learning will be improved. Evidence supports the proposition that teacher performance variables are likely to be a causative agent in pupil learning.

ITIP Model

Another process-product model called Instructional Theory Into Practice (ITIP) was developed by Hunter (1978) at University of California Los Angeles (UCLA). This program is a model of teaching which has been widely implemented by school districts across the United States as a staff development in-service program. The ITIP model has provided for the operationalization of many theoretical findings into practical classroom applications.

Hunter (1971), in developing ITIP, focused on teacher decision-making as the variable most likely to affect learning. She contended that teacher behaviors that embody certain principles from psychological literature make student learning "more probable, more efficient, more predictable, and more economical" (p. 148). These teaching behaviors fall into three categories:

> (1) decisions and behaviors that are related to the selection of the learning objective, i.e. "what" is to be learned; (2) decisions and behaviors that determine the behavior of the learner, i.e. what he/she will do to learning; and (3) decisions and behaviors that determine those actions of the teacher designed to facilitate learning; i.e. the "how" in the process of teaching (Hunter, 1978, p. 2).

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Hunter (1978) proposed a schemata of coordinates for the teaching-learning process that Wolfe (1984a) described in the Napa County, California, study:

> [Hunter] has theorized that a vertical axis consists of the incremental nature of the learning task itself where learning proceeds from the less complex to the more complex, from easier to more difficult. On this axis each learning is a synthesis of certain essential "sub-learnings." The learner's position on this incremental vertical axis is based on what he/she already knows (which constitutes the foundation for what he will learn next). This establishes on fixed point of reference for all teaching. Hunter categorizes behaviors and decisions which assure maintenance on the correct point of the vertical axis as (1) teacher and student behaviors are focused on the intended objective, (2) the objective is at the correct level of difficulty and complexity for the learner, and (3) the teacher monitors student progress and makes necessary adjustments which leads to achievement of the intended objective (Hunter, 1978).
>
> The horizontal axis in the teaching-learning process consists of certain principles of learning which apply to all levels on the vertical axis. Hunter categorizes these research-validated principles as those which: (1) affect motivation to learn; (2) affect the rate and degree of learning; (3) affect retention of learned material; and (4) affect transfer of learning to any situation where it is appropriate. Hunter states that if the correct placement on the vertical axis is assumed, successful achievement is more dependent on the valid application of the principles of learning in the teaching process than on I.Q., family background, previous experience, or other outside-of-school factors. On the horizontal axis involving these principles of learning, Hunter proposes that perceptions of the effectiveness or ineffectiveness of teaching-learning behaviors can be used as reference points to determine whether (1) principles of learning incorporated by the teacher facilitate learning and/or (2) certain principles of learning are being ignored or misused and thereby interfere with learning (Hunter, 1978).
>
> With this system of educational coordinates, Hunter reports that educators can pursue the more productive question of "given this learning task to be achieved (the vertical axis), which learning principles (horizontal axis) will facilitate its achievement for this <u>particular learner</u> (mobile data which changes from learner to learner

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> and from time to time with any one learner)?" (Hunter, cited in Wolfe, 1984a, p. 3)

Building upon the schemata, Hunter (1978) identified skills which form the basis for teacher decisions: "selecting an objective at the correct level of difficulty, task analyzing the objective, diagnosing the learner, and prescribing learning tasks appropriate for the learner" (p. 2). Utilizing these skills results in an effective lesson. Hunter (1978) maintained the components of an effective lesson, anticipatory set, instruction, guided practice, and independent practice, are observable and facilitate learning.

Throughout the United States, Hunter's (1978) model has become a popular staff development program. Name variations of the model include Instructional Theory Into Practice, Clinical Supervisions, Effective Teaching Model, Mastery Learning, and Essential Elements of Instruction.

ITIP's popularity and wide acceptance is based in its appeal to both administrators and teachers. Administrators find ITIP meets many basic requirements for staff development. ITIP provides: (a) sequential, rationale, research-based assumptions; (b) prepackaged, self-contained in-service; and (c) a basis for teacher evaluations. ITIP training also includes theory, demonstration practice, feedback, and classroom application. Joyce and Showers (1980) indicated that, among staff development models commonly used, the ITIP model provides the best opportunity for the accurate, consistent, and spontaneous use of new behaviors in the workplace.

Teachers also have supported ITIP's staff development because

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the model is designed to reinforce educators for their existing high quality professional skills, update current research, develop a common vocabulary, and organize demonstrated independent teaching skills (Stebbins, 1985). Porter (1986) reported teachers loved the program but hated being evaluated by its standards. A suggested reason for this paradox may be the simplicity of the Hunter (1978) model at first glance and the extremely difficult application of it.

More important than its popularity and wide acceptance, the ITIP model takes well-established principles of educational psychology and relates them to teachers' instructional activities. The variables included in ITIP's essential elements of instruction are: stating objectives, activating prior knowledge, teaching for transfer, motivating and reinforcing appropriate behavior, conducting frequent assessment, and providing appropriate practice. These variables are directly derived from cognitive principles in educational psychology texts but not uniformly applied in classroom instruction. Slavin (1986) stated that most educational psychologists would agree with Hunter's (1978) assertion that the research supporting the model is based on what has been validated by a hundred years of research in human learning.

Research on ITIP

Project Linkage

In spite of ITIP's popularity, wide use, and support from valid psychological principles, little systematic research has tested its

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effectiveness. Project Linkage, a project funded by the California State Department of Education in a Los Angeles inner-city school, and propositions corroborated in the Beginning Teacher Evaluation Study and Effective Schools Studies have been cited as validation of the Hunter (1978) model. Davidman (1984), however, cautioned that "the nature of these studies, as well as selected conceptual and methodological problems in a wide range of school effectiveness studies, leads me to conclude that these studies provide partial, but not complete validation for the Hunter model" (p. 14). Rowan and Miracle (1983), Slavin (1986), and Porter (1986) concurred.

Napa County Study

The Napa County, California, longitudinal evaluative study of the Hunter (1978) program conducted by Stallings, Robbins, Presbrey, and Scott (1986) is also cited as validation for the program. The study showed short-term positive effects (Years 2 and 3) but no lasting changes in teachers' behaviors (Year 4). Teacher behaviors were validated by the use of the Instructional Skills Observation Instrument (Wolfe, 1984b) by trained observers. Specifically, there was a significant increase in student engagement, but program effects on student achievement were minimal. The reasons for the disappointing conclusions are speculative. Was the failure to sustain student growth due to lack of maintenance of program skills or a failure of the program to be effective in practice? Clearly, there is a need for more research to support the methodology of

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Hunter's (1978) Instructional Theory Into Practice in-service program.

Program for Effective Teaching

At the annual meeting of the American Education Research Association (AERA) in New Orleans in 1988, a symposium was held on the statewide implementation of ITIP in South Carolina, which included an evaluation of the achievement effects of the program over a 3-year period. The South Carolina model, called Program for Effective Teaching (PET) trained 15,362 teachers, 2,033 administrators, and 1,118 trainers. The state provided extended training, offered in class follow-up training, and altered administrative structures to insure high-quality implementation. Mandeville (1988) and Rivers (1988) reported that teachers trained in the Hunter (1978) model were overwhelmingly positive toward it, but no impressive differences in achievement between students of PET-trained teachers and students of other teachers were found.

West Orange

Donavan, Sousa, and Walberg (1987) reported an evaluation of the program in Grades 3, 6, 9, and 11 involving 35 trained and 29 untrained teachers in West Orange, New Jersey. Adjusted achievement scores for students of trained and untrained teachers were nearly identical.

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Research Hypothesis

The purpose of in-service training is to help teachers become more effective in the classroom. Teaching more effectively should result in positive changes in student achievement. This study investigated the relationship between in-service training, specifically ITIP, and student outcomes.

The hypothesis for this study is: If teachers receive ITIP training, there will be a significant difference in student group mathematics scores. The independent variable is teachers who have had ITIP training. This independent variable was tested by the varying degrees of contact students have with teachers: (a) no ITIP versus ITIP, (b) no ITIP versus ITIP 1-year contact, (c) no ITIP versus ITIP consecutive contact, (d) ITIP 1-year contact versus ITIP consecutive contact, (e) no ITIP versus ITIP intermittent contact, (f) ITIP 1-year contact versus ITIP intermittent contact, and (g) ITIP consecutive contact versus ITIP intermittent contact. The dependent variable is changes in student group achievement, which were measured by the locally developed Exit Level Mathematics Test (Roseville Community Schools, 1986).

Chapter Summary

This chapter has presented a review of literature related to in-service models for effective teaching strategies. Background information was given on the history of in-service and in-service evaluation. Process-product models of instruction were discussed.

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One particular process-product model, Instructional Theory Into Practice (ITIP, Hunter, 1978), was examined in detail. Evaluation of in-service training, using the ITIP model, as it related to student achievement is needed and will be the focus of this investigation.

Discussed in Chapter III is the specific methodology of the study. The subjects who participated, the instrumentation used, an explanation of data collection, and method of analysis are presented.

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CHAPTER III

METHODOLOGY

Instructional Theory Into Practice (ITIP), developed by Hunter (1978), identifies effective teaching strategies that enhance student outcomes. ITIP represents a major expenditure for staff development funds for Roseville Community Schools, a mid-size suburban school district. Over the past 10 years, 50% of teachers have participated in this training. Most participants have been elementary teachers.

The district's purpose of staff development is to improve student outcomes. ITIP training is one strategy being used. The primary purpose of this study was to evaluate the ITIP model as it relates to student outcomes. Student outcomes were measured by the district's Exit Level Mathematics Test (Roseville Community Schools, 1986). Included in this chapter are: research design, instrumentation, selection of subjects, procedure, data collection, data analysis, limitations, and methodological assumptions.

Research Design

The research method used for this study is descriptive. Descriptive research "describes and interprets what is. It is concerned with conditions or relationships that exist; practices that prevail; beliefs, points of view, or attitudes that are being held;

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processes that are going on; effects that are being felt; or trends that are developing" (Best, 1970, p. 315).

This study measured student achievement on the district's Exit Level Mathematics Test. Testing was done in September 1987 and May 1990. The Exit Level Mathematics Test was administered to students in Grades 3, 4, and 5 in September 1987 to determine if there were differences between groups (ITIP versus no ITIP) at the beginning of the study. Data were collected in May 1990 from the student Exit Level Mathematics Test scores to determine if there was a difference between groups.

Participating teachers were identified in two groups: those teachers who had participated in ITIP training and those teachers who had not participated in ITIP training. This was validated by the district's curriculum director. In addition, teachers were asked to participate in the observation phase to see if ITIP strategies were being used during mathematics instruction. Consent forms (Appendix A) assuring confidentiality were sent to all participating teachers.

This descriptive study systematically tested the following hypotheses:

H_1: If elementary teachers receive Instructional Theory Into Practice (ITIP) training, there will be a significant difference in student group mathematics test scores.

H_2: If students have been taught by an ITIP-trained teacher for 1 year, there will be a significant difference in student group mathematics test scores as to those students whose teachers have not

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been trained in ITIP.

H_3: If students in consecutive grades have been taught by teachers with ITIP training, there will be a significant difference in student group mathematics test scores as compared to those students whose teachers have not been trained in ITIP.

H_4: If students in consecutive grades have been taught by teachers with ITIP training, there will be a significant difference in student group mathematics test scores as compared to students who for 1 year had been exposed to a teacher with ITIP training.

H_5: If students in intermittent grades have been taught by teachers with ITIP training, there will be a significant difference in student group mathematics test scores as compared to those students whose teachers have not been trained in ITIP.

H_6: If students in intermittent grades have been taught by teachers with ITIP training, there will be a significant difference in student group mathematics test scores as compared to students who for 1 year had been exposed to a teacher with ITIP training.

H_7: If students in consecutive grades have been taught by teachers with ITIP training, there will be a significant difference in student group mathematics test scores as compared to students who in intermittent years had been exposed to teachers with ITIP training.

The independent variable is elementary teachers who have had ITIP training. The dependent variable is improved student mathematics test scores.

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The hypotheses in the null form for statistical purposes are:

Ho_1: There is no difference in student group mathematics test scores of teachers with ITIP training and teachers without ITIP training.

Ho_2: There is no difference in group mathematics test scores of students who for 1 year have had teachers with ITIP training and those students whose teachers have not had ITIP training.

Ho_3: There is no difference in group mathematics test scores of students who in consecutive grades have had teachers with ITIP training and those students whose teachers have not had ITIP training.

Ho_4: There is no difference in group mathematics test scores of students who in consecutive grades have had teachers with ITIP training and those students who were exposed for only 1 year to teachers with ITIP training.

Ho_5: There is no difference in group mathematics test scores of students who in intermittent grades have had teachers with ITIP training and those students whose teachers have not had ITIP training.

Ho_6: There is no difference in group mathematics test scores of students who in intermittent grades have had teachers with ITIP training and those students who were exposed for only 1 year to teachers with ITIP training.

Ho_7: There is no difference in group mathematics test scores of students who in consecutive grades have had teachers with ITIP

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training and those students who in intermittent years have had teachers with ITIP training.

Instrumentation

In 1985, the board of education of Roseville Community Schools accepted the recommendation of the curriculum director to develop subject-grade competency tests. These tests, locally normed, were keyed to local subject matter, goals, and competencies. The first competency test was completed in the area of mathematics in 1986.

To develop the test, the curriculum department selected a mathematics committee comprised of 12 teachers and 2 administrators. The purpose of the committee was twofold: textbook selection and the identification of grade level objectives. The Harcourt Brace Jovanovich mathematics series for grades kindergarten through eight (Abbott & Wells, 1985) was selected by the committee. Using the publisher's scope and sequence chart, the Iowa Test of Basic Skills (ITBS, Hieronymus, Linquist, Hoover, & Others, 1979) objectives, and the state's minimal competency mathematics objectives, grade level objectives were identified. Classroom teachers verified the accuracy of the grade level objectives. The final draft of grade level objectives was presented to an outside consultant to develop an item bank for each objective matching grade sequence to test objectives. From this bank, the committee selected three items to test each objective. The items were then checked for readability and congruence of classroom and textbook presentation.

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In the spring of 1986, the test was piloted by classroom teachers for grade objective mastery. During the summer, the committee met to review results and teacher comments. Item analyses were completed. Revisions were made in grade objectives, item selection, and test length. The revised test is presently administered to all students in May of each school year.

In cooperation with the Intermediate School District, tests are machine scored and the district is provided with classroom printouts, grade level summaries, and district summaries. Results are available to classroom teachers before the conclusion of the school year.

The purpose of this test, locally called the Exit Level Mathematics Test, is to evaluate student mastery of grade level objectives. The intent is for teachers to assess content emphasis for the next school year.

This test is criterion-referenced. A criterion-referenced test enables one to describe just what an individual can do without reference to the performance of others. Performance is reported in terms of the level of mastery of a defined content/skill domain. There is a representative sample of items measuring the stated objectives so that individual performance can be described directly in terms of the specific knowledge and skills that these persons are able to achieve (Ary, Jacobs, & Razavieh, 1985). This locally normed test is keyed to local subject matter goals and competencies.

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Validity

Validity refers to the extent to which an instrument measures what it is intended to measure. A group of experts verified the validity of this locally developed Exit Level Mathematics Test. This group was comprised of a committee of mathematics teachers representing all grades, elementary classroom teachers, the curriculum director, the intermediate school district (ISD) testing coordinator, and a private educational consultant.

Two areas of validity, face validity and content validity, were measured. The Exit Level Mathematics Test has face validity. It appears to measure what it claims to measure (Isaac & Michael, 1985). District classroom teachers verified the face validity of this test. The Exit Level Mathematics Test also has content validity. Content validity is the representativeness or sampling adequacy of the content of a measuring instrument (Kerlinger, 1973). Content validation is essentially and of necessity based on judgment. It involves a careful and critical examination of the test items as they relate to the specified content area. One must judge if the content and objectives measured by the test are representative of those that constitute the content domain (Ary et al., 1985). Content validation was accomplished by comparing the instrument against the state's minimal mathematics objectives and the Iowa Test of Basic Skills (Hieronymus et al., 1979).

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Reliability

Reliability of a measuring instrument is the degree of consistency with which an instrument measures. Reliability describes the variance from occasion to occasion, as well as the stability and predictability of the instrument. The reliability coefficient for the locally designed mathematics competency test is not reported.

During the development of the test, the mathematics committee, aided by the educational consultant and classroom teachers, verified the consistency of the items tested. The test is reliable with respect to form. The stability of the instrument over time has not been verified. The lack of retesting or using alternate forms is a limitation of the instrument.

Generalizability

Isaac and Michael (1985) indicated that generalizability is the problem of external validity. Considerations to increase the generalizability of results are:

1. Selection of subjects: Students and teachers are selected at random from a variety of classes and/or schools. In this study, the following meets this consideration: (a) Classrooms in 10 elementary schools were used, (b) 255 teachers have received ITIP training (the 32 volunteers for this study represented a cross section of elementary teachers trained), and (c) at the onset of this study, 900 students in three different grade levels participated.

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2. Variation of stimulus source: Varying the stimulus source may actually increase the generalizability of the results. ITIP training is presented in the same format, same philosophy, and same time frame regardless of location. The 32 teachers participating represent a variety of teaching approaches that would vary the stimulus source.

The generalizability of the study is also strengthened because:

1. Most elementary schools across the country have a similar organizational structure regardless of socioeconomic factors.

2. The objectives taught in mathematics are generally the same in other third, fourth, and fifth grades.

3. The test used in the pretest-posttest study is based on objectives in (a) Harcourt Brace Jovanovich mathematics scope and sequence (Abbott & Wells, 1985), (b) Michigan Educational Assessment Program (Michigan State Board of Education, 1985), and (c) Iowa Test of Basic Skills (Hieronymus et al., 1979).

Selection of Subjects

Community

Located in Macomb County, the city of Roseville is an established community. The city started as a stage coach stop conveniently located between Detroit and the county seat, Mt. Clemens. It has grown to a population of 51,412.

Roseville is primarily a blue-collar community with 20,025 housing units, of which 14,571 are owner occupied. The median state

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equalized value of the owner occupied units is $27,700.

This community is primarily residential without a major industry to provide a strong tax base. There are 66 wholesale establishments, 370 retail stores, and 310 service related businesses (U.S. Department of Commerce, 1991).

School District

The school district experienced a period of rapid growth in the 1960s. Peak enrollment boasted 15,000 students, with 18 elementary schools, 3 junior high schools, and 2 high schools.

The unavailability of additional space for growth and lowered birth rates started a period of declining enrollment for the district and with it, financial difficulty.

Buildings were closed to meet the changing times. Presently, there are 10 elementary schools, 2 junior high schools, and 1 high school. The enrollment is approximately 6,300 students.

These adaptions created stability and increased community support. School improvement efforts are ongoing. Changes within the school programs are indicative of new state and national standards.

Grade Level

The selection of grade levels to participate in the study was determined from multiple criteria: (a) the time required to administer the pretest, (b) the skill of students required to take a machine scored test, (c) the numbers of teachers at each grade level

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who participated in ITIP training, and (d) the test history of students who have participated in the Exit Level Mathematics Test since its inception.

Using these criteria, Grades 3, 4, and 5 were selected for this study. Kindergarten, first, and second grades were excluded from the study because, at the beginning of the school year, the time needed to administer the test would be prohibitive, and students have not been taught the necessary test-taking skills. Sixth grade was eliminated from this study because only 2 of 13 teachers had received ITIP training.

Students

The district believes in heterogeneous grouping. Students are randomly assigned to classrooms when there is more than one section available. Retentions, in this district, are concentrated in the primary grades. Few, if any, students in Grades 3, 4, or 5 would be exposed to the same Exit Level Mathematics Test the previous year.

Teachers

There are 53 teachers in Grades 3, 4, and 5. All teachers have been employed in the district a minimum of 2 years and hold at least a bachelor's degree and state certification. The average seniority is 19.6 years. Twenty-four teachers have earned master's degrees.

In the summer, all teachers in Grades 3, 4, and 5 were asked to participate in this study. Teachers who did not respond to the letter of invitation were contacted by phone.

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Procedure

Observation

There is a need for demonstrated learning on the part of teachers before measures of teacher training can affect student outcomes. To verify that ITIP strategies were part of mathematics instructions, trained observers validated teacher behaviors by the use of the Instructional Skills Observation Instrument (ISOI, Wolfe, 1984b) used by Stallings (1986) in the Napa County longitudinal study of the Hunter (1978) program. Teachers were invited to participate in the observation phase of the study. Their willingness to participate was the return of the consent form (see Appendix B).

Three recently retired teachers were trained to observe a mathematics lesson. These teachers had previously received ITIP instruction. As part of the observation training process, ITIP strategies and the ISOI were reviewed. For interrater reliability, observers visited a classroom mathematics lesson and rated the frequency and appropriateness of ITIP strategies using the ISOI. After the lesson, observers conferenced to review and discuss their ratings. Consensus was reached on common observational techniques.

Testing

Teachers who agreed to participate in the pretest-posttest phase of this study received the testing materials in the second week of September 1987. Materials included the Exit Level Mathematics Test booklets for the appropriate grade level, generic

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machine-scorable answer sheets, and directions for testing procedure. Testing was completed by the second week in October 1987 and answer sheets returned to the researcher.

Answer sheets were grouped by grade level and teacher. Scoring was completed at the intermediate school district. The results were shared with the classroom teacher for content planning for the remainder of the school year.

The final testing phase of this study was the administration by the classroom teacher of the Exit Level Mathematics Test in the first week of May 1990. This testing was part of the district's mandated testing program and was scored by the intermediate school district. The building principal shared the results with the classroom teacher.

This study began in 1987 with the final data collection in 1990. The 3-year period allowed the researcher the opportunity to chart the number of contacts students had with ITIP-trained teachers.

Data Collection

Test score printouts, supplied by the intermediate school district, were used to record test scores. The Exit Level Mathematics Test scores for the following 2 years were obtained from the district's curriculum department. These data were used to compare the effects of continuous, intermittent, or no student exposure to ITIP-trained teachers.

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The local staff development team (LSDT) is responsible for system-wide staff in-service. A printout of teachers who have participated in ITIP training and the dates of ITIP training are available from LSDT.

Trained observers used the Instructional Skills Observation Instrument (ISOI) to verify the teachers' use of ITIP strategies in the classroom. The ISOI was developed by Wolfe (1984b) and was used to measure teachers' implementations of ITIP in the Napa County study (Stallings et al., 1986). This instrument measures the quality and appropriateness of four program components: set/purpose/objectives, instructions, guided practice, and independent practice (includes closure). Operational definitions for the observed components were developed with the assistance of Hunter (developer of the ITIP, 1978). The critical issue was not whether or not a teacher used an element, but rather whether or not a teacher used the element and, if so, if it was used effectively. Maximum possible score on the ISOI is 88. Scores are averaged for comparison. The observers have participated in the basic ITIP training and training in the use of the ISOI. A sample of both ITIP and non-ITIP-trained teachers were observed in a classroom setting for one mathematics lesson.

Data Analysis

An analysis of variance (ANOVA) is a ratio of observed differences/error term used to test the hypothesis (Ary et al., 1985). ANOVA is one of the most widely used statistical procedures in

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behavioral science research (Hinkle, Wiersma, & Jurs, 1979). Kerlinger (1973) "emphatically state(s) that there is no better way to study research design than through an analysis of variance approach" (p. 148).

In all analyses, $\underline{F}$ ratios significant at the .05 level were deemed significantly large to reject the underlying null hypotheses.

The Exit Level Mathematics Test has a different number of objectives for each grade. In order to compare test results from different grades, raw scores were converted to standard $\underline{Z}$ scores.

Limitations

1. Subjects: The study was limited to third-, fourth-, and fifth-grade elementary students.

2. Administration of instrumentation: The test was administered by different teachers in different settings.

3. Single school district: While one district was used, the findings may be applicable to districts with similar populations.

4. Bias: Teachers who volunteered to participate in the pretest-posttest phase of this study and in ITIP training rather than participating by random selection may be unrepresentative.

5. Instrumentation: The Exit Level Mathematics Tests were locally developed and lack reliability coefficient.

6. Observations: Teacher observations to verify the use of ITIP strategies were completed in the spring of 1990 and not during the experimental testing period.

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Methodological Assumptions

For the purposes of this study, the following assumptions were made:

1. Student selection represented heterogeneous grouping.

2. Mathematics is representative of all content areas taught in Grades 3, 4, and 5.

3. The reliability and validity factors of the instrumentation used in this study were sufficient for meeting the purposes of this study.

Chapter Summary

The methodology used to investigate what effect teacher participation in the in-service training, ITIP, had on student achievement has been discussed in this chapter. The sample was selected from elementary teachers and students in Grades 3, 4, and 5 in the Roseville Community Schools.

The study was based on data collected from the administration of the Exit Level Mathematics Test. The validity and reliability of the instrument are not standardized, but were tested by a group of experts for validity and grade appropriateness.

The analysis of variance (ANOVA) was used to determine if differences exist in student achievement between students who had been taught by teachers who participated in ITIP training and students who had been taught by teachers who had not participated in ITIP training. Other data were presented on the number of years students

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had been exposed to teachers with ITIP training. Teacher observations to confirm the use of ITIP strategies were discussed.

Chapter IV contains the analysis of data. The matching techniques utilized, the analytical techniques used, and the statistical analysis are explained in Chapter IV, with tables summarizing the results.

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CHAPTER IV

ANALYSIS OF DATA

In-service training has become the primary vehicle of school districts to help teachers maintain professional growth in an effort to positively influence student achievement. The primary purpose of this study was to examine the impact of one specific in-service program, Hunter's (1978) Instructional Theory Into Practice (ITIP), on student outcomes.

This chapter includes a summary of the study, the statistical techniques used, and the research results of each hypothesis investigated.

Summary of the Study

Six hundred forty-nine students and 32 teachers in Grades 3, 4, and 5 participated in this study. Of the participating teachers, 20 were ITIP trained. The selection of Grades 3, 4, and 5 allowed the researcher the opportunity to examine the results of student Exit Level Mathematics Test scores for 3 years.

This descriptive study began with the administration of the Exit Level Mathematics Test (Roseville Community Schools, 1986) in September 1987. Final test results were collected in May 1990. During this period, students had instruction from three teachers. Teacher contacts were charted to determine the number of contacts

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students had with ITIP-trained teachers.

Teacher observations were completed in May 1990 to confirm if ITIP strategies were used in mathematics instruction in the observation phase of this study. Teachers volunteered to participate. Teachers with ITIP training and without ITIP training were observed. Trained observers in the Instructional Skills Observation Instrument (ISOI, Wolfe, 1984b) recorded the appropriateness and use of ITIP strategies. A numerical score was determined for each observation.

Statistical Techniques

The statistic used in this study is an analysis of variance (ANOVA). ANOVA is a ratio of observed differences/error used to test the hypothesis (Ary et al., 1985). In all analyses, *F* ratios significant at the .05 level were deemed significantly large to reject the underlying null hypotheses.

Raw scores on the Exit Level Mathematics Tests by grade level were converted to standard *Z* scores because the number of objectives tested at each grade level was different. *Z* scores provided the comparison between the relative positions of individuals on different tests.

Test Results for 1987

A test was administered to students in September 1987 to determine if differences existed between the groups at the onset of this study. The test data collected from the 649 students were grouped as follows: (a) no ITIP training, (b) ITIP training, (c) ITIP

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training 1-year contact, (d) ITIP training consecutive contact, and (e) ITIP training intermittent contact.

An ANOVA was performed on the pretest data to correspond to the seven null hypotheses investigated in the posttest phase of this study.

A difference in test scores on the Exit Level Mathematics Test at the alpha level less than .05 was found to exist between the following groups:

1. Student's contact with teachers who have no ITIP training (97 students) compared to those with ITIP training (552 students).

2. Student's contact with teachers who had no ITIP training (97 students) compared to those with ITIP training for 1 year (277 students).

A difference in test scores on the Exit Level Mathematics Test at the alpha less than .05 was found not to exist between the following groups:

3. Student's contact with teachers who had no ITIP training (97 students) compared to those with ITIP training in consecutive contact (215 students).

4. Student's contact with teachers who had ITIP training 1 year (277 students) compared to those with ITIP training in consecutive years (215 students).

5. Student's contact with teachers who had no ITIP training (97 students) compared to those who had ITIP training in intermittent contacts (60 students).

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6. Student's contact with teachers who had ITIP training for 1 year (277 students) compared to ITIP training in intermittent contacts (60 students).

7. Student's contact with teachers who had ITIP training in consecutive contacts (215 students) compared to ITIP training in intermittent contacts (60 students).

These findings are displayed in Table 1.

Final Test Results

Ho_1: There is no difference in student group mathematics test scores of teachers with ITIP training and teachers without ITIP training.

Performing an ANOVA for the data collected from the 649 students who in the last 3 years had teachers with either no ITIP training (97 students) or had teachers for at least 1 and as many as 3 consecutive years with ITIP training (552 students), a difference in test scores on the Exit Level Mathematics Test at an alpha level less than .05 was found to exist between the two groups. These findings in support of the hypothesized relationship between a student's contact with a teacher trained in ITIP and the student's success on an Exit Level Mathematics Test are summarized in Table 2.

Ho_2: There is no difference in group mathematics test scores of students who for 1 year have had teachers with ITIP training and those students whose teachers have not had ITIP training.

Data were collected from 374 students who in the last 3 years had teachers with either no ITIP training (97 students) or had

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Table 1

Relationship Between Degree of ITIP Training for Teachers and Their Students' Performance on an Exit Level Mathematics Test (Pretest)

Group	n	Mean	SD	p
No ITIP training	97	-.202	1.015	.031*
ITIP training	552	.035	0.992	
No ITIP training	97	-.202	1.015	.012*
One year ITIP training	277	.095	0.986	
No ITIP training	97	-.202	1.015	.163
ITIP training consecutive contact	215	-.031	0.986	
ITIP training 1-year contact	277	.095	0.986	.161
ITIP training consecutive contact	215	-.031	0.986	
No ITIP training	97	-.202	1.015	.235
ITIP training intermittent contact	60	-.001	1.041	
ITIP training 1-year contact	277	.095	0.986	.500
ITIP training intermittent contact	60	-.001	1.041	
ITIP training consecutive contact	215	-.031	0.986	.835
ITIP training intermittent contact	60	-.001	1.041	

$^{*}p < .05$.

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Table 2

Relationship Between Degree of ITIP Training for Teachers (No ITIP vs. ITIP) and Their Students' Performance on an Exit Level Mathematics Test

Group	*N*	Mean	*SD*	*p*
No ITIP training	97	-.375	0.986	.000*
ITIP training	552	.066	0.987	

*p < .05.

teachers for 1 year with ITIP training (277 students). Using ANOVA, a difference in test scores on the Exit Level Mathematics Test at an alpha level less than .05 was to exist between the two groups. These findings support the hypothesized relationship between a student's contact with a teacher in ITIP for 1 year and the student's success on an Exit Level Mathematics Test. See Table 3.

Table 3

Relationship Between Degree of ITIP Training for Teachers (None vs. 1 Year) and Their Students' Performance on an Exit Level Mathematics Test

Group	*N*	Mean	*SD*	*p*
No ITIP training	97	-.375	0.986	.005*
ITIP training 1-year contact	277	-.053	0.959	

*p < .05.

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Ho_3: There is no difference in group mathematics test scores of students who in consecutive grades have had teachers with ITIP training and those students whose teachers have not had ITIP training.

Data were collected from 312 students who in the last 3 years had teachers with either no ITIP training (97 students) or had teachers trained in ITIP in consecutive years (215 students). A difference in test scores on the Exit Level Mathematics Test at the alpha level less than .05 was found to exist between the two groups using an ANOVA. These findings in support of the hypothesized relationship between a student's contact with a teacher trained in ITIP in consecutive years and that student's success of the Exit Level Mathematics Test are displayed in Table 4.

Table 4

Relationship Between Degree of ITIP Training for Teachers (None vs. Consecutive) and Their Students' Performance on an Exit Level Mathematics Test

Group	$\underline{N}$	Mean	$\underline{SD}$	$\underline{p}$
No ITIP training	97	-.375	0.986	.000*
ITIP training consecutive contact	215	.229	1.004	

*$\underline{p} < .05$.

Ho_4: There is no difference in group mathematics test scores of students who in consecutive grades have had teachers with ITIP training and those students who were exposed for only 1 year to

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teachers with ITIP training.

An ANOVA was used for the data collected from 492 students who in the last 3 years had teachers with 1 year of ITIP training (277 students) or had teachers in as many as 3 consecutive years with ITIP training (215 students). A difference in test scores on the Exit Level Mathematics Test at an alpha level less than .05 was found to exist between the two groups. These findings in support of the hypothesized relationship between a student's contact with a teacher trained in ITIP for consecutive years and that student's success on an Exit Level Mathematics Test are described in Table 5.

Table 5

Relationship Between Degree of ITIP Training for Teachers (1 Year vs. Consecutive) and Their Students' Performance on an Exit Level Mathematics Test

Group	*N*	Mean	*SD*	*p*
ITIP training 1-year contact	277	-.053	0.959	.002*
ITIP training consecutive contact	215	.229	1.004	

*$p < .05$.

Ho_5: There is no difference in group mathematics test scores of students who in intermittent grades have had teachers with ITIP training and those students whose teachers have not had ITIP training.

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Data were collected from 157 students who in the last 3 years had teachers with either no ITIP training (97 students) or had teachers in intermittent years with ITIP training (60 students). Performing an ANOVA, a difference in test scores on the Exit Level Mathematics Test at an alpha level less than .05 was found to exist between the two groups. These findings in support of the hypothesized relationship between a student's contact in intermittent years with a teacher trained in ITIP and that student's success on an Exit Level Mathematics Test are summarized in Table 6.

Table 6

Relationship Between Degree of ITIP Training for Teachers (None vs. Intermittent) and Their Students' Performance on an Exit Level Mathematics Test

Group	N	Mean	SD	p
No ITIP training	97	-.375	0.986	.014*
ITIP training intermittent contact	60	.029	0.989	

$*p < .05$.

Ho_6: There is no difference in group mathematics test scores of students who in intermittent grades have had teachers with ITIP training and those students who were exposed for only 1 year to teachers with ITIP training.

Performing an ANOVA for the data collected from 337 students who in the last 3 years had teachers with ITIP training (277 students) for 1 year or had teachers with ITIP training in intermittent

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years (60 students), a difference in test scores on the Exit Level Mathematics Test at an alpha level less than .05 was found not to exist between two groups. These findings failed to support the hypothesized relationship between a student's contact with teachers trained in ITIP in intermittent years and that student's success on an Exit Level Mathematics Test (see Table 7).

Table 7

Relationship Between Degree of ITIP Training for Teachers (1 Year vs. Intermittent) and Their Students' Performance on an Exit Level Mathematics Test

Group	N	Mean	SD	p
ITIP training 1-year contact	277	-.053	0.959	.550
ITIP training intermittent contact	60	.029	0.989	

Ho_7: There is no difference in group mathematics test scores of students who in consecutive grades have had teachers with ITIP training and those students who in intermittent grades have had teachers with ITIP training.

Performing an ANOVA for the data collected from 275 students who in the last 3 years had teachers with ITIP training in consecutive years (215 students) or had teachers with ITIP training in intermittent years (60 students), there was no difference in test scores on the Exit Level Mathematics Test at an alpha level less than .05 between the two groups. These findings did not support the

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hypothesized relationship between a student's contact with a teacher trained in ITIP in consecutive years and that student's success on an Exit Level Mathematics Test (see Table 8).

Table 8

Relationship Between Degree of ITIP Training for Teachers (Consecutive vs. Intermittent) and Their Students' Performance on an Exit Level Mathematics Test

Group	*N*	Mean	*SD*	*p*
ITIP training consecutive contact	215	.229	1.004	.174
ITIP training intermittent contact	60	.029	0.989	

Observations

At the conclusion of the data collection of the Exit Level Mathematics Test, teacher observations were made to confirm the use of ITIP strategies in mathematics instruction. Fourteen teachers volunteered to participate in the observation phase of the study. Of the participating teachers, eight were ITIP trained.

Trained observers recorded the appropriateness and use of ITIP strategies during one mathematics lesson. The instrument used was the Instructional Skills Observation Instrument (ISOI, Wolfe, 1984b). The maximum score possible on the ISOI is 88. Observation raw scores were averaged: ITIP-trained teachers averaged 52.75, while non-ITIP-trained teachers averaged 62.83.

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Chapter Summary

Discussed in this chapter was the analysis of data used to investigate what effect teacher participation in the in-service training, ITIP, will have on student achievement as measured by the Exit Level Mathematics Test.

The analytical techniques and statistical results with tables were presented.

The conclusions and recommendations of this research are discussed in Chapter V. A summary of this study is also included.

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CHAPTER V

DISCUSSION AND RECOMMENDATIONS

By the beginning of the 1980s, teacher effectiveness research validated good practices, suggested directions for improvement, and contributed to educational theory and research. Teacher behaviors and patterns of teacher and student interaction associated with student achievement gains were identified. The research, reviewed by Brophy and Good (1986), firmly established that teachers make a difference. Effective teaching practices elicit greater achievement gains. Several process-product models of instruction emerged from this field of study.

Instructional Theory Into Practice (ITIP) developed by Hunter (1978) is an example of a process-product in-service program which has been widely implemented by school districts across the United States. ITIP is appealing, practical, and well-grounded in educational and psychological theory; but until recently, there were few research studies examining its effectiveness. A possible explanation for widespread implementation of programs without controlled evaluation was suggested by Shulman (cited in Brandt, 1992). "We of the educational community have gotten into a very bad habit; we have become consumers and not critics" (p. 19). Slavin (1989) further observed that school districts must stop adopting fads and instead examine programs based on reliable data. This study was a result of

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a shared concern over the lack of evaluation of the ITIP staff development program.

Summary

The purpose of this study was to investigate the comparative effectiveness of student contacts with ITIP-trained teachers versus non-ITIP-trained teachers on mathematics achievement over a 3-year period. Using an analysis of variance (ANOVA) with an alpha level significant at .05, it was found that the group taught by ITIP-trained teachers (1 year, consecutive, and intermittent years) achieved significantly higher on the Exit Level Mathematics Test (Roseville Community Schools, 1986) than the control group. Classroom observations failed to support these findings.

Results

The following null hypotheses were tested:

Ho_1: There is no difference in student group mathematics test scores of teachers with ITIP training and teachers without ITIP training.

Ho_2: There is no difference in group mathematics test scores of students who for 1 year have had teachers with ITIP training and those students whose teachers have not had ITIP training.

Ho_3: There is no difference in group mathematics test scores of students who in consecutive grades have had teachers with ITIP training and those students whose teachers have not had ITIP training.

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Ho_4: There is no difference in group mathematics test scores of students who in consecutive grades have had teachers with ITIP training and those students who were exposed for only 1 year to teachers with ITIP training.

Ho_5: There is no difference in group mathematics test scores of students who in intermittent grades have had teachers with ITIP training and those students whose teachers have not had ITIP training.

Ho_6: There is no difference in group mathematics test scores of students who in intermittent grades have had teachers with ITIP training and those students who were exposed for only 1 year to teachers with ITIP training.

Ho_7: There is no difference in group mathematics test scores of students who in consecutive grades have had teachers with ITIP training and those students who in intermittent grades have had teachers with ITIP training.

Pretest Results

Hypothesis 1 (Ho_1) is rejected at the .05 alpha level.

Hypothesis 2 (Ho_2) is rejected at the .05 alpha level.

Hypothesis 3 (Ho_3) is retained at the .05 alpha level.

Hypothesis 4 (Ho_4) is retained at the .05 alpha level.

Hypothesis 5 (Ho_5) is retained at the .05 alpha level.

Hypothesis 6 (Ho_6) is retained at the .05 alpha level.

Hypothesis 7 (Ho_7) is retained at the .05 alpha level.

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Final Test Results

Hypothesis 1 (Ho_1) is rejected at the .05 alpha level.

Hypothesis 2 (Ho_2) is rejected at the .05 alpha level.

Hypothesis 3 (Ho_3) is rejected at the .05 alpha level.

Hypothesis 4 (Ho_4) is rejected at the .05 alpha level.

Hypothesis 5 (Ho_5) is rejected at the .05 alpha level.

Hypothesis 6 (Ho_6) is retained at the .05 alpha level.

Hypothesis 7 (Ho_7) is retained at the .05 alpha level.

Observations

Classroom observations of a sampling of participants (14 teachers) in the study were made to confirm the use of ITIP strategies in mathematics instruction. Trained observers recorded use, frequency, and appropriateness of strategies on the Instructional Skills Observation Instrument (ISOI, Wolfe, 1984b). ITIP-trained teachers averaged 52.75. Non-ITIP-trained teachers averaged 62.83. These observations did not support the Hypotheses Ho_1 through Ho_5.

Discussion

Pretest Results

Pretest results indicate that the groups were equal at the onset of the study. Exceptions are Ho_1 and Ho_2 which support the research hypotheses that students who had contact (any or 1 year) with ITIP-trained teachers achieved significantly higher.

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Designed to determine if there were differences between groups to begin with, the Exit Level Mathematics Test has a serious weakness when used as a pretest. The instrument was intended to measure exit skills at each grade level. For example, a basic mathematics concept is introduced at Grade 1, practiced in Grade 2, and tested the last time the concept is identified as a grade objective in Grade 3. Therefore, the test administered in September was not grade appropriate.

Final Test Results

There is a significant difference in mathematics scores of students whose teachers have been ITIP trained (Ho_1-Ho_5; 1-year contact, consecutive contact, and intermittent contact) compared to those whose teachers had not been ITIP trained. All hypotheses were tested at the .05 level of significance. The alpha level ranged from .000 to .014.

The increase in achievement for students who received instruction from ITIP-trained teachers was not expected. It was predicted there would be no differences between groups for several reasons:

1. Previous research findings, the Program for Effective Teaching (Mandeville, 1988) and the West Orange Study (Donavan et al., 1987) found no impressive differences in student achievement between trained and untrained teachers.

2. There was no follow-up training or coaching provided for ITIP-trained teachers. Porter (1986) surmised that changes in behavior and gains in student achievement disappeared as soon as staff

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development activities decreased.

3. The dependent variable, ITIP training, is not exclusive in impacting student outcomes. Success may be subject to other variables.

Caution was also advised because the instrument used to measure student achievement was a nonstandardized, locally developed test. Although acknowledged as a weakness, the use of the Exit Level Mathematics Test had several advantages. The instrument was grade appropriate, measured grade level objectives, and was developed by district elementary teachers.

Contrary to expectations, this study supported the assumption that students whose teachers had been trained in ITIP achieved significantly higher on the Exit Level Mathematics Test than students of non-ITIP-trained teachers.

What conclusions can be drawn from the results? Although achievement was significant for students who received instruction from ITIP-trained teachers, this researcher is reluctant to conclude that the dependent variable, ITIP training, was the causative agent. Slavin (1986) reasoned that better teachers get better results from students in any model, so correlations between the quality of implementation and student achievement may be correlations between quality of teaching and achievement and do not validate a particular model.

The data for Ho_6 and Ho_7 in the final test results failed to support the research hypotheses. Findings indicate that consecutive contacts with ITIP-trained teachers may be more effective than

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intermittent contacts. A concentration of in-service efforts for all teachers should have a greater impact than training only part of the staff.

Observations

Classroom observations do not support the results of this study. Non-ITIP-trained teachers scored higher (62.83) on the ISOI in the appropriateness and use of ITIP strategies during one mathematics lesson than ITIP-trained teachers (52.75). Explanations for this contradiction may include:

1. The participants in the observation phase of the study were all volunteers. The failure to randomize prohibits the assumption that this group was representative of the total population.

2. In addition to ITIP training, teachers had opportunities for staff development in the New Definition of Reading strategies, the new standards in mathematics and science, and Cooperative Learning. Many of the same effective teaching strategies that are part of ITIP are also incorporated in other in-service programs (see Table 9).

Recommendations

Although this study cannot serve as validation of Hunter's (1978) ITIP model, the results could indicate that in-service training which reinforces effective teaching strategies may increase student achievement. Further investigation is necessary, however, in several areas before conclusive results can be drawn.

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Table 9

Process-Product Models Matrix

Elements of direct instruction	Instructional Theory Into Practice (ITIP)	Michigan's Redefinition of Reading	National Council of Teachers of Mathematics Standards	National Science Teachers Assoc. Recommendations	Cooperative Learning
1. Instructional activity is initiated and reviewed in context of meaning.	X	X	X	X	X
2. Students are prepared for each lesson stage to enhance involvement and minimize errors.	X	X	X	X	X
3. The principles of distributed and successful practice are built into the program.	X	X	X		X
4. Active teaching is present. The teacher:					
Sets and articulates the learning goals.	X	X	X	X	X
Actively assesses student progress.	X	X	X	X	X
Frequently makes class presentations illustrating how to do the work.	X	X	X	X	

One recommendation for further study is altering the variables. In this study, ITIP participation was the dependent variable. Multiple effects and causes now must be considered to determine which variables positively affect student outcomes. Other in-service programs that reinforce effective teaching strategies such as the New Definition of Reading, Activities Integrating Math and Science (AIMS), Math Our Way, and Cooperative Learning should be considered as variables affecting student achievement.

A second consideration should be the random selection of teachers. In this study, teachers volunteered to participate in ITIP training, the pretest, the posttest, and the observations. It would be interesting to consider if their interests, attitudes, beliefs, and values contributed to positive findings. Did teachers' feelings of competence and satisfaction increase the probability of student learning? Would randomization change the findings?

Student achievement was measured by scores on the Exit Level Mathematics Test. Changing the method of assessment might validate in-service effectiveness. Nationally normed standardized tests would provide data on student growth. Authentic assessment would provide additional insights on student achievement. Authentic assessment may include teacher and student journals, portfolios, observations, and demonstrated learnings.

Further study could also concentrate on the observation phase. Rather than a single observation of classroom instruction, multiple observations over a period of time by the same observers would provide a more complete picture of the use of instructional techniques

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in the classroom. Another variation would be observations by different observers of mathematics lessons over a period of time. Observers should also reflect the randomized selection of teachers. A heterogeneous group of ITIP-trained and non-ITIP-trained teacher observers could be utilized.

Additionally, studies that measure student achievement based on in-service training should be longitudinal. Gains were found over a 3-year period in this study. It is recommended that this study be replicated over a 5-year period. The Napa County, California, study by Stallings et al. (1986) showed short-term positive effects (Years 2 and 3) but no lasting changes in teachers' behaviors (Year 4).

In-service training that reinforces effective teaching strategies seems to increase student achievement. As districts become more accountable and resources more limited, the investment in staff development must be continually evaluated to insure that it positively impacts student achievement. Districts must develop an evaluation for staff development programs or must demand reliable data that supports a program before implementation. The goal of in-service is to have a highly trained, well-supported staff who can make sound decisions in meeting the unique needs of students and positively affect student outcomes.

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APPENDICES

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Appendix A

Human Subjects Institutional Review Board Approval Letter

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Human Subjects Institutional Review Board

Kalamazoo, Michigan 49008-3899

WESTERN MICHIGAN UNIVERSITY

Date: July 8, 1992

To: Martha O'Kray

From: Mary Anne Bunda, Chair *Mary Anne Bunda*

Re: HSIRB Project Number: 92-05-08

This letter will serve as confirmation that your research protocol, "An Analysis of student Math Scores Based Upon Teacher Training in the ITIP Model" has been approved under the exempt category of review by the HSIRB. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the approval application.

You must seek reapproval for any changes in this design. You must also seek reapproval if the project extends beyond the termination date.

The Board wishes you success in the pursuit of your research goals.

xc: Cowden, ED Leadership

Approval Termination: July 8, 1993

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Appendix B

Teacher Consent Form

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TEACHER CONSENT FORM

Martha O'Kray is investigating the effect of staff development on student outcomes. This dissertation research is being conducted as a requirement for graduation from Western Michigan University.

Specifically, the research investigates if teacher participation in ITIP positively affect student scores as measured by the district's math competency tests. The data will be used for research purposes in evaluating ITIP inservice. You are one of 35 teachers who have been asked to participate.

The data collection for this research includes:

1. Pretest-posttest math exit test results. The grade-appropriate tests will be administered in the fall for the pretest phase of the study. The results will be available in November for use in classroom planning. The May administration of the test, which meets district requirements, serves as the posttest phase. Test administration will take approximately one to two class periods.

2. Classroom observations. Trained retired teachers will observe one math lesson (30-45 minutes) in your classroom using the Instructional Skills Observation Instrument.

In this study, no individual names will be used nor will it be part of a school evaluation process. Confidentiality is assured by assigning identification numbers to both teachers and students. Teacher identification will be linked to student identification, but only group data will be reported. Group data will be categorized by ITIP training and no ITIP training. At any time if you wish to withdraw, you may do so without prejudice.

If you have any questions, contact Martha O'Kray at work at 445-5688 or at home at 731-0186 or Dr. David Cowden at Western Michigan Univeristy 616-387-3883.

****

☐ I agree to participate in this research.

____
Teacher Signature

____
Date

____
Witness

MO/rn
June 18, 1992

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Appendix C

Instructional Skills Observation Instrument
and Correspondence

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INSTRUCTIONAL SKILLS OBSERVATION INSTRUMENT

NAPA COUNTY OFFICE OF EDUCATION

Ed Henderson, Superintendent

Developed by
Patricia R. Wolfe, Ed.D.

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FOUNTAIN ELEMENTARY SCHOOL
16850 Wellington
Roseville, MI 48066
445-5765

February 23, 1988

Ms. Pam Robbins
Director, Special Projects
Napa County Schools
4032 Maher Street
Napa, CA 94558-2296

Dear Ms. Robbins,

Thank you for your reply to my request for information on the ISOI (Instructional Skills Observation Instrument). The paper by Patricia R. Wolfe describing its use in the NIE research project and the additional reports you sent me January 20, 1988 have been very helpful. I appreciate the time and interest you took.

I have enclosed a copy of my proposed dissertation study for your review. I am interested in reviewing the ISOI as a possible instrument to be used in the observation phase of my study which will be taking place next month. I have already developed an observation tool, but wanted to examine the ISOI instrument. If the ISOI is used, it will be used only for the outlined research. I have enclosed $25.00 for a copy of the ISOI.

I will be happy to share the results of my study with you when published.

Sincerely,

Martha O'Kray
Principal

MO/jh

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OFFICE OF THE SUPERINTENDENT
NAPA COUNTY SCHOOLS
4032 Maher Street, Napa, California 94558-2296

February 17, 1988

Ms Martha O'Kray, Principal
Fountain Elementary School
16850 Wellington
Roseville, Michigan 48066

Dear Ms O'Kray,

Thank you for your interest in the ISOI (Instructional Skills Observation Instrument). This instrument was developed as part of a four-year NIE research project and was designed to measure instructional facility in the elements of lesson design. A paper is enclosed which describes its use in the project.

Although the ISOI has proved to be a reliable instrument in several research efforts, I have concerns regarding its applicability in other settings. One of my worst fears is that it be used as part of the teacher evaluation process or in any setting where teachers have not been thoroughly appraised of its purpose and intended use.

A copy of the ISOI and Manual may be ordered by sending a check or purchase order for $25.00 made out to the Napa County Office of Education. Permission to use the instrument will be granted upon receipt of a letter specifying that it will only be used for research or training purposes.

I would appreciate receiving a copy of any results that are obtained so that they may be shared with other users.

Sincerely,

Pam Robbins

Pam Robbins
Director, Special Projects

PR:mfl
encl.

Mailed 2-23-88
ck# $25

ED HENDERSON
Superintendent
253-6802

BERNICE BETTENCOURT
Director
Support Services
253-6822

ERWIN BOLLINGER
Director
Special Education
253-6807

FRANCIS CHAMBERLAIN
Coordinator
Staff Development
253-6809

JOYCE HING MCGOWAN
Director
R.O.P./Voc. Ed.
253-6830

NANCY REINKE
Coordinator
Special Education
253-6865

PAM ROBBINS
Director
Special Projects & Research
253-6804

HARLEN SMETZER
Director
Special Services
253-6812

PAT WOLFE
Director
Instruction
253-6809

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Appendix D

Exit Level Mathematics Test and
Roseville Community Schools
Approval Letter

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Roseville Community Schools

Roseville, Michigan

Mathematics Test

THIRD GRADE

Exit Level Skills

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Roseville Mathematics Test
THIRD GRADE

You are going to use your mathematical skills on this test. You will have as much time as you need to finish the test. Work as quickly as you can, but do not hurry.

Be sure to write your answers on your answer sheet. If you want to work a problem, you may use the scratch paper provided. Remember, always mark your answers on the answer sheet. Mark only one answer for each item. If you change an answer, erase the first mark completely. Now look at the sample item below.

Sample: 2 + 2 = __

A. 2

B. 4

C. 6

D. 8

Answer Sheet

Sample: A ○ B ○ C ○ D ○

The correct answer is 4, so you would mark B on your answer sheet by filling in the circle because the letter in front of 4 is B.

If you have any questions about the directions, please raise your hand. Otherwise, turn the page and begin the test.

Materials needed:

1. Rulers, both standard and metric
2. Scratch paper
3. Number 2 pencil
4. Eraser

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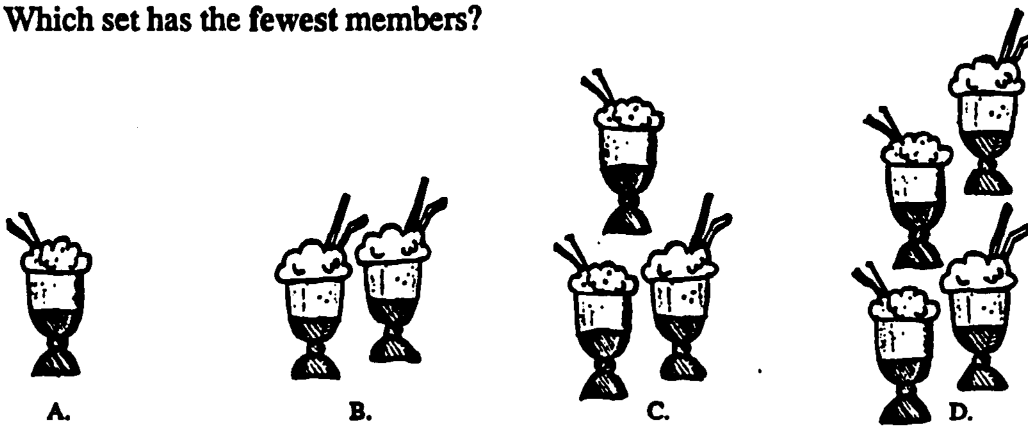
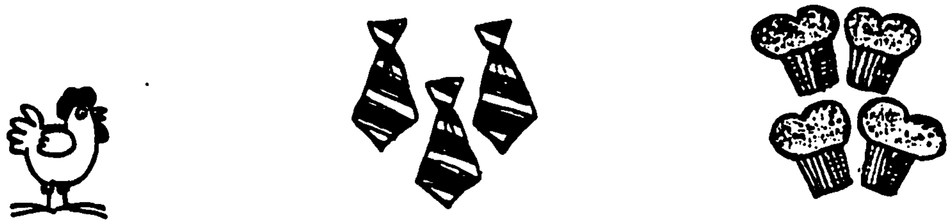
Directions: Find the answer.

1 **Which set has the fewest members?**



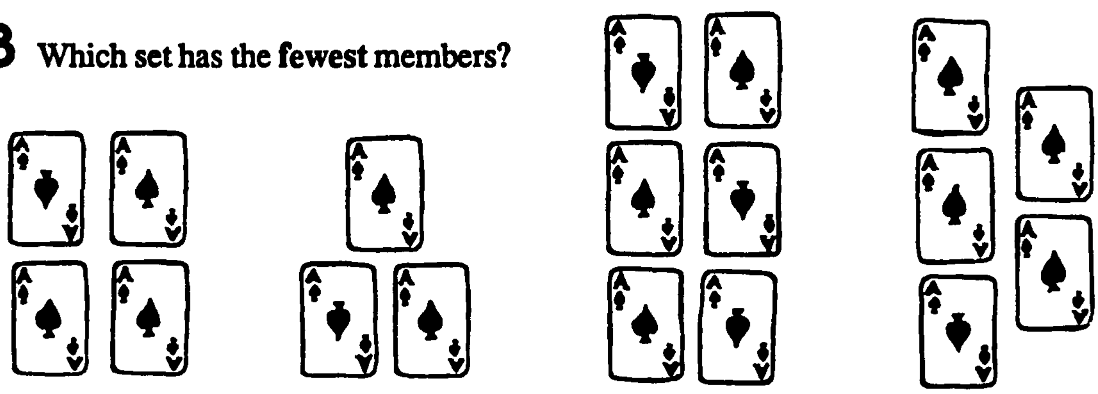
A. B. C. D.

2 **Which set has the fewest members?**



A. B. C.

3 **Which set has the fewest members?**



A. B. C. D.

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3.3

Directions: Find the answer.

4 What is the third month of the year?

A. April

B. May

C. March

D. June

5 What is the fifth day of the week?

A. Tuesday

B. Thursday

C. Monday

D. Friday

6 On which day of the week is March 24?

MARCH						
Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

A. Wednesday
B. Thursday
C. Friday
D. Saturday

7 Is the number 83 odd or even?

A. Even

B. Odd

8 Is the number 58 odd or even?

A. Even

B. Odd

9 Is the number 56 odd or even?

A. Even

B. Odd

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Directions: Find the answer.

10 Which numbers are in order from least to greatest

A. 35, 461, 78, 842

B. 461, 842, 78, 35

C. 35, 78, 461, 842

D. 78, 842, 461, 35

11 Which numbers are in order from least to greatest

A. 16, 88, 414, 312

B. 312, 414, 88, 16

C. 414, 312, 16, 88

D. 16, 88, 312, 414

12 Which numbers are in order from smallest to largest?

A. 25, 64, 312, 498

B. 312, 25, 64, 498

C. 25, 498, 312, 64

D. 64, 312, 25, 498

13 8,421 means

A. 8 hundreds + 4 tens + 21 ones

B. 8 thousands + 42 hundreds + 1 one

C. 8 thousands + 400 hundreds + 20 tens + 1 one

D. 8 thousands + 4 hundreds + 2 tens + 1 one

14 3,680 means

A. 300 + 60 + 80

B. 3,000 + 6,800 + 0

C. 3,000 + 600 + 80 + 0

D. 3,000 + 60,000 + 800 + 0

15 9,999 means

A. 9 thousands + 9 hundreds + 9 tens + 9 ones

B. 900 thousands + 99 tens + 9 ones

C. 9 thousands + 99 ones

D. 9 thousands + 90 hundreds + 9 tens + 9 ones

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Directions: Find the answer.	**Directions: Find the missing addend.**

16 $27 + 44 = \boxed{}$

A. 31

B. 61

C. 71

D. 111

17

$$\begin{array}{r} 48 \\ -\ 19 \\ \hline \end{array}$$

A. 67

B. 51

C. 31

D. 29

18

$$\begin{array}{r} 98 \\ +\ 46 \\ \hline \end{array}$$

A. 51

B. 52

C. 134

D. 144

19 $12 + \boxed{} = 16$

A. 2

B. 3

C. 4

D. 6

20 $\boxed{} + 6 = 19$

A. 12

B. 13

C. 14

D. 15

21 $16 + \boxed{} = 16$

A. 3

B. 2

C. 1

D. 0

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Directions: Find the amount of money in the picture.

22

A. 25¢
B. $.45
C. $.70
D. 85¢

23

A. 60¢
B. $.65
C. 70¢
D. $.95

24

A. $1.02
B. $.70
C. 60¢
D. $.52

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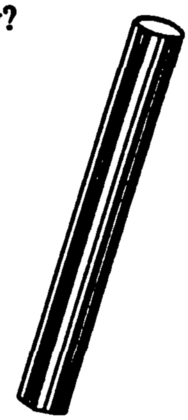
Directions: Find the answer.

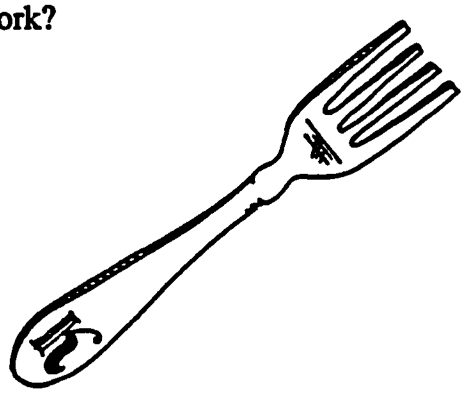
25 How tall is the straw?

A. 6 cm
B. 5 cm
C. 4 cm
D. 3 cm



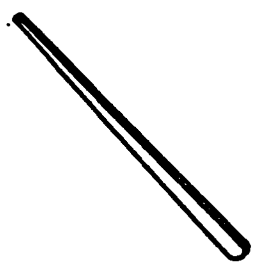
26 How long is the fork?

A. 5 cm
B. 6 cm
C. 7 cm
D. 8 cm



27 How long is the toothpick?

A. 9 cm
B. 10 cm
C. 5 cm
D. 12 cm



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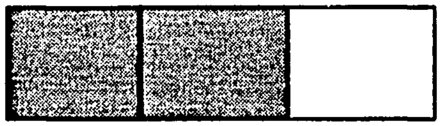
Directions: Find the answer.

28 Which part is shaded?



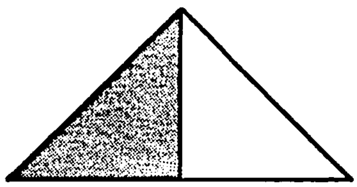
A. $\frac{1}{3}$

B. $\frac{2}{3}$

C. $\frac{1}{4}$

D. $\frac{2}{4}$

29 Which part is shaded?



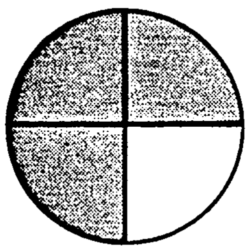
A. $\frac{1}{2}$

B. $\frac{2}{2}$

C. 2

D. $\frac{1}{4}$

30 Which part is shaded?



A. $\frac{1}{4}$

B. $\frac{2}{4}$

C. $\frac{3}{4}$

D. 4

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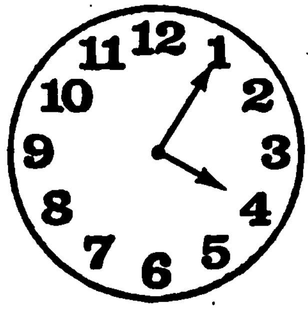
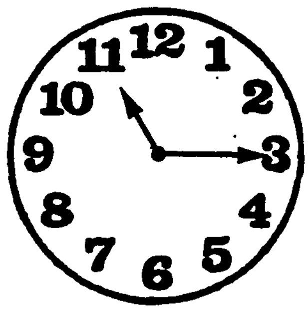
Directions: Choose the correct time.

31



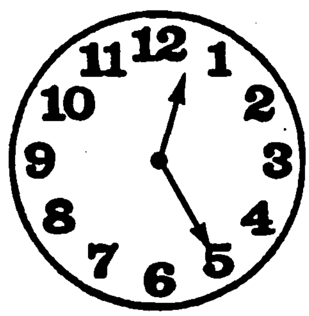
A. 1:20
B. 1:05
C. 4:01
D. 4:05

32



A. 3:00
B. 3:05
C. 11:13
D. 11:15

33



A. 12:25
B. 12:23
C. 4:00
D. 5:00

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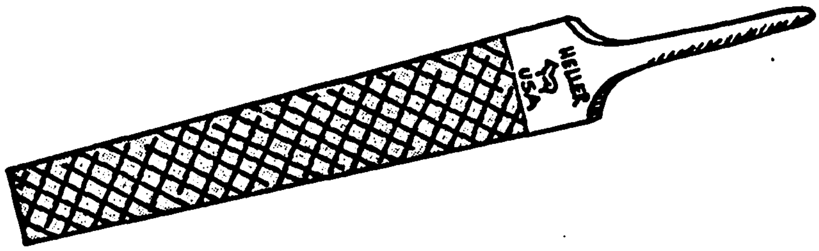
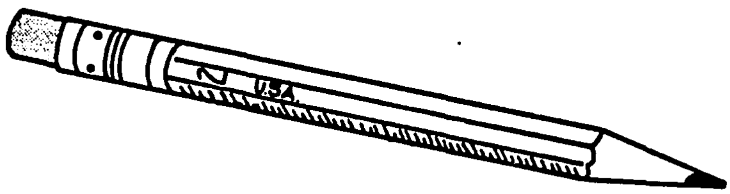
Directions: Measure to find the answer.

34 About how long is the file?



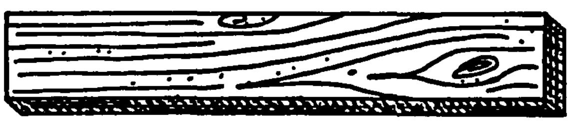
A. 2 inches
B. 3 inches
C. 4 inches
D. 5 inches

35 About how long is the pencil?



A. 3 inches
B. 4 inches
C. 5 inches
D. 6 inches

36 About how long is the board?



A. 3 inches
B. 7 inches
C. 8 inches
D. 9 inches

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Directions: What is the temperature?

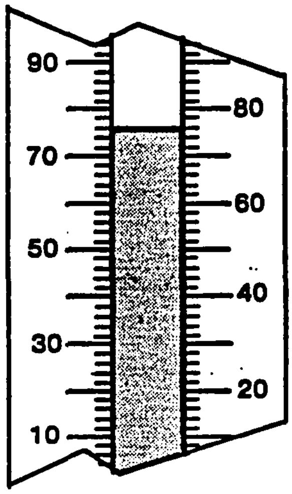
37

A. 40°

B. 52°

C. 64°

D. 76°



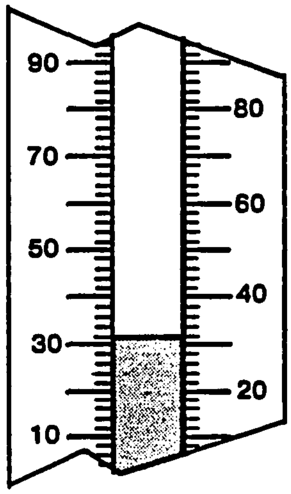
38

A. 32°

B. 26°

C. 16°

D. 15°



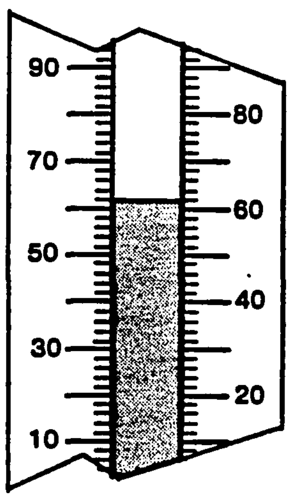
39

A. 48°

B. 52°

C. 62°

D. 78°



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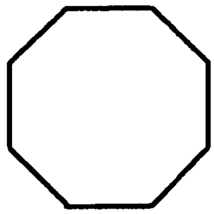
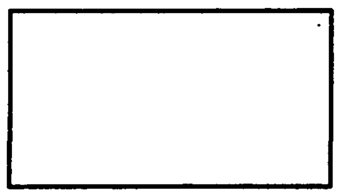
Directions: Find the answer.

40 How many sides does the figure have?



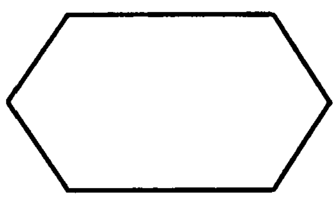
A. 4 C. 8
B. 6 D. 10

41 How many corners does the figure have?



A. 6 C. 4
B. 5 D. 3

42 How many corners does the figure have?



A. 4 C. 8
B. 6 D. 10

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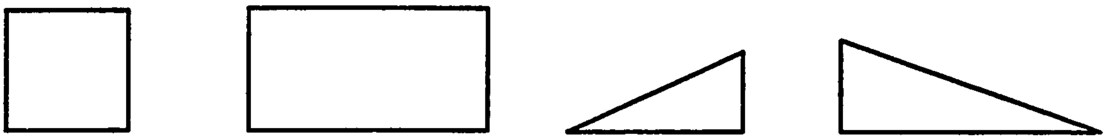
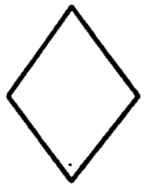
Directions: Find the answer.

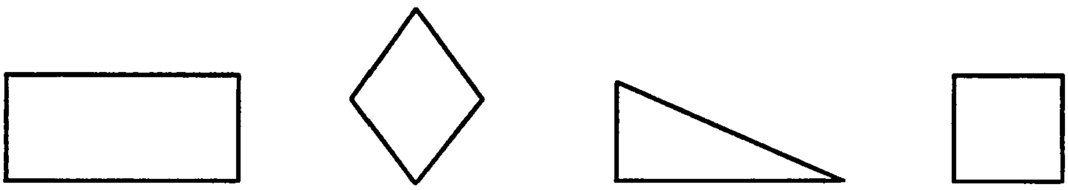
43 Which picture is the same size and shape as  ?



A. B. C. D.

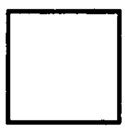
---

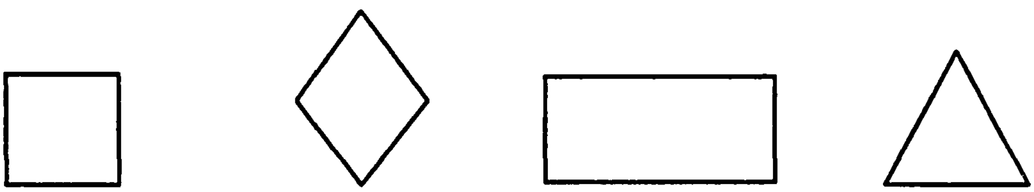
44 Which picture is the same size and shape as  ?



A. B. C. D.

---

45 Which picture is the same size and shape as  ?



A. B. C. D.

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Directions: Read the item and choose the operation which tells how to solve the problem.

46 Mom made 23 cookies and Jimmy ate 3 of them. How many cookies were left for the rest of the family?

A. Add

B. Subtract

C. Multiply

D. Divide

47 There are 31 seventh graders and 14 sixth graders. How many children are there in all?

A. Add

B. Subtract

C. Multiply

D. Divide

48 In the library there are 61 horse books and 25 car books. How many more horse books than car books?

A. Add

B. Subtract

C. Multiply

D. Divide

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Roseville Community Schools

Roseville, Michigan

Mathematics Test

FOURTH GRADE

Exit Level Skills

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Roseville Mathematics Test
FOURTH GRADE

You are going to use your mathematical skills on this test. You will have as much time as you need to finish the test. Work as quickly as you can, but do not hurry.

Be sure to write your answers on your answer sheet. If you want to work a problem, you may use the scratch paper provided. Remember, always mark your answers on the answer sheet. Mark only one answer for each item. If you change an answer, erase the first mark completely. Now look at the sample item below.

Sample: $2 + 2 =$ __

A. 2

B. 4

C. 6

D. 8

Answer Sheet

Sample: A ○ B ○ C ○ D ○

The correct answer is 4, so you would mark B on your answer sheet by filling in the circle because the letter in front of 4 is B.

If you have any questions about the directions, please raise your hand. Otherwise, turn the page and begin the test.

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Directions: Round the underlined number to the nearest 10.	**Directions:** Round the underlined number to the nearest 100
1 166 A. 160 B. 170 C. 180 D. 190	**4** 3,468 A. 3,400 B. 3,460 C. 3,468 D. 3,500
2 3,612 A. 3,630 B. 3,620 C. 3,612 D. 3,610	**5** 836 A. 900 B. 836 C. 830 D. 800
3 784 A. 800 B. 784 C. 780 D. 770	**6** 399 A. 380 B. 390 C. 399 D. 400

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Directions: Find the answer.

7 What is the place value of 2 in 302,476?

A. Hundred-thousands

B. Tens

C. Hundreds

D. Thousands

8 What is the place value of 6 in 147,861?

A. Hundred-thousands

B. Hundreds

C. Thousands

D. Tens

9 What is the place value of 9 in 668,921?

A. Ones

B. Tens

C. Hundreds

D. Thousands

10 What is 100 less than 2,314?

A. 3,314

B. 2,414

C. 2,314

D. 2,214

11 What number is 1,000 more than 6,821?

A. 5,821

B. 6,821

C. 6,921

D. 7,821

12 What is 1,000 less than 4,645?

A. 5,000

B. 4,645

C. 4,000

D. 3,645

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Directions: Find the answer.

13 $705 + 627 = \square$

A. 1,232

B. 1,322

C. 1,332

D. 1,432

16

$$\begin{array}{r} 705 \\ -\underline{627} \end{array}$$

A. 22

B. 78

C. 122

D. 132

14

$$\begin{array}{r} 1{,}785 \\ \underline{+468} \end{array}$$

A. 2,243

B. 2,253

C. 2,343

D. 2,353

17

$$\begin{array}{r} 3{,}416 \\ -\underline{\ \ 489} \end{array}$$

A. 3,037

B. 2,937

C. 2,927

D. 2,827

15

$$\begin{array}{r} 9{,}821 \\ +\underline{7{,}689} \end{array}$$

A. 16,510

B. 17,500

C. 17,510

D. 17,610

18 $4{,}617 - 3{,}990 = \square$

A. 627

B. 637

C. 727

D. 1,627

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Directions: Find the answer.

19

$$\begin{array}{r} 89 \\ \times\ \underline{7} \end{array}$$

A. 563

B. 623

C. 663

D. 666

20

$$\begin{array}{r} 76 \\ \times\ \underline{3} \end{array}$$

A. 228

B. 229

C. 238

D. 239

21 $21 \times 9 = \square$

A. 140

B. 149

C. 169

D. 189

22 $4\overline{)344}$

A. 76

B. 77

C. 86

D. 87

23 $5\overline{)1{,}565}$

A. 215

B. 275

C. 313

D. 315

24 $6\overline{)96}$

A. 32

B. 26

C. 16

D. 14

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Directions: Find the answer.

25 63 + 7 = 9 can be rewritten as which multiplication sentence below?

A. 63 X 9 = 567

B. 7 X 63 = 9

C. 9 X 7 = 63

D. 7 X 63 = 441

26 84 + 6 = 14 can be rewritten as which multiplication sentence below?

A. 6 X 84 = 504

B. 84 X 14 = 1176

C. 84 X 6 = 14

D. 6 X 14 = 84

27 135 + 3 = 45 can be rewritten as which multiplication sentence below?

A. 3 X 45 = 135

B. 135 X 3 = 305

C. 45 X 135 = 6075

D. 135 X 3 = 45

28 How would you write 5 tenths as a decimal?

A. 50

B. 5

C. .5

D. .05

29 How would you write $18\frac{3}{10}$ as decimal?

A. 183

B. 18.3

C. 1.83

D. .183

30 Write 0.3 as a decimal in words.

A. Thirty

B. Three

C. Three tens

D. Three tenths

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Directions: Find the answer.

31 $\frac{16}{4} = \square$

A. 2

B. 3

C. 4

D. 5

32 $\frac{31}{31} = \square$

A. 4

B. 3

C. 2

D. 1

33 $\frac{145}{5} = \square$

A. 28

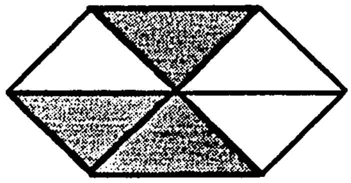
B. 29

C. 30

D. 31

Directions: Which fraction names the shaded part of the figure?

34



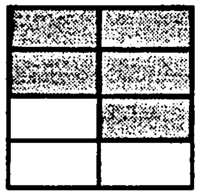
A. $\frac{2}{6}$

C. $\frac{6}{3}$

B. $\frac{3}{6}$

D. 6

35



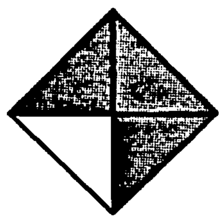
A. $\frac{5}{8}$

C. $\frac{3}{5}$

B. $\frac{3}{8}$

D. $\frac{5}{5}$

36



A. $\frac{1}{4}$

C. $\frac{3}{4}$

B. $\frac{2}{4}$

D. $\frac{4}{4}$

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Directions: Find the answer.

37 20 minutes after nine o'clock.

A. 20:09

B. 9:02

C. 9:20

D. 9:40

38 10 minutes before ten o'clock.

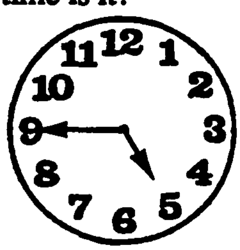
A. 10:10

B. 9:50

C. 9:10

D. 10:50

39 What time is it?



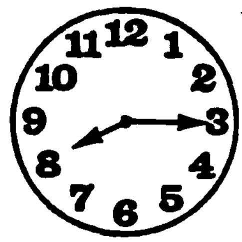
A. 9 minutes after four o'clock

B. 20 minutes after nine o'clock

C. 15 minutes before four o'clock

D. 15 minutes before five o'clock

40 What time did Steve wake in the morning?



A. 3:40 p.m.

B. 3:40 a.m.

C. 8:15 p.m.

D. 8:15 a.m.

41 What time is it if it is 40 minutes later than 3:10?

A. 2:30

B. 3:50

C. 4:10

D. 4:50

42 Judy's breakfast will be ready in 15 minutes. It is now 7:17. What time will breakfast be ready?

A. 6:32

B. 7:02

C. 7:27

D. 7:32

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Directions: Find the answer.

43 Six dollars and twenty-three cents =

A. $6.23

B. $62.03

C. $6.203

D. $6.23¢

44 One hundred twenty-three dollars and two cents =

A. $123.2

B. $123.02

C. $12.32

D. $123.02¢

45 Write $66.80 in words.

A. Sixty-six dollars and eight cents

B. Sixty-six dollars eighty cents

C. Sixty-six dollars and eighty cents

D. Six hundred sixty-eight dollars

46

$$\begin{array}{r} \$42.95 \\ -\ \underline{7.06} \end{array}$$

A. $50.01

B. $34.91

C. $34.89

D. $35.89

47

$$\begin{array}{r} \$16.25 \\ +\ \underline{21.01} \end{array}$$

A. $15.24

B. $37.36

C. $37.26

D. $37.26¢

48

$$\begin{array}{r} \$124.67 \\ +\ \underline{36.14} \end{array}$$

A. $160.81

B. $160.71

C. $150.81

D. $150.71

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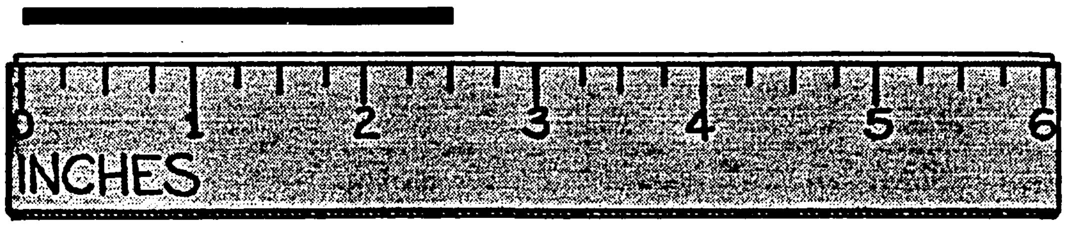
Directions: In the pictures below, how long is the line segment above the ruler?

49



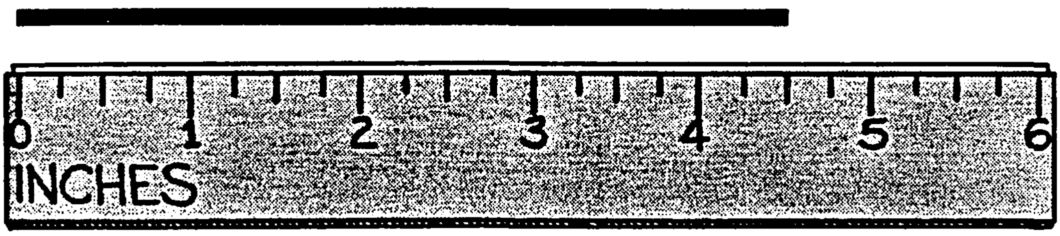
A. $\frac{1}{2}$ inch

B. 2 inches

C. $2\frac{1}{2}$ inches

D. $2\frac{1}{4}$ inches

50



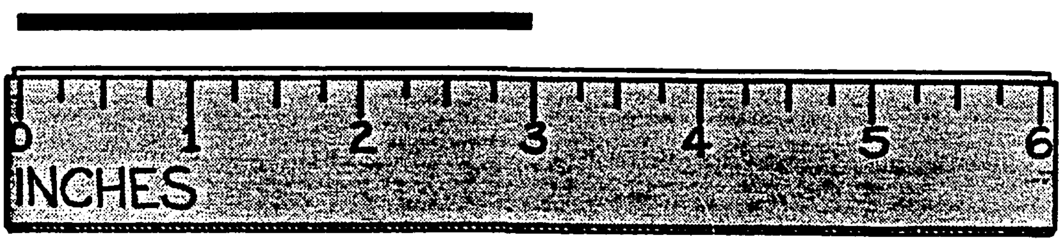
A. 3 inches

B. $3\frac{1}{4}$ inches

C. 4 inches

D. $4\frac{1}{2}$ inches

51



A. 3 inches

B. $2\frac{3}{4}$ inches

C. $2\frac{1}{2}$ inches

D. 2 inches

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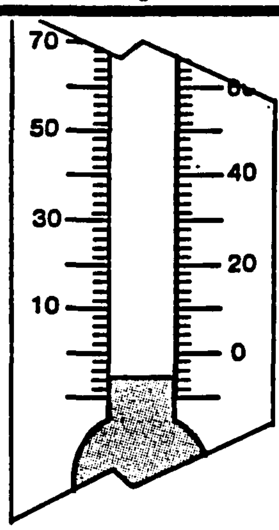
Directions: What is the temperature?

52



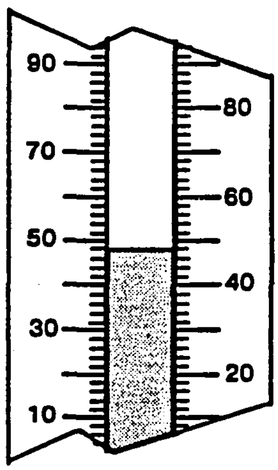
A. 0°

B. 5°

C. -5°

D. -15°

53



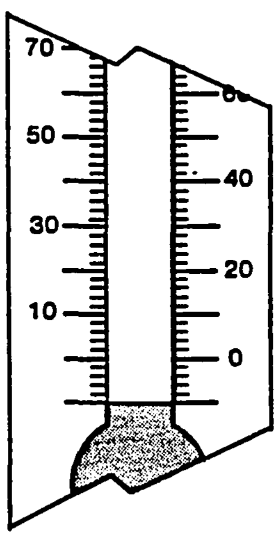
A. 46°

B. 47°

C. 48°

D. 50°

54



A. 0°

B. 10°

C. -20°

D. -10°

Directions: Find the answer.

55

4 pt. = $\square$ qt.

A. $\frac{1}{2}$

B. 1

C. 2

D. 8

56

8 qt. = $\square$ gal.

A. 1

B. 2

C. 16

D. 32

57

4 cups = $\square$ qt.

A. 16

B. 4

C. 2

D. 1

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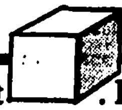
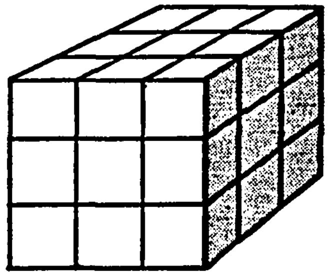
Directions: This is a cubit unit . For the next three items choose the numeral that tells how many cubic units are needed to build the figure.

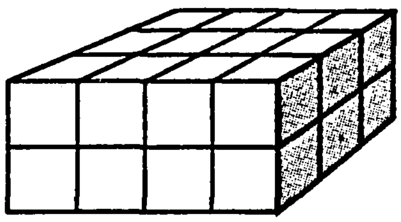
58



A. 9   C. 21

B. 18   D. 27

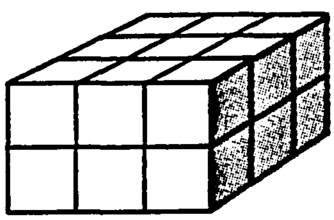
59



A. 8   C. 24

B. 12   D. 28

60



A. 6   C. 13

B. 9   D. 18

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Directions: Find the answer.

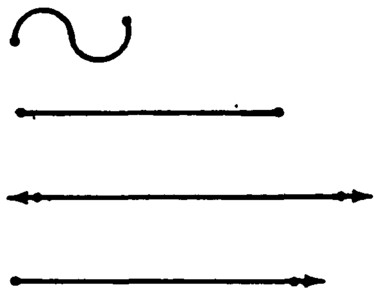
61 Which is a line?

A.

B.

C.

D.



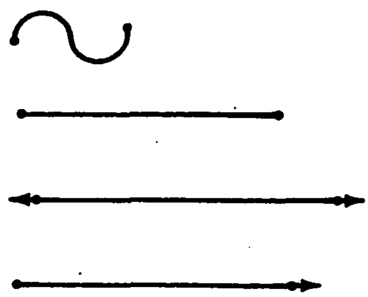
62 Which is a line segment?

A.

B.

C.

D.



63 What is the name of the line?

A. $\overline{SA}$

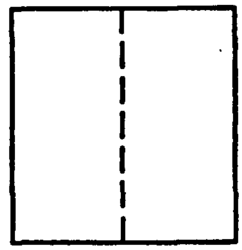
B. SA

C. AS

D. $\overleftrightarrow{AS}$

Directions: Is the dotted line in each figure a line of symmetry?

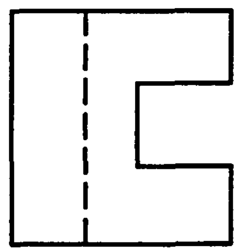
64



A. Yes

B. No

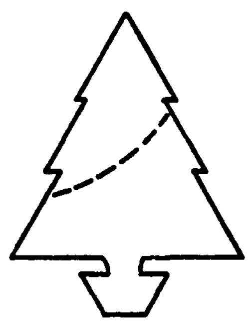
65



A. Yes

B. No

66



A. Yes

B. No

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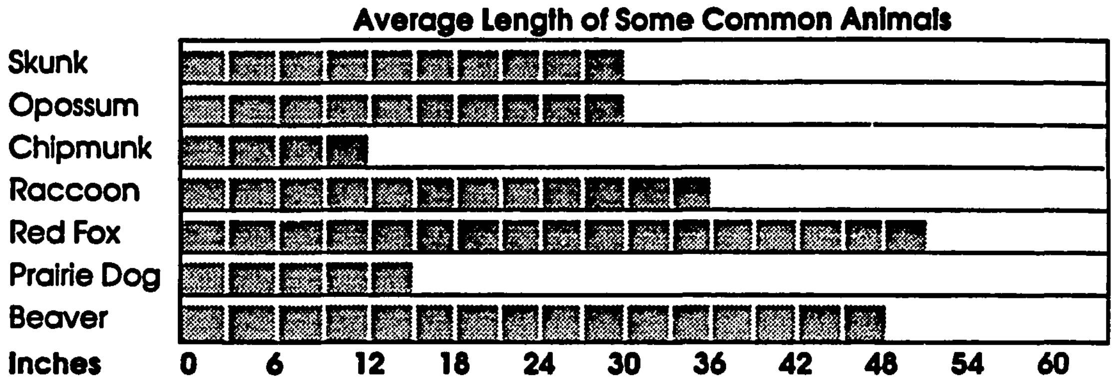
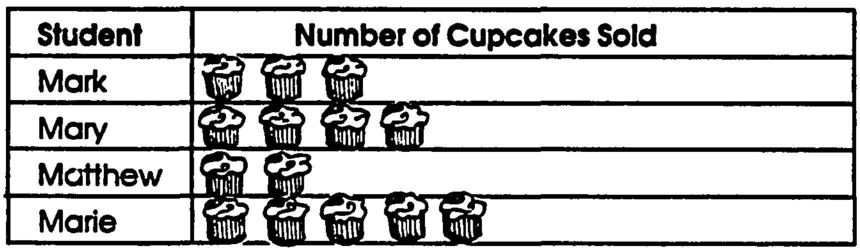
Directions: Find the answer.

67 Use the bar graph below to find which animal is 36 inches long.



A. Skunk
B. Raccoon
C. Red Fox
D. Opossum

Use the pictograph below to answer questions 68 and 69.



68 Who sold the least number of cupcakes?

A. Mark
B. Mary
C. Matthew
D. Marie

---

69 How many cupcakes did Matthew sell?

A. 2
B. 3
C. 5
D. 6

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Roseville Community Schools

Roseville, Michigan

Mathematics Test

FIFTH GRADE

Exit Level Skills

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Roseville Mathematics Test
FIFTH GRADE

You are going to use your mathematical skills on this test. You will have as much time as you need to finish the test. Work as quickly as you can, but do not hurry.

Be sure to write your answers on your answer sheet. If you want to work a problem, you may use the scratch paper provided. Remember, always mark your answers on the answer sheet. Mark only one answer for each item. If you change an answer, erase the first mark completely. Now look at the sample item below.

Sample: $3 + 8 =$ __

A. 9

B. 10

C. 11

D. 12

Answer Sheet

Sample: A ○ B ○ C ○ D ○

The correct answer is 11, so you would mark C on your answer sheet by filling in the circle because the letter C corresponds to 11.

If you have any questions about the directions, please raise your hand. Otherwise, turn the page and begin the test.

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Directions: Find the answer.

1 Round 48,579 to the nearest thousand.

A. 48,000

B. 48,500

C. 48,600

D. 49,000

2 Round 36,214 to the nearest thousand.

A. 36,000

B. 36,200

C. 36,300

D. 37,000

3 Round 14,789 to the nearest thousand.

A. 15,800

B. 15,000

C. 14,800

D. 14,000

4 Which number is divisible by both 5 and 2

A. 515

B. 730

C. 864

D. 917

5 Which number is divisible by 5?

A. 714

B. 823

C. 1,567

D. 2,345

6 Which number is divisible by 2?

A. 461

B. 783

C. 844

D. 927

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Directions: Find the answer.

7 2,152,730 = ____

A. 2 millions + 52 thousands + 7 hundreds + 30 ones

B. 2 thousands + 15 ten thousands + 2 thousands + 7 hundreds + 3 tens

C. 2 millions + 152 thousands + 7 hundreds + 3 tens

D. 2 millions + 100 hundred-thousands + 50 ten-thousands + 7 hundreds + 3 tens

8 4,010,461 = ____

A. 4 thousands + 10 hundreds + 461

B. 4 millions + 1 thousand + 461 ones

C. 4 millions + 1 ten-thousand + 4 hundreds + 6 tens + 1 one

D. 4 millions + 1 ten-thousand + 46 tens + 1 one

9 5,000,200 = ____

A. 5 millions + 2 hundreds

B. 5 millions + 200 hundreds

C. 5 millions + 200 ones

D. 500 thousands + 200 ones

10

$$\begin{array}{r} 70{,}036 \\ 2{,}952 \\ +\ \underline{43{,}844} \end{array}$$

A. 115,732

B. 116,722

C. 116,832

D. 116,932

11 34,414 + 76,112 = ____

A. 99,526

B. 100,526

C. 109,526

D. 110,526

12

$$\begin{array}{r} 26{,}314 \\ +\ \underline{98{,}128} \end{array}$$

A. 114,433

B. 114,442

C. 124,442

D. 134,442

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Directions: Find the answer.	Directions: Estimate the answer by rounding each number to the nearest ten.

13 70,036 - 43,844

A. 37,292

B. 33,892

C. 33,812

D. 26,192

14

$$\begin{array}{r} 13{,}416 \\ -\ \underline{7{,}892} \end{array}$$

A. 6,524

B. 5,624

C. 5,534

D. 5,524

15

$$\begin{array}{r} 81{,}000 \\ -\ \underline{29{,}416} \end{array}$$

A. 51,416

B. 51,584

C. 62,416

D. 62,694

16

$$\begin{array}{r} 83 \\ +\ \underline{61} \end{array}$$

A. 130

B. 140

C. 150

D. 160

17

$$\begin{array}{r} 95 \\ +\ \underline{16} \end{array}$$

A. 100

B. 110

C. 120

D. 130

18

$$\begin{array}{r} 75 \\ -\ \underline{26} \end{array}$$

A. 70

B. 60

C. 50

D. 40

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Directions: Find the answer.

19

$$\begin{array}{r} 73 \\ \times\ \underline{21} \end{array}$$

A. 1,533

B. 1,633

C. 2,191

D. 14,673

20

$$\begin{array}{r} 25 \\ \times\ \underline{36} \end{array}$$

A. 61

B. 700

C. 800

D. 900

21

$$\begin{array}{r} 96 \\ \times\ \underline{42} \end{array}$$

A. 3,032

B. 3,732

C. 3,832

D. 4,032

22 $4\overline{)1{,}732}$

A. 430

B. 408

C. 433

D. 480

23 $5\overline{)3{,}455}$

A. 681

B. 691

C. 781

D. 791

24 $7\overline{)13{,}472}$

A. 1,925

B. 1,924 r4

C. 1,824 r4

D. 1,824

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Directions: Look at the decimal fraction then find the answer which correctly names the place value of each digit.

25 5.28

A. 5 ones, 2 tenths, 8 hundredths

B. 5 ones, 2 tens, 8 hundreds

C. 5 hundreds, 2 tens, 8 ones

D. 5 hundredths, 2 tens, 4 ones

26 23.16

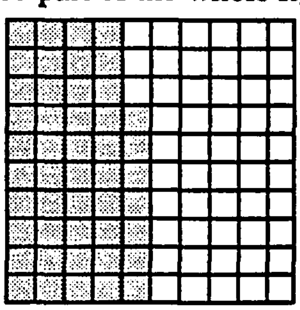
A. 23 tens, 1 tenth, 6 hundredths

B. 2 tens, 3 ones, 1 tenth, 6 hundredths

C. 2 tenths, 3 hundredths, 1 thousandth, 6 ten-thousandths

D. 2 thousands, 2 hundreds, 1 ten, 6 ones

27 Choose the decimal that names the shaded part of the whole figure.



A. 0.47 C. 47

B. 0.53 D. 53

Directions: Find the answer

28

$$\begin{array}{r} 13.01 \\ -\ \underline{7.57} \end{array}$$

A. 5.56

B. 5.44

C. 6.54

D. 14.56

29 74.13 - 16.69 = $\boxed{}$

A. 57.43

B. 57.44

C. 67.44

D. 90.82

30 7.89 + 18.66 = $\boxed{}$

A. 25.44

B. 25.45

C. 25.55

D. 26.55

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Directions: Find the answer.

31 624,951 + 352,312 = ____

A. 976,263

B. 977,263

C. 987,273

D. 1077,273

32

$$\begin{array}{r} 13,021 \\ 572,436 \\ +\ \underline{59,531} \end{array}$$

A. 534,988

B. 634,988

C. 644,988

D. 654,988

33

$$\begin{array}{r} 815,946 \\ -\ \underline{36,982} \end{array}$$

A. 446,126

B. 778,964

C. 889,064

D. 889,964

34 $\frac{1}{7}$ of 42 = ____

A. $\frac{1}{6}$

C. $\frac{1}{294}$

B. 6

D. 294

35 $\frac{3}{8}$ of 32 = ____

A. $\frac{1}{12}$

C. 12

B. $\frac{3}{256}$

D. $\frac{256}{8}$

36 $\frac{2}{7}$ of 35 = ____

A. 10

C. $\frac{2}{5}$

B. $\frac{1}{10}$

D. $\frac{5}{2}$

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Directions: Find the answer.

37 $4\frac{3}{5} - \frac{2}{5} = \square$

A. $3\frac{2}{5}$

C. $4\frac{1}{5}$

B. $3\frac{3}{5}$

D. $4\frac{2}{5}$

38

$$\begin{array}{r} 8\frac{3}{8} \\ +\ 3\frac{1}{8} \\ \hline \end{array}$$

A. $5\frac{1}{8}$

C. $11\frac{1}{2}$

B. $5\frac{2}{8}$

D. 12

39

$$\begin{array}{r} \frac{3}{5} \\ +\ \frac{4}{5} \\ \hline \end{array}$$

A. $\frac{1}{5}$

C. $1\frac{1}{5}$

B. 1

D. $1\frac{2}{5}$

Directions: Reduce the fraction to lowest terms.

40 $\frac{21}{33} = \square$

A. $\frac{3}{7}$

C. $\frac{7}{11}$

B. $\frac{3}{11}$

D. $\frac{21}{33}$

41 $\frac{25}{50} = \square$

A. $\frac{1}{2}$

C. $\frac{4}{9}$

B. $\frac{5}{10}$

D. $\frac{25}{50}$

42 $\frac{18}{24} = \square$

A. $\frac{1}{2}$

C. $\frac{9}{12}$

B. $\frac{3}{4}$

D. $\frac{18}{24}$

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Directions: Find the answer.

43 Which statement tells the same time in two ways?

A. 11 minutes after 2 OR two twenty-one
B. 20 minutes before 12:00 OR eleven forty
C. $\frac{1}{2}$ hour before 5 OR five thirty
D. 15 minutes before 5 OR five forty-five

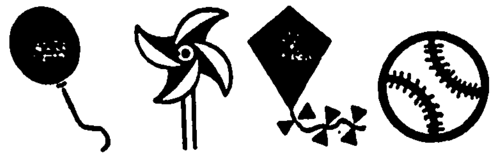
44 2 days = $\boxed{}$ hours

A. $\frac{1}{2}$
B. 24
C. 36
D. 48

45 You wake up at 8:15 a.m. and leave for school 23 minutes later. What time do you leave for school?

A. 8:20 a.m.
B. 8:30 a.m.
C. 8:38 a.m.
D. 9:00 a.m.

46 Paul had 92¢. He bought one baseball. How much did he have left?



30¢ 45¢ 65¢ 84¢

A. 3¢
B. 7¢
C. 17¢
D. Not Given

47 What change should you receive if you give a $10.00 bill for a $9.73 purchase

A. 17¢
B. 27¢
C. 37¢
D. Not Given

48 Mary had $4.00. She bought a doll for $3.66. How much did she have left?

A. $1.34
B. 44¢
C. 0.54
D. $ .34

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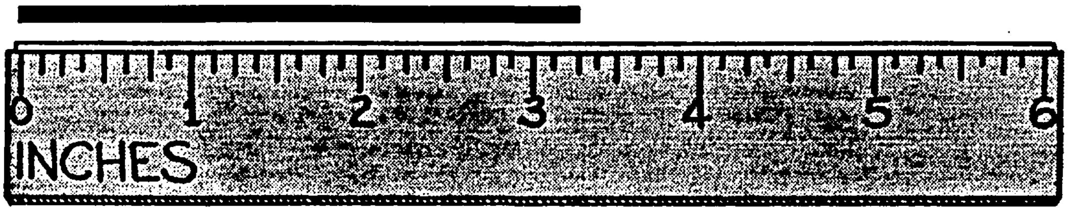
Directions: In each picture below, how long is the line segment above the ruler.

49



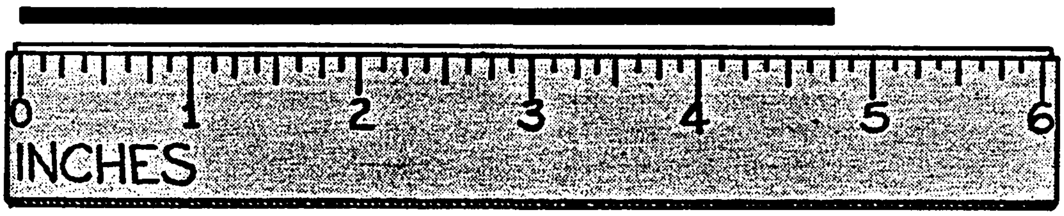
A. $3\frac{1}{4}$ inches

B. $3\frac{1}{2}$ inches

C. $3\frac{3}{8}$ inches

D. $3\frac{4}{8}$ inches

50



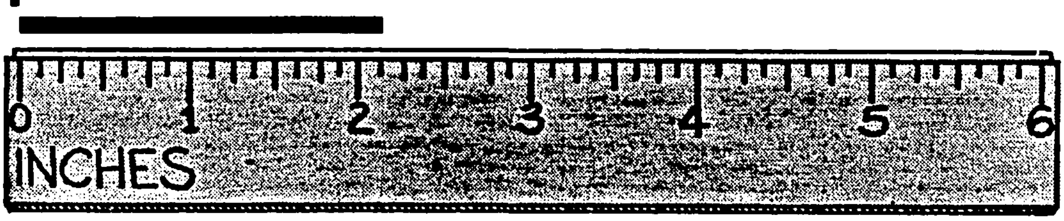
A. $4\frac{1}{8}$ inches

B. $4\frac{1}{4}$ inches

C. $4\frac{1}{2}$ inches

D. $4\frac{3}{4}$ inches

51



A. $2\frac{1}{8}$ inches

B. $2\frac{2}{8}$ inches

C. $2\frac{1}{2}$ inches

D. $2\frac{3}{8}$ inches

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Directions: What is the temperature?

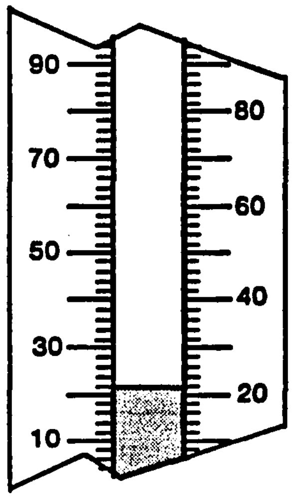
52

A. 15°

B. 20°

C. 22°

D. 25°



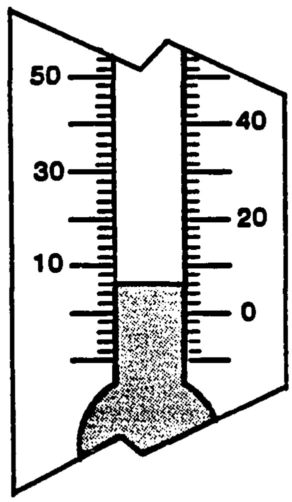
53

A. 0°

B. 10°

C. 6°

D. -10°



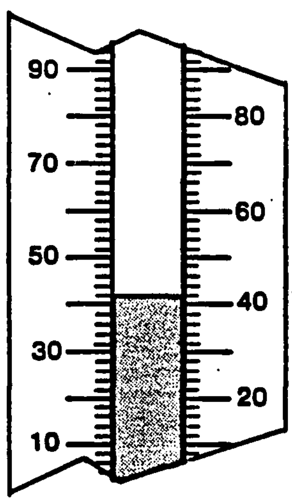
54

A. 40°

B. 42°

C. -40°

D. -42°



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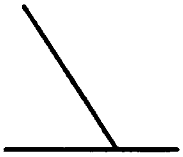
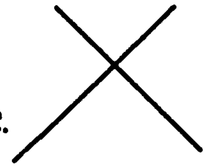
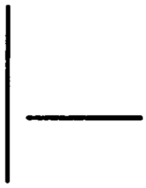
Directions: Find the answer.

55 Which pair of line segments are parallel?

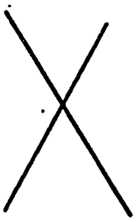
A. 

C. 

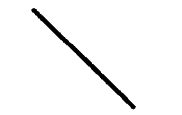
B. 

D. 

56 Which pair of line segments are intersecting?

A. 

C. 

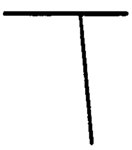
B. 

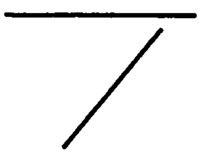
D.

57 Which pair of line segments are parallel?

A. 

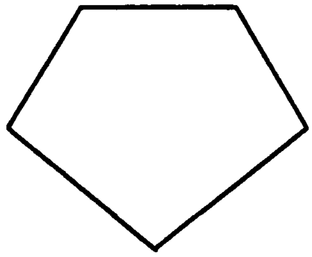
C.

B. 

D. 

Directions: What is the figure called?

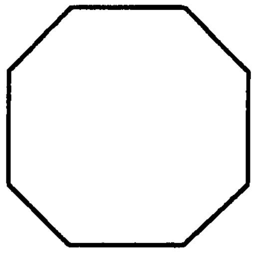
58



A. Pentagon C. Hexagon

B. Parallelogram D. Rectangle

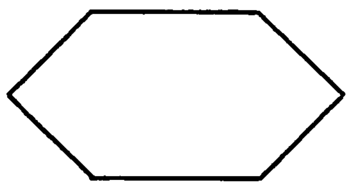
59



A. Pentagon C. Octagon

B. Hexagon D. Rectangle

60



A. Pentagon C. Octagon

B. Hexagon D. Rectangle

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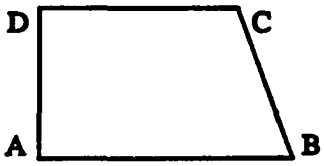
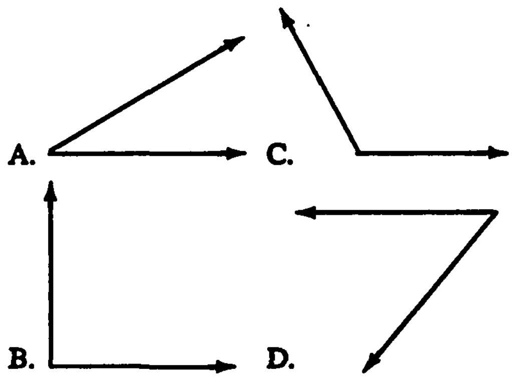
Directions: Find the answer.

61 In the diagram below, which angle forms a right angle?

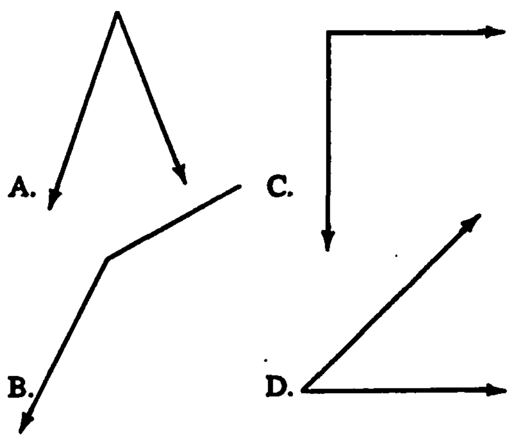


A. ∠CBA
C. ∠CDA
B. ∠BCA
D. ∠ABC

62 Which angle is a right angle?



63 Which angle is a right angle?



Directions: Choose the operation which tells how to solve the problem

64 Doug played records for 3 hours. He played 8 records an hour. How many records did he play?

A. Add
B. Subtract
C. Multiply
D. Divide

65 Mrs. Jones buys 9 bags of candy. The total cost is $89.55. What is the price of each bag of candy?

A. Add
B. Subtract
C. Multiply
D. Divide

66 Greg mows lawn after school for 3 hours. He earns $7.50. How much does he earn in 1 hour?

A. Add
B. Subtract
C. Multiply
D. Divide

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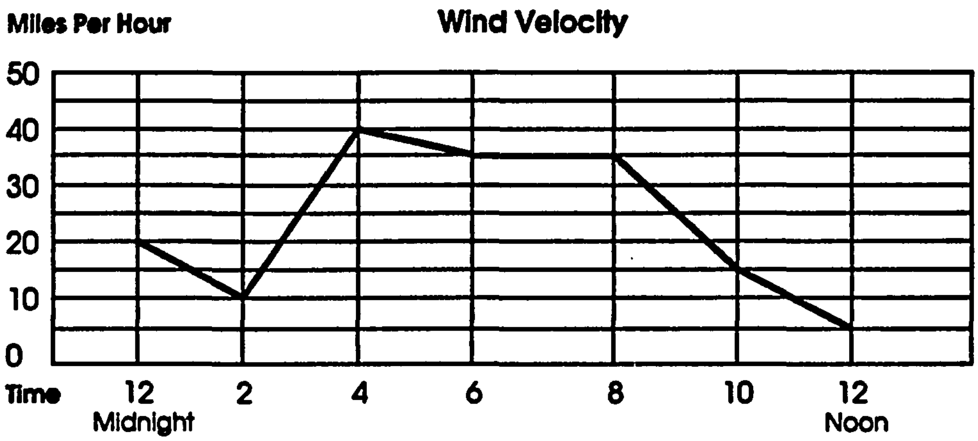
Directions: Use the line graph below to answer questions 67 through 69.



67 At what time was the wind blowing the fastest?

A. 2:00
B. 4:00
C. 8:00
D. Noon

68 At which times was the wind velocity the same speed?

A. 2:00 and 10:00
B. 4:00 and 6:00
C. 6:00 and 8:00
D. 2:00 and 12 Noon

69 During which two-hour period did the wind velocity increase the most?

A. 10:00 and 12 Noon
B. 2:00 and 4:00
C. 12 Midnight and 2:00
D. 6:00 and 8:00

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ROSEVILLE COMMUNITY SCHOOLS

ADMINISTRATION BUILDING
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August 3, 1989

HSIRB Office
Western Michigan University
A-223 Ellsworth Hall
Kalamazoo, MI 49008-3899

ATTN: Dr. Mary Anne Bunda, Chair

Dear Committee:

Martha O'Kray has permission to conduct her study investigating the effect of staff development on student outcomes. It is understood that the results from this research will be made public.

Sincerely,

Carole Quadrozzi

Carole Quadrozzi
Assistant Superintendent

/rn

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Appendix E

Data Entry Descriptions

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O'KRAY - DATA ENTRY DESCRIPTIONS

TEACHER ID:	2 DIGIT ENTRY
STUDENT ID:	3 DIGIT ENTRY
PRETEST:	2 DIGIT SCORE
POSTTEST:	2 DIGIT SCORE

ITIP CONTACT:	*NONE*	*ONE YEAR*	*CONSECUTIVE*	*INTERMITTENT*
SINGLE DIGIT ENTRY	0	1	2	3

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Appendix F

Data Summary Sheet

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O'KRAY - DATA SUMMARY SHEET

TEACHER ID	STUDENT ID	PRETEST	POSTTEST	ITIP CONTACT

Page ___

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