



Student teaching : opportunities for observing, experimenting with, and implementing assessment practices recommended by the NCTM Standards documents
by David Alan Buhl

A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Education
Montana State University
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Abstract:

This study used qualitative research methods to investigate opportunities for two secondary mathematics student teachers, Mark and Paula, to observe, experiment with, and implement assessment practices advocated by the NCTM Standards documents.

Both student teachers observed and implemented assessment practices during student teaching that were similar to preferences stated prior to student teaching. Mark indicated an interest prior to student teaching, and then again at its completion, in exclusively using traditional assessment practices in a typical high school mathematics course. During his student teaching experience, Mark observed his cooperating teacher using traditional assessment practices and then continued to implement his cooperating teacher's assessment practices. Prior to student teaching, Paula indicated an interest in using traditional assessment practices, as well as learning about journals and portfolios. During her student teaching experience, Paula observed her cooperating teacher using traditional assessments, as well as journals, portfolios, group assessments, and self assessments. Initially, Paula was unaware of the various uses of alternative assessment, but became acquainted with their uses as she continued to implement her cooperating teacher's assessment practices.

Both student teachers also indicated an interest prior to student teaching in not "rocking the boat". However, both student teachers made minor changes in their cooperating teacher's assessment practices during student teaching. At the completion of student teaching, both student teachers expressed an interest in implementing assessment practices in their first year of teaching similar to the assessment practices they implemented during student teaching.

Both student teachers stated a lack of exposure and experience in their preservice content and methods courses with the alternative assessment practices advocated by the National Council of Teachers of Mathematics.

Recommendations are made for the necessity of providing preservice students with the opportunity to observe instructors in mathematics content and methods courses implementing alternative assessment practices.

Recommendations are also made for the selection of cooperating teachers who have alternative assessment practices in place for student teachers to observe, experiment with, and implement during student teaching.

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ASSESSMENT PRACTICES RECOMMENDED BY THE
NCTM STANDARDS DOCUMENTS

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Co-chairpersons: Dr. William Hall
Dr. Glenn Allinger

Montana State University - Bozeman
1995

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Signature David Buhl

Date June 26, 1995

DEDICATION

To my wife, JoAnn, and our daughter, Ester

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I would like to thank the student teachers and their cooperating teachers for their willingness to participate and also their insights which made this study possible.

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Abstract

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CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

Introduction

With the publication of the *Assessment Standards for School Mathematics* (1995), the *Professional Standards for Teaching Mathematics* (1991) and the *Curriculum and Evaluation Standards for School Mathematics* (1989), the National Council of Teachers of Mathematics (NCTM) has called for changes in: (1) secondary mathematics curriculum, (2) instruction, and (3) assessment. Other publications, such as *Everybody Counts* (1989) and the *National Assessment of Educational Progress* (1987), have contributed to the call for reform in secondary mathematics classrooms. Thompson (1992) stated:

The conception of mathematics teaching that can be gleaned from documents such as the Cockcroft Report (1983), *Everybody Counts* (1989), and the NCTM Curriculum and Evaluation Standards (1989) is one in which students engage in purposeful activities that grow out of problem situations, requiring reasoning and creative thinking, gathering and applying information, discovering, inventing, and communicating ideas, and testing those ideas through critical reflection and argumentation (p. 128).

Studies (Brown et al, 1988; Dossey, 1988; McKnight et al, 1987) conclude that the conception of mathematics, as an evolving and dynamic process, is quite different from many students' current conception of mathematics as a static field dominated by rules and procedures. To effectively change students' conception of

mathematics, NCTM proposes major changes in the teaching and assessing of high school mathematics.

The *Standards* documents published by NCTM (1995, 1993, 1991, 1989) recommend that the goals of mathematics stress problem solving, reasoning, understanding, and communicating with mathematics. Crawford (1990) stated, "Rather than a curriculum based solely upon a set of skills and procedures to be imparted, mathematics should be explored, discovered, and reasoned" (p. 2). Schoen (1993) stated,

For this vision of the mathematics curriculum to become a reality, textbooks and other instructional material that support these curricular goals will need to be developed. Thus, all assessment, whether developed by the teacher or by agencies outside the classroom, should be aligned with the content topics of the curriculum and should reinforce the view of what is important in the curriculum and in classroom instruction (p. 8).

The vision in the *Standards* documents of mathematics teaching is to provide opportunities for students to form a deeper understanding of mathematics and develop mathematical power. This places new demands on instruction and encourages teachers to reevaluate and align the methods and manner by which students are assessed. Many existing methods of assessment do not adequately measure outcomes identified in the Curriculum and Evaluation Standards for School Mathematics (NCTM, 1989). The Curriculum and Evaluation Standards (NCTM, 1989) propose that:

- student assessment be integral to instruction;
- multiple means of assessment methods be used;

- all aspects of mathematical knowledge and its connections be assessed;
- instruction and curriculum be considered equally in judging the quality of a program (NCTM, 1989, p. 190).

One effort in Montana to change mathematics teaching to be more in line with that envisioned by NCTM is the National Science Foundation (NSF) supported Systemic Teacher Excellence Preparation (STEP) Collaborative Project. This project is designed (1) to bring about large-scale improvement in the preparation of K - 12 mathematics and science teachers in Montana, and (2) to serve as a national model for rural areas with significant minority populations.

The STEP Project also developed alliances with two NSF curriculum writing projects, the Systemic Initiative for Montana Mathematics and Science (SIMMS) Project involving grades 9 -12 and the Six through Eight Mathematics (STEM) Project. A summary of the goals of each project are located in Appendix D, page 102. In addition to developing alliances with the SIMMS Project and the STEM Project, the STEP Project is collaborating with the Montana Council of Teachers of Mathematics (MCTM), the Montana Science Teachers Association (MSTA), the Office of Public Instruction, and the Montana University System.

Merely calling for change or reform at the classroom level does not insure impact on teachers' beliefs and practices. Research studies by Crawford (1990) and Goodlad (1990) suggest that calls for reform by sources outside the classroom often fail to make an impact inside the classroom. Future teachers' beliefs about mathematics instruction and assessment, formed over many years of observation and participation as students, are deeply held and difficult to change.

Studies (Davis, 1990; Ball, 1989; & Meyerson, 1977) conclude that methods courses alone are not sufficient in changing future teachers' beliefs about

classroom practices experienced prior to methods courses. When attempting to implement reform at the classroom level, factors that influence beliefs and practices need to be investigated.

Purpose of this Study

The Assessment Standards for School Mathematics (NCTM, 1995) and the evaluation standards contained in the Curriculum and Evaluation Standards for School Mathematics (NCTM, 1989) emphasize assessment practices different from current practices occurring in many secondary classrooms. NCTM (1989, p. 190) advocates the following aspects of assessment:

- Assessing what students know and how they think about mathematics;
- Having assessment be an integral part of teaching;
- Focusing on a broad range of mathematical tasks and taking a holistic view of mathematics;
- Developing problem situations that require the applications of a number of mathematical ideas;
- Using multiple assessment techniques, including written, oral, and demonstration formats;
- Using calculators, computers, and manipulatives in assessment

This study investigated opportunities provided for student teachers to observe, experiment with, and implement assessment practices advocated by the NCTM *Standards* (1995, 1993, 1991, 1989) documents. Four general objectives served to guide this study: (1) to describe cooperating teachers' assessment practices and student teacher's perceptions of his/her cooperating teacher's

assessment practices; (2) to determine the cooperating teacher's willingness to allow his/her student teacher to experiment with assessment practices different from what the cooperating teacher was using and the student teacher's interest in experimenting with assessment practices different from what his/her cooperating teacher was using; (3) to describe student teachers' assessment practices used during student teaching; and (4) to identify student teachers' beliefs about assessment at the beginning of student teaching and at the completion of student teaching.

Research Questions

1. What assessment techniques, formats, and rubrics were used by the cooperating teacher?
2. What were the ways in which the cooperating teacher used assessment information?
3. How did the cooperating teacher incorporate students' use of calculators, computers, and manipulatives in the assessment process?
4. What was the student teacher's perception of their cooperating teacher's assessment practices?
5. Was the cooperating teacher willing to allow his/her student teacher to experiment with assessment practices different from what the cooperating teacher was using?
6. What was the student teacher's interest in experimenting with assessment practices different from what his/her cooperating teacher was using?
7. What assessment techniques, formats, and rubrics were used by the student teacher?

8. What were the ways in which the student teacher used assessment information?
9. How did the student teacher incorporate students' use of calculators, computers, and manipulatives in the assessment process?
10. Prior to student teaching, what were the student teacher's beliefs about NCTM recommended assessment practices?
11. Upon the completion of student teaching, what were the student teacher's beliefs about NCTM recommended assessment practices?

Appendix A, page 87, summarizes the questions and related procedures and methods.

Significance of this Study

This study will build on previous research by providing greater depth to the knowledge base in two areas: (1) the opportunities provided for student teachers to observe and model NCTM advocated assessment practices; and (2) the role of student teaching in formulating student teachers' beliefs about assessment.

This study will also contribute to the evaluation of the preservice education and career component of the STEP Project by providing data in two areas: (1) identifying inservice topics that need to be included in the Professional Development for cooperating teachers in the STEP designated eight model schools, and (2) describing actions of cooperating teachers that influence student teachers' beliefs about effective assessment practices.

Definition of Terms

assessment - the process of gathering evidence about a student's knowledge of, ability to use, and disposition towards mathematics and of making inferences based on that evidence for a variety of purposes (NCTM, 1995, p. 87)

assessment practices - the method of assessment and the purpose of the assessment

method of assessment - the method by which the teacher gathers evidence about a student's knowledge of, ability to use, and disposition towards mathematics

purpose of assessment - the use to which the assessment information will be used

alternate forms of assessment - a variety of assessment methods and formats which may include, but not be restricted to, the following:

performance assessment - involves presenting students with a mathematics task or project and then observing, interviewing, and/or looking at their product to assess what they actually know and can do (Stenmark, 1989, p. 13)

portfolio - a purposeful or useful collection of students' work which exhibits the student's efforts, progress, and achievement

(Paulson et al, 1991)

student interviews - questioning a student

student journal - student writing which may be used to describe or summarize key topics in an internal dialogue as they reflect on and explore the mathematics they have encountered

evaluation - the assignment of a value to the results of the assessment

beliefs - an individual's understanding and feelings that shape the ways that the individual conceptualizes and engages in mathematical behavior

cooperating teacher - the individual whose in classroom the student teacher assumes control

student teacher - the individual who assumes control of teaching from the cooperating teacher

mathematical power - mathematical power includes the ability:

- to explore, conjecture, and reason logically;
- to solve non-routine problems;
- to communicate about and through mathematics;
- to connect ideas within mathematics and between mathematics and other intellectual activity (NCTM, 1989, p. 1)

integrated mathematics - mathematics curriculum utilizing various aspects of content and emphasizing problem solving, mathematical reasoning, real-world applications, and the appropriate use of technology

SIMMS Materials - one type of integrated mathematics curriculum

Systemic Initiative for Montana Mathematics and Science (SIMMS) - a National Science Foundation funded project supporting 9 - 12 integrated mathematics curriculum writing and related professional development

Review of Literature

Preliminary Comments

With the publication of the *Standards* documents (1995, 1993, 1991, 1989), the National Council of Teachers of Mathematics (NCTM) has called for changes in secondary mathematics curriculum, instruction, and assessment with the purpose of developing mathematical power in all students. To reach the goal of developing

mathematical power for all students, the National Council of Teachers of Mathematics advocates teaching and assessment practices different from much of the current practice in secondary mathematics classrooms. The purpose of this study was to investigate opportunities provided to student teachers to observe, experiment with, and implement assessment practices advocated by NCTM.

The review of literature begins with an historical perspective of assessment in education and mathematics education pertinent to this study. The review also presents research relative to: (1) assessment practices; (2) conceptions of mathematics related to assessment; (3) efforts to change mathematics preservice teachers' beliefs about teaching and assessment; and (4) the influence of the student teaching experience on student teachers' beliefs about teaching and assessment.

Historical Perspective on the Role of Assessment

In the early 1920's, assessment became mis-aligned with instruction when it became necessary to detect individual differences to meet specific manpower requirements for factories (Mitchell, 1992; Stiggins, 1991). Mitchell (1992) argues the factory model produced three levels of workers: (1) college-track students who prepared for public universities, (2) general-track students who prepared for clerical jobs, and (3) vocational students who became the manual workers for the assembly lines. As a result of manpower need, teacher-made objective tests were used to detect individual differences in achievement among students.

As immigration to the United States increased causing the population of the United States to become more ethnically diverse, Stiggins (1991) suggests that

teacher-written, objective tests were often seen as inherently biased and inferior in quality. As such, these tests were replaced by more scientific and cost effective instruments. Stiggins (1991) states that when teacher written objective tests were replaced by more scientific instruments, such as standardized tests, assessment and instruction became separated from each other.

Once separated, assessment practices became more complex and technical, thus putting greater distance between instruction and assessment. As the distance between instruction and assessment became greater and as technology became available, testing programs using standardized instruments such as multiple choice tests became more centralized and widely used within school districts and/or state agencies.

Policy level decision makers and school officials became consumed by the growing use of standardized tests at all levels. The unfortunate results were that these standardized tests were rarely aligned with the objectives of the local curricula, yet they started to drive the curriculum (National Research Council, 1989).

By the late 1950's, U.S. education was stirred by the response to *Sputnik*, the Soviet Union's triumph in space, which gave rise to a flood of curriculum reform projects that became known as the new math (Mitchell, 1992; Cooper, 1985). This new math disappeared amid the turmoil of the 1960's and 1970's leaving the basic structure of the school, that of tracking students, unchanged (Mitchell, 1992).

In 1983, the National Commission on Excellence released *A Nation at Risk* which acknowledged the inadequacies of American education. Webb (1992) stated,

The Nation at Risk report (National Commission on Excellence in Education, 1983) delineated the problem by comparing American students' relatively low test scores with those of students from other industrialized nations, as well as noting the decline from 1963 to 1980 in average mathematics scores on the College Board's Scholastic Aptitude Tests (p. 661)

By the late 1980's, all aspects of American education came into question, including the role of assessment (Mitchell, 1992). Movements began to restructure American schools, to reshape curricula, to professionalize teachers, and to reform assessment (Kilpatrick, 1992).

The National Council of Teachers of Mathematics initiated the *Standards Project* in 1986 which has now resulted in the publication of three sets of recommendations that together provide a coordinated vision of the school mathematics curriculum, the teaching of mathematics, and the assessment of mathematics abilities (NCTM, 1995, 1991, 1989).

The *Curriculum and Evaluation Standards for School Mathematics* (1989) presents a vision of mathematical content appropriate for each student and an evaluation system to complement this content vision. The *Professional Standards for Teaching Mathematics* (1991) presents a vision of pedagogy relevant to and supportive of this content. The working draft of the *Assessment Standards for School Mathematics* (1995) provides a set of standards that focus on considerations involved in examining or developing assessment tasks, assessment events, assessment instruments, and assessment frameworks for a continuum of educational reform purposes.

Assessment Practices

Assessment systems currently used by most states, provinces, districts, and schools are not consistent with the goals of the reform efforts in school mathematics (NCTM, 1993). Webb (1992) states, the dominance of paper and pencil and short-answer test forms and the lack of clear expectations of performance suggest that assessment in classrooms is not embedded in instruction (p. 276).

The data on teachers using assessment methods in secondary classrooms is limited. Stiggins and Bridgeford (1985) report secondary teachers' assessment methods are dominated by traditional paper and pencil tests. Of the mathematics teachers responding, eighty-five percent reported using published tests.

Webb (1992) reported, ... although teacher-made objective tests and published tests have received the most attention in measurement textbooks and research articles, forty-seven percent of teachers surveyed rated performance assessment as the most important type of classroom evaluation (p. 276).

Linn (1983) researched how teachers diagnose students' strengths and weaknesses. He found that seventy-four percent of those surveyed said they preferred using results from standardized achievement tests.

If the vision of the NCTM recommendations is going to be realized, students' performance needs to be assessed in a manner consistent with these reform efforts. NCTM (1989) proposes:

- student assessment be integral to instruction;
- multiple means of assessment methods be used;
- all aspects of mathematical knowledge and its connections be assessed (NCTM, 1989, p. 190).

To accomplish these proposed changes, NCTM (1995, p. 83) advocated

these major shifts in assessment practice:

<u>Toward</u>	<u>Away From</u>
Assessing students' full mathematical power	Assessing only students' knowledge of specific facts and isolated skills
Comparing students' performance with established criteria	Comparing students' performance with that of other students
Giving students multiple opportunities to demonstrate their full mathematical power	Restricting students to a single way of demonstrating their mathematical knowledge
Developing problem situations that require the applications of a number of mathematical ideas	Using exercises or word problems requiring only one or two skills
Using assessment results to ensure that all students have the opportunity to achieve their potential	Using assessment to filter and select students out of the opportunities to learn mathematics
Aligning assessment with curriculum and instruction	Treating assessment as independent of curriculum and instruction
Basing inferences on multiple sources of evidence	Basing inferences on restricted or single sources of evidence
Regarding assessment as continual and recursive	Regarding assessment as sporadic and conclusive

The National Council of Teachers of Mathematics (1993) stated, "Unless corresponding changes are made in assessment practices, promising new programs developed by teachers and schools will certainly clash as they come into contact with outdated, but often-used and revered, tests" (p.13).

Conceptions of Mathematics

The conception of mathematics presented in each of the NCTM Standards documents is best characterized by "doing" mathematics rather than just "knowing" mathematics. Thompson (1992) stated:

The conception of mathematics teaching that can be gleaned from documents such as the Cockcroft Report (1983), Everybody Counts (1989), and the NCTM Curriculum and Evaluation Standards (1989) is one in which students engage in purposeful activities that grow out of problem situations, requiring reasoning and creative thinking, gathering and applying information, discovering, inventing, and communicating ideas, and testing those ideas through critical reflection and argumentation (p. 128).

This view of mathematics is quite different than students' current conception of mathematics. Research studies (Thompson, 1992; Brown et al, 1988; Dossey, 1988; McKnight et al, 1987) show student's current conception of mathematics is that of a subject dominated by rules, facts, and procedures. Dossey (1988) and McKnight et al (1987) reported that most students in the United States believe that mathematics is useful, but its main characteristics are memorizing facts and following rules and procedures.

Supporting research by Brown et al (1988) and Thompson (1992) on students' beliefs about mathematics indicate that students believe that mathematics is important, difficult and based on rules. Brown et al (1988) stated, "A large

majority of the students felt that mathematics is rule based, and about half of the students reported that learning mathematics is mostly memorizing" (p. 339).

Thompson (1992) concluded, "For many, mathematics is a discipline characterized by accurate results and infallible procedures, whose basic elements are arithmetic operations, algebraic procedures, and geometric terms and procedures" (p. 127).

Preservice students are in the transition from being a student to becoming a teacher. Preservice students' beliefs about mathematics formed as students should have an impact on the way they assess when they teach. Changing preservice students' deeply held beliefs of mathematics and assessment practices that have been formed over many years of observation and experience is no easy task. There is a need for research on how observing, experimenting with, and implementing assessment practices recommended by NCTM during student teaching influence preservice students' beliefs about assessment practices.

Role of Student Teaching Experience

In their review of the literature on the role of teacher education in changing student teachers' beliefs, Borko and Brown (1992) stated, "There is debate about the extent to which formal teacher education programs can encourage teachers to modify the beliefs that they bring with them. Twelve to fourteen years of experience as students in classrooms serve as a strong socializing influence not easily overcome later in formal teacher education programs or even as teachers in the classroom" (p. 227).

However, research studies (Bush and Davis, 1982; Goodlad, 1990; Richardson-Koehler, 1988) suggest teachers do credit their student teaching experience with impacting how they teach. Bush and Davis (1982) surveyed

teachers about the effectiveness of their undergraduate education program in preparing them to teach. Almost three-fourths of the teachers identified student teaching as the most useful component of their program. Supporting studies (Goodlad, 1990; Richardson-Koehler, 1988) show that teachers believe their field experiences and student teaching had the greatest impact on the way they teach.

Research studies (Nagel and Driscoll, 1992; Smith, 1991; Goodlad, 1990; Richardson-Koehler, 1988; Bush, 1986; Bush and Davis, 1982; Veenman, 1984; Hodges, 1983) have examined influences within the student teaching experience that have impacted how prospective teachers teach. These influences include relationships between the cooperating teacher and/or university supervisor (Bush, 1992; Joyner, 1991; Bush et al, 1990, Bush and Davis, 1982;), the curriculum (Bush, 1986), dilemmas between practices that support student learning and practices that appear efficient and widely used (Nagel and Driscoll, 1992), personal variables (Hodges, 1983), discipline problems (Hodges, 1983) , and prior experiences in mathematics classrooms (Smith, 1991).

Research studies (Joyner, 1991; Bush et al, 1990; Campbell and Wheatley, 1983) do show that within the student teaching experience, the cooperating teacher has a major impact on how student teachers teach. Bush et al (1990) found that, although student teachers' conception of teaching was based more on pre-college classroom experiences than college mathematics content courses, the cooperating teachers' performance had more influence on the preservice teachers than either the cooperating teacher's or supervisor's suggestions.

Campbell and Wheatley's (1983) earlier findings support the importance of cooperating teachers when they found student teachers were eager to imitate any technique without much concern as to whether it was appropriate for them or for

their students (p. 61). Nagel and Driscoll (1992) found that student teachers were willing to abandon what they had learned at the university in order to align themselves with the school where they practice teach.

Joyner (1991) found that cooperating teachers had a large impact on student teachers' beliefs about the implementation of new strategies appropriate to learning mathematics. Student teacher responses on favoring the use of a new strategy changed from sixty-three percent to forty percent when their cooperating teacher did not implement the new strategy. Therefore, it would seem that a cooperating teachers actual classroom performance in instruction and assessment is a key to bringing about change in their student teachers' assessment philosophy.

There is no published research on how cooperating teachers' assessment beliefs and practices influence student teachers' assessment philosophy. From the research available on how cooperating teachers do influence student teachers beliefs about teaching and implementing new strategies appropriate to learning, it would seem logical that the assessment beliefs and observed practices of the cooperating teacher will also influence the student teachers' assessment philosophy.

With the publication of the *Standards* documents (1995, 1991, 1989), NCTM has presented a vision of mathematics curriculum, instruction, and assessment different from what many preservice students have experienced prior to the preservice program. Preservice students' beliefs about assessment have been formed through many years of observation and experience as students in a traditional curriculum and are difficult to change. To effectively change preservice students' beliefs about assessment toward the model advocated by NCTM, opportunities are needed during student teaching for student teachers to observe,

experiment with, and implement effective assessment strategies. Research is needed on how these opportunities to observe, experiment with, and implement effective assessment practices influence student teachers' beliefs about assessment.

Efforts to Change Preservice Teachers' Beliefs

Research studies (Dossey, 1992; Steinberg et al, 1985; Thompson, 1984; McGallaird, 1983) have shown that how teachers interpret and implement curricula is influenced significantly by their knowledge and beliefs about mathematics formed from observations and past experiences. Research studies (Ball, 1989; Meyerson, 1978) have also shown that changing preservice teachers long held beliefs about instruction and assessment requires more than one or two specifically designed methods courses. It would seem that benefits could be gained from research on how preservice teachers' beliefs about instruction and assessment change in the transition from being a preservice teacher education student to a practicing teacher.

Studies (Shirk, 1973; Collier, 1972) suggest that without preservice programs designed to elicit change in future teachers' beliefs about an innovation, there will be little movement or change in their beliefs throughout the preservice program. Neither researcher investigated preservice teachers' beliefs about instruction and assessment and the influence of student teaching on these beliefs.

In 1989, Ball designed a methods course to elicit change in preservice teachers' beliefs more towards of a philosophy of learning and teaching mathematics advocated by NCTM. Ball observed that although the prospective teachers stated the methods course shifted their philosophy about teaching towards a philosophy of teaching advocated by the *Standards* documents (NCTM 1989,

1991, 1993) when placed in a teaching environment, they found it easy to fall back on previously experienced learned patterns of teachings.

Meyerson (1978) investigated the effects of a methods course designed specifically to change preservice teachers' beliefs about mathematics. Meyerson observed that students' beliefs had been developed over many years of observing and experiencing mathematics and how it was taught, and concluded one methods course was not sufficient to change these deeply held beliefs.

At this time there is no research on the success of a methods course designed to elicit change in preservice teachers' beliefs about assessment. However, the research on the success of methods courses designed to elicit change in future teachers' beliefs about mathematics would suggest that methods courses are not sufficient in themselves in changing preservice teachers' beliefs about assessment practices.

CHAPTER 2

METHODS AND PROCEDURES

Introduction

This study investigated opportunities provided to two student teachers to observe, experiment with, and implement assessment practices recommended by the NCTM Standards documents. Four general objectives guided this study: (1) to describe cooperating teachers' assessment practices and student teacher's perceptions of his/her cooperating teacher's assessment practices; (2) to determine the cooperating teacher's willingness to allow his/her student teacher to experiment with assessment practices different from what the cooperating teacher was using and his/her student teacher's interest in experimenting with assessment practices different from what his/her cooperating teacher was using; (3) to describe student teacher's assessment practices used during student teaching; and (4) to identify student teachers' beliefs about assessment practices at the beginning of student teaching and at the completion of student teaching.

Pelto and Pelto (1978) suggest the task of the qualitative researcher is to reduce to a minimum the distortions of an uneven mirror by a careful definition of concepts and specification of research operations, so that the powers and vagaries of the human mind work to our advantage (p. 37). The research design required qualitative methods since qualitative research approaches are focused on the interpretive description and explanation of people, places, conversations, and phenomena not easily handled by statistical procedures. This research seeks to

provide readers with understanding of observed behavior from the participants' own frame of reference.

Bogden and Biklen (1992) and Goetz and LeCompte (1984) state several guidelines for qualitative research which indicate the appropriateness of qualitative research for this study. First, they recommend the mathematics classroom as the most direct source of data, where the researcher is the key instrument for collecting data. The data for this study was collected in the classroom where the researcher observed events as they occurred and through audio-taped interviews prior to, during and after student teaching.

Second, the research takes on the form of a descriptive text. The written word is very important in the qualitative approach, both in recording data and disseminating the findings. This study guided the researcher to develop descriptions from all data collected. Forms of data used include interview transcripts, field notes, student teacher journals, and assessment documents.

Third, the research describes a process rather than documenting outcomes or products. This study focused on mathematics classroom events in which preservice teachers observed and modeled assessment practices during their student teaching experience.

Fourth, qualitative data is analyzed inductively, where theory is developed from the bottom up from many interconnected pieces of collected evidence. For this study, patterns in perceptions or beliefs of cooperating teachers and student teachers will be drawn out from the data, rather than starting from an hypothesized pattern and attempting to prove or disprove it.

Fifth, meaning is of essential concern in qualitative research. Qualitative researchers are concerned with participant perspectives to help illuminate the

dynamics that are often invisible to the outsider. This study will investigate student teachers in the process of teaching secondary mathematics while they attempt to make sense out of assessment practices.

Pre-Pilot Study

The conceptual basis for this study originated while assisting with the secondary methods course, Methods in Teaching Senior High Mathematics, at Montana State University-Bozeman during the fall semester, 1993. The course was designed to:

- Model a variety of effective teaching strategies;
- Fully integrate uses of technology into instruction;
- Model appropriate assessment techniques that involve higher-order thinking skills and problem solving;
- Model approaches found to be effective in engaging female and minority students, especially Native Americans, in mathematics and science coursework (STEP Proposal, 1992).

Course requirements included two thirty minute classroom mini-lessons presented by each student. Each presentation was video taped with the first set of presentations occurring midway through the semester and the second set of presentations occurring during the last week of the semester. Students were responsible for the content and methodology of each of their presentations. At the completion of the presentations, students were required to review and self assess their video taped presentations.

Two students in the methods course volunteered to individually participate in an interview with the researcher after reviewing and self assessing their second video taped presentation. Since the use of cooperative learning, technology, and alternative assessment were integrated in the design of the methods course, the interview format encouraged the participants to describe how the delivery and assessment of the mathematics content could have been improved using cooperative learning, technology, and/or alternative assessment.

Reviewing data from the interviews suggested that the participants were planned to use technology, cooperative learning and alternative assessment in their mathematics classrooms. Both participants perceived a lack of experience with alternative assessment in their personal school careers, and stated concerns about the impact that this lack of experience will have on their ability to implement alternative assessment in the future.

To further investigate the student teaching experience as it related to implementing technology, cooperative learning, and/or alternative assessment, two additional preservice students from the secondary mathematics methods course participated in an interview at the completion of student teaching spring semester, 1994.

The interview protocol, located in appendix B, page 92, was designed to allow the four participants to describe their student teaching experience as it related to implementing technology, cooperative learning, and alternative assessment. Interviews were audio recorded, transcribed, and analyzed to determine future direction of this study.

After analyzing data collected from the interviews with the preservice students in the secondary mathematics methods course and from the student

teachers at the completion of their student teaching experience, four areas of interest emerged suggesting further study.

One area for further study involves the opportunities provided for student teachers to observe NCTM recommended assessment practices being modeled by their cooperating teacher. All four pre-pilot student teachers that were interviewed perceived their cooperating teacher's assessment practices as traditional, with assessment being used for the sole purpose of assigning grades. Thus, one of the objectives of this study was to describe the cooperating teacher's assessment practices and his/her student teacher's perceptions of these assessment practices.

A second area for further study is the opportunity provided for student teachers to implement NCTM recommended assessment practices during their student teaching experience. The two participants interviewed prior to student teaching expressed enthusiasm and interest in implementing various assessment methods during their student teaching.

A third area for further study is the student teacher's perception of his/her cooperating teacher's willingness to allow them to implement different assessment techniques. Two of the participants that were interviewed after their student teaching experience perceived their cooperating teachers as reluctant to allow them to implement assessment methods different from assessment methods already in place by the cooperating teacher. This suggested a third objective for this study which was to determine the cooperating teacher's willingness to allow his/her student teacher to experiment with assessment practices different from what the cooperating teacher used and the student teacher's interest in experimenting with assessment practices different from what his/her cooperating teacher used.

A fourth area to emerge for further study is the change in student teachers' assessment beliefs from before to after the student teaching experience. Changing preservice teachers' deeply held beliefs about assessment practices that have been formed over many years of observation and experience is no easy task. This suggested a fourth objective of this study which was to identify student teachers' beliefs about assessment at the beginning of student teaching and at the completion of student teaching.

Pilot Study

One student teacher and his cooperating teacher at a class AA school in Montana participated in a pilot study during fall semester, 1994. The researcher visited the classroom a minimum of once per week during the twelve week student teaching experience. Techniques of qualitative data collection and data analysis described by Bogden and Biklen (1992), Patton (1990), and Goetz and LeCompte (1984) were used. Difficulties encountered with the data collection during the pilot study were noted, and this data was used to make modifications or corrections for the actual study.

At the completion of the pilot study, final preparations for the research study were completed. These preparations, which are described in the next section, included selecting participants and identifying appropriate data collection methods for this study.

Selection of Participants

Three secondary mathematics preservice students at Montana State University-Bozeman were initially selected in November, 1994, for participation in this study which began January, 1995. Prior to student teaching all three students had completed the prerequisites for student teaching, including the course, Methods in Teaching Senior High Mathematics.

Diversity of geographic location of student teaching sites, within the limitation of the researcher's ability to visit each location weekly during this study, was used as the criterion when considering eligible participants for this study. Permission for participation in this study was asked for and granted by all the participants, including the preservice students and their cooperating teachers.

The three student teachers in this study are identified as Donna, Mark, and Paula. Due to difficulties encountered during student teaching, Donna was removed from the mathematics classroom six weeks into the study and subsequently rescinded her permission to be included in this study.

Data Collection Methods

Goetz & LeCompte (1984) recommend multiple methods of data collection to provide the triangulation or cross reference of data desired in qualitative studies to create a diverse source for and reinforcement of researcher observations.

The following methods of data collection were used to triangulate the data for this study: (1) using a participant journal, each student teacher recorded impressions and reflections related to observing, experimenting with, and implementing assessment practices, as well as, reflections on interaction with

his/her cooperating teacher related to assessment; (2) an observer field journal was used by the researcher to record field notes from classroom observations, informal interviews with cooperating teachers and/or student teachers, and researcher's impressions and reflections; (3) classroom observations focused on assessment practices used during this study and also focused on the interaction between student teachers and cooperating teachers as the interaction related to this study; (4) informal interviews were used to question participants on observations of classroom episodes and to clarify researcher misconceptions of entries in the participant journal; (5) three formal interviews, located in Appendix C, page 95, with individual student teachers were conducted during the student teaching experience to elicit information about student teacher's beliefs about assessment practices and their perceptions of the cooperating teacher's assessment practices; (6) one formal interview, located in Appendix C, page 95, was conducted with each cooperating teacher and focused on his/her assessment practices and his/her willingness to allow the student teacher to use NCTM recommended assessment practices; and (7) a document file for each pair of cooperating teachers and student teachers was kept for assessment documents and rubrics used by the participants during this study.

Participant Journal

Bogden and Biklen (1992) recommend journals as a method of collecting first person narratives describing individual's actions, experiences, and beliefs. Journals represent evidence on how social situations appear to actors in them and what meanings various factors have for participants (p. 132). When written under the immediate influence of an experience, journals can be particularly effective for student teachers to capture their thoughts and perceptions.

Initially, student teachers were asked to record, a minimum of twice per week, a description and reflective commentary on the following aspects of their student teaching experience: (1) perceptions of assessment practices modeled by their cooperating teacher, (2) perceptions of their cooperating teacher's encouragement and willingness to allow them to experiment with and use NCTM recommended assessment practices, (3) assessment practices personally used in their student teaching experience, and (4) outside influences (i.e. parents, administrators, and university supervisor) as they relate to assessment practices in the classroom.

During the third week of the study, both student teachers indicated that making journal entries twice a week was difficult considering their busy schedules. It was mutually agreed upon by the researcher and the student teachers that journal entries would be made a minimum of once per week under the conditions stated previously or from guidelines given by the researcher after observing teaching or assessment episodes.

Observer Field Journal

Bogden and Biklen (1992) and Patton (1990) recommend a field journal containing observer's insights, interpretations, and beginning analysis about what is happening in the field. Throughout this study, a field journal was used to contain field notes encompassing: (1) verbal portraits of the participants, (2) impressions and observations from informal interviews with cooperating teachers and/or student teachers, (3) description of the physical characteristics of the mathematics classrooms, (4) descriptions of assessment practices and classroom activities used by cooperating teachers or student teachers, and (5) the researcher's

impressions and reflections. These field notes were used to assist in the reconstruction of events that occurred throughout this study.

To acknowledge and help control observer's effect and influences, Bogden and Biklen (1992) recommend both descriptive and reflective field notes. Descriptive entries documented the researcher's best effort to objectively record detailed observations that occurred in the field. Reflective field notes documented reflections on the researcher's frame of mind and points of clarification related to this study.

Classroom Observations

The initial classroom observation was used to establish rapport, which allowed the cooperating teachers and student teachers to become comfortable with the researcher's presence and to gather general information related to this study. As the study progressed, observations focused on three areas: (1) cooperating teacher's assessment practices used during the student teacher observation period, (2) student teacher's assessment practices used during their teaching episodes, and (3) observed interaction between the student teacher and his/her cooperating teacher as it related to this study.

Informal Interviews

Informal interviews were impromptu and conversational in nature and used to further probe participant's explanations and/or clarify to researcher's misconceptions of participant's written and/or verbal comments related to this study. These informal interviews, or conversations, were less than five minutes in

duration and occurred either prior to the beginning of the lesson or immediately following the end of the classroom observation.

Formal Interviews

Each student teacher participated in three formal interviews. Interview formats and questions, which are located in Appendix C, page 95, were formulated using recommendations by Bogden and Biklen (1992) and Patton (1990), and field tested during fall semester, 1994.

The first interview occurred during the last week of fall semester, 1994, prior to student teaching. The interview format was designed to encourage the student teacher to describe beliefs about NCTM recommended assessment practices.

The second formal interview with each student teacher occurred at the completion of the student teacher's observation period, which lasted approximately three weeks. The format of this interview was designed to encourage the student teacher to describe their perceptions of the cooperating teacher's assessment practices.

The final formal interview with each student teacher occurred at the thirteenth week of student teaching. The interview format was similar to the first interview and was designed to encourage the student teacher to describe their beliefs about NCTM recommended assessment practices, as well as to self assess his/her cooperating teacher's assessment philosophy.

Each cooperating teacher participated in one formal interview held during the second week of January, 1995. The interview format was designed to encourage cooperating teachers to describe their assessment methods and uses, the

use of technology and manipulatives in the assessment process, and their willingness to allow their student teacher to experiment with NCTM recommended assessment practices.

Document File

When available, assessment instruments and rubrics used by the cooperating teachers and/or their student teachers were collected. These instruments were used in conjunction with other data collected in the data analysis.

Data Analysis

The process of constant comparison of data was used during and after the data collection. Goetz and LeCompte (1984) state the discovery of relationships, or hypothesis generation, begins with the analysis of initial observations, undergoes continuous refinement throughout the data collection and analysis process, and continuously feeds back into the process of category coding (p. 182). Patton (1990) recommends the process of constant comparison to include: (1) identifying recurring regularities or patterns in the data which relate to the research purposes; (2) collecting additional data to verify these patterns; (3) establishing priorities to determine which patterns are more important than others; (4) describing and interpreting the different patterns; and (5) testing patterns for completeness.

Initial descriptive patterns for comparison purposes were developed and categorized during the pilot study, fall semester, 1994. These categories were then altered, added, or deleted as a result of the analysis of the observer's field

journal, audio taped interviews, participant journals, and document files collected during this study.

Statement of Researcher Bias

While employed as a research assistant with the STEP project, the researcher assisted with the development and implementation of the course, Methods in Teaching Senior High Mathematics, at Montana State University-Bozeman, fall semester, 1993. After reviewing the literature on the uses of alternative assessment, this researcher became aware of the benefits of alternative assessment.

This researcher made an effort to avoid placing value judgements on statements made by the four participants in this study. Entries in the observer field journal were used as a control. Bias would be evident in statements made in the observer field journal.

Limitations and Delimitations

The following limitations restrict the generalizability of the results of this study:

1. This study was limited to those students who have passed the secondary mathematics methods course, Methods in Teaching Senior High Mathematics, at Montana State University-Bozeman.
2. The length of the student teaching experience, and thus the duration of data collection was twelve weeks.

The following delimitations restrict the generalizability of the results of this study.

1. This study was delimited to two student teachers in a restricted geographical proximity to Montana State University-Bozeman.
2. This study was delimited in that there are other factors that impact student teacher's beliefs beyond the cooperating teacher's assessment practices.

CHAPTER 3

FINDINGS

Introduction

This study investigated opportunities provided for student teachers to observe, experiment with, and implement assessment practices recommended by NCTM. Three student teachers initially participated in this study. One student teacher dropped out of student teaching six weeks into the study and subsequently rescinded her permission to be included in the study. The two remaining student teachers are identified as Paula and Mark, and their respective cooperating teachers are identified as Mary and Don.

This chapter begins with classroom profiles of the cooperating teachers followed by profiles of the student teachers in this study. Next, this chapter will present findings aligned to the four general objectives of this study. Each objective will be addressed by answering the research questions of this study pertinent to the objective. Research questions for this study are located on pages 5-6, and again in Appendix A, page 87.

One objective of this study was to describe cooperating teachers' assessment practices and student teacher's perceptions of their cooperating teacher's assessment practices. This objective will be addressed by the following topics: (1) assessment practices used by the cooperating teachers, (2) high school students' use of calculators, computers, and manipulatives in the cooperating teachers' assessment process, and (3) student teacher's perceptions of their cooperating teacher's assessment practices.

A second objective of this study was to determine the cooperating teachers' willingness to allow their student teacher to experiment with assessment practices different from what the cooperating teacher was using and his/her student teacher's interest in experimenting with assessment practices different from what his/her cooperating teacher was using. This objective will be addressed by the following topics: (1) cooperating teachers' willingness to allow their student teachers to experiment with different assessment practices, and (2) student teachers' perceptions about opportunities to experiment with assessment practices different from their cooperating teacher's assessment practices.

A third objective of this study was to describe student teachers' assessment practices during student teaching. This objective will be addressed by the following topics: (1) assessment practices used by student teachers, and (2) high school students' use of calculators, computers, and manipulatives in the student teachers' assessment processes.

The fourth objective for this study was to identify student teachers' beliefs about assessment. This objective will be addressed by the following topics: (1) student teacher's beliefs about assessment practices prior to student teaching, and (2) student teacher's beliefs about assessment upon the completion of student teaching.

Participant Profiles

Don

Don has spent all 8 years of his teaching career at Brandon High School, a small high school consisting of grades 9-12, with an enrollment of approximately 100 students. The class observed for the study was a third period Algebra II class

with 20 students. The classroom environment included six rows of five desks facing the white board with the teacher's desk off to the side. The desks were for the most part stationary. One Macintosh computer was located on Don's desk for personal use. A classroom set of TI-82 calculators were available to students upon request.

Don has taken an extended studies course, which included ten evenings of participation, involving reform mathematics. Nevertheless, he maintains a traditional environment concerning teaching and assessment practices. A typical Algebra II class period would begin with Don asking students to exchange their homework papers to be graded. Don would then state answers to the homework while students would correct their neighbor's papers. Students were then requested to write the number of incorrect responses at the top of the paper before handing it back to the owner. After questions from the homework had been addressed, students passed the homework forward for Don to collect. Once the papers had been collected, Don would lecture over the new material in the next section of the book leaving approximately ten minutes for students to work together, if they choose to, on the next day's assignment. A typical conversation involved students working together comparing answers:

John: What did you get for number 3?

Jane: Seventeen. What did you get?

John: Same. Let's go to the next problem

During the initial interview, Don discussed his thoughts about assessment and evaluation.

I feel that a teacher assesses students on a daily basis so teachers can have an idea on how kids are grasping the information. This might occur just by observing facial expressions during a lecture or how students are handling

the homework. Evaluation then is where each individual is presenting to you his/her actual knowledge through a test.

Don went on to mention that assessment of students performance in the classroom "is done through testing of homework material." He mentioned an awareness that testing is not the only method by which a "person can assess a student's performance, but I prefer this method because I write my own tests."

Mary

Mary has 12 years teaching experience at Centerville High School, a small four year high school with an enrollment of approximately 200 students. The class observed for this study was a first period Integrated Mathematics class with 9 students. The integrated mathematics curriculum materials used for this class were developed by the SIMMS Project (see Appendix D, page 102), an NSF funded curriculum writing and professional development project. Mary has had extensive education, through summer institutes, for using these curriculum materials.

The classroom environment included four rows of four desks facing the white board with the teacher's desk off to the side. These desks were rearranged into groups of three when cooperative groups were used. The classroom was equipped with 13 Macintosh computers, which were set up along the side walls, for student's use . A classroom set of TI-82 calculators were available to students upon request.

A typical class period would begin with students taking about five minutes to make entries in their journals. The prompt which students referred to when writing was placed on the overhead prior to students entering the classroom. Upon the completion of the journal entries, Mary would discuss with the students the activity or lesson for the class period. Students would break into set groups of

three to either work at their desks or at the computer, depending upon what was involved in the lesson. The class period would end with students returning to their desks and discussing what was needed to be completed for the next day's lesson.

Mary discussed her thoughts about assessment and evaluation in a secondary mathematics classroom.

Classroom assessment means gathering information about individual students in the classroom. The information is used to inform the teacher so that appropriate changes in instructional strategies can be made. It also informs the student and parents of the student's progress, weaknesses, and strengths. Evaluation is assigning a number value, or letter grade to whatever is being assessed.

Mark

Mark was assigned to do his student teaching with Don at Brandon High School. Mark was returning to college following a two year absence in which he was employed by the family business to "pay some bills." Mark graduated from Brandon High School and mentioned that Don was not a teacher there during his high school career. Mark mentioned that he chose Brandon High School to do his student teaching because of the close proximity to the university and because of his familiarity with the school.

Mark completed his secondary mathematics methods course two years prior to his student teaching and mentioned that being away from college for two years caused him to miss out on current "reforms" like "SIMMS and STEP." He discussed how these might affect him in the classroom.

It seems like every two years or so there is something new that comes about. Now those things have to come about for a reason and they must have the backing behind them to prove that this or that works. Now at the same time, there are going to be things that you know work that have been

through years of experience or that you find out have been taught a certain way for a long time. I think you have to decide which is the best way to go.

On at least four occasions, Mark was observed making comments to the class that he never had the opportunity in college to use the content he was covering for the lesson. One such example observed involved the concept of synthetic division. While teaching, Mark mentioned to the students that he couldn't recall using synthetic division in college. Mark was asked by the researcher after the lesson to discuss whether he thought students need to learn how to do synthetic division. Mark stated students should be introduced to the concept. "It is not for me to decide if they will need it in the future. I understand that my job as a teacher is to teach."

Mark described his definition of assessment as "a gathering of information to make a decision about a student's grade." He was very adamant about homework, quizzes, and tests as appropriate assessment methods in a high school mathematics class. In the interview prior to student teaching, Mark stated he had little experience in previous mathematics courses using various methods of alternative assessment

During the interview prior to student teaching, Mark discussed his reluctance to use, what he phrased, "newer" assessment methods such as portfolios and/or journals. He felt that "if a student is set on being graded a certain way and these journals or portfolios don't happen to fit with, let's say, their personality, there could be a conflict in how the grade is calculated."

Paula

Paula was of traditional college school age and was assigned to do her student teaching with Mary at Centerville High School. Paula and Mark were in

different secondary mathematics methods courses. During the interview prior to student teaching, Paula indicated she had read the NCTM Curriculum and Evaluation Standards as well as the NCTM Professional Teaching Standards as assignments in her secondary mathematics methods course.

Paula mentioned an awareness of the SIMMS and STEP projects indicating a desire to student teach in a school that was using SIMMS materials because "they make connections in mathematics with other subjects." She also mentioned learning about the projects in her secondary and middle school mathematics methods courses. Paula stated she was very interested in working with the SIMMS materials to "help me get a job."

During the initial interview prior to student teaching, Paula described her definition of assessment as "collecting data to make judgments on a student's improvement over time." She felt that "homework, quizzes, tests, journals, and portfolios" are all appropriate and it is important that all methods of assessment "should be interrelated" and teachers should not "stick to just one of them."

Paula stated how excited she was to student teach and try "all types of assessment". She discussed in the interview prior to student teaching about getting ideas on various alternative assessments from sessions at a regional National Council of Teachers of Mathematics conference. She indicated little experience in her previous mathematics courses using various methods of alternative assessment.

Cooperating Teacher's Assessment Practices and
Student Teacher's Perceptions of these Assessment Practices

Assessment Practices used by the Cooperating Teacher

Both cooperating teachers employed the use of traditional methods of assessment including observations, homework, quizzes, and tests. In addition, Mary's district policy required her students to keep notebooks and Don's district policy required him to give quarter tests for students who were absent five days during the quarter. While Don used these traditional methods exclusively, Mary also incorporated journals, portfolios, group work, and student self assessment.

On a typical Monday, Don would write the assignment for each day of the upcoming week on the side board. The homework assignments were from problems out of the textbook that covered the material from the particular day's anticipated lecture. Don collected and recorded submission of homework assignments in order to "communicate daily to students that I value homework." On occasion Don would browse over the student graded homework looking for ways in which students "showed work that justifies the answer." Typically, students were given opportunities to ask questions about the homework prior to handing it in, rather than when Don passed them back the following day. Don was not observed during the study "redoing" problems from homework after returning the homework the following day.

Students in Don's class were provided opportunities for extra credit by "following rules and regulations which I feel are very important when they experience the job world." Some of the "rules and regulations" included student behavior, student effort in completing homework, tardiness, and absenteeism.

Mary assigned homework during the modules and the homework typically was to complete the activity "worked on" during class. Depending on whether the homework involved group work, Mary would collect the papers, grade them in the evening, and return them the next day. She wrote comments on the papers explaining errors that were made.

Mary and Don both used observations to adjust their instruction when students were observed having difficulty answering questions during the lecture or from the homework/activity. In Don's classroom, students had opportunities to ask or answer questions prior to handing in the homework, while he was lecturing, or during the time allotted to work on the next day's assignment. Typically, students in Mary's classroom had opportunities to ask questions during the discussion time at the beginning or the end of the class period, or while Mary was walking around and observing them working on the activity.

Mary and Don both mentioned giving weekly quizzes earlier in the quarter. During the study, neither cooperating teacher was observed giving a quiz. Both mentioned they felt time constraints with the end of the semester approaching and therefore, did not give any quizzes. Don stated his quizzes "typically" covered material contained in the homework assignments given the previous week while Mary stated her quizzes covered specific "technology procedures."

Mary and Don each had to employ an assessment method to satisfy their respective district requirements. In Don's school district, quarter examinations were required of students who had four unexcused absences during the quarter or who had a failing grade for the quarter. For all other students, the quarter examination was optional. For the students who took the quarter examination,

Don counted the examination as an extra chapter test and the score was averaged in with the chapter test scores taken during the quarter.

In addition to the quarter examination given during the study, Don was observed giving one chapter test. The test was comprised of content and format similar to problems assigned during the chapter. Don mentioned that when making up tests, "I use previous year's tests and publisher-made tests to guide which types of problems I write."

In Mary's district, students were required by the district to keep daily notebooks containing homework assignments. Teachers were required by the district to collect the notebooks once a quarter. For the SIMMS class, Mary substituted the use of portfolios to "assess growth over time" in place of the notebooks and collected them at the end of each quarter. At the completion of each module, students chose their best pieces of work during the module to be included in the portfolio. Also included in the portfolios were student write ups discussing why they chose each piece and the criteria they used to choose them.

During the first five minutes of each class period students wrote in their journals from a prompt Mary provided. She mentioned using journals as a "way of communicating my thoughts to the students" and for students to "(1) communicate in writing how they perceive things that are going on in the class, (2) reflect on what they have learned by expressing new concepts or ideas in their own words, and (3) express their opinions and attitudes about the class which they might not do otherwise."

Group interaction scores and individual participation scores were also used by Mary to evaluate students on their group work. She would determine their scores by observing the individual groups while using scoring rubrics from the

SIMMS Assessment Handbook (1995). Mary stated that group interaction scores were used "to communicate to the students that I value team work and have certain expectations for group work" and individual participation scores assess individuals on their class participation and to "try to make students understand that I expect more from them than just being in class."

Students were also requested to self assess their group interaction scores and to explain the scores they would give themselves. In addition to the group work, students also were required to assess their portfolios and journals. They were required to comment on personal growth described in their portfolios and personal strengths and weaknesses described in their journals.

Students' use of Calculators, Computers, and Manipulatives in the Assessment Process

Both cooperating teachers had classroom sets of TI-82 graphing calculators readily available and encouraged students to use them whenever necessary. The TI-82's were observed in both classrooms being used during lectures, class discussion, homework, quizzes, and tests.

Although the content to where the calculators were used varied, Mary's and Don's approaches to using them in the classroom was consistent on a daily basis. Mary would discuss the concept, make conjectures, and then have students test the conjectures with the use of the calculator. One example involved discussing the probability of finding defects in a lot containing a number of products. Students made conjectures on the nature of the probabilities involved, and then tested the conjectures using a program on the calculator.

In addition to the calculators, Mary's classroom contained thirteen Macintosh computers located along the walls. During the study, students were

observed using a spreadsheet program to aid in solving problems and a word processing program to write up numerous assignments. Mary mentioned that it was typical for students to use computers a minimum of once a week.

For Don's students, the typical use of the TI-82 calculators on either homework, quizzes, or tests was limited to the basic four operation computations. Although it was not observed during the study, Don mentioned that he restricts the use of calculators on tests when, "I want students to show me they know how to use an algorithm." Don had one Macintosh computer on his desk and it was for personal use. Don commented, "Most things I need a computer for, I can do with a calculator."

During the study, manipulatives were not observed in either classroom. Don mentioned "the only manipulatives I use are compasses and protractors for the Geometry class." Mary indicated she had used several manipulatives earlier in the year and specifically mentioned manipulatives related to the calculators such as the Calculator Based Learning (CBL) unit, which is an electronic sensing device that attaches to the TI-82 calculator and was developed by Texas Instruments.

Student Teachers' Perceptions of their Cooperating Teacher's Assessment Practices

After observing Don's assessment practices for three weeks, Mark described Don's assessment practices as "concrete, with homework, quizzes, and tests." Mark reported, "Don collected homework and gave quizzes and tests for grading purposes similar to my high school classes. It has been done that way for 100 years, so it must be OK." Mark also described how Don's extra credit was an attempt to influence behavior.

Actually, there is a check system in there also. If you don't have the homework done or are misbehaving, you get a check. Every check is worth an absence, and an absence at the end of the quarter is worth one percent of extra credit, so there is some sort of assessment if you have missed, or misbehaved, where these checks are added up, and affect the overall grade.

Paula discussed her cooperating teacher's assessment practices as "giving students multiple chances to show what they can really do." Paula elaborated,

If they can't test well, she gives them other ways to see if they are still getting the material without failing the class. There is a wide variety such as, they can write it in their journals and say, hey, I do know how to do this, but the test scares me. There is just a lot of variety in each kid, and I think her different types of assessment really help to see what students are like.

Paula commented on the purposes behind the assessment methods Mary used.

Journals allowed for communication between Mary and her students. Quizzes and tests, which accounted for fifty percent of the grade, told her how well students connected the material overall. Homework on the daily lesson allowed her to see if students understood the material. Portfolios were used for students to monitor their progress through the year. Finally, participation (individual-group participation) points were used to encourage participation.

Paula also mentioned how Mary used observations as an assessment tool in her classroom.

Sometimes she would give an example problem that the lesson would be applied to, and ask the students to work through the problem. This allowed her to walk around the room and see how well students understood the material before assigning homework. She then could make a decision whether further instruction was needed.

Cooperating Teacher's Willingness to Allow his/her
Student Teacher to Experiment with Assessment Practices
Different from what the Cooperating Teacher was Using
and the Student Teacher's Interest in Experimenting
with Assessment Practices Different from what
his/her Cooperating Teacher was Using

Cooperating Teacher's Willingness Towards Allowing his/her Student Teacher to Experiment with Assessment Practices Different From What the Cooperating Teacher is Using

Prior to the arrival of their student teachers, Mary and Don indicated a reluctance to allow their student teachers to experiment with assessment practices different from what they used. Mary planned to encourage her student teacher to continue using assessment practices in place "because it is hard on students to have someone come in the middle of the year and change everything." Of the assessment methods Mary was using, she felt portfolios would be the most difficult for student teachers because "portfolios need to be kept for a long period of time."

Don stated what he expected of his student teacher as far as implementing a different type of assessment.

I feel the student teacher should follow fairly close to his cooperating teacher's assessment plan for the quarter. Seventy-five percent of the assessment should follow the supervising teacher's plan. If a student teacher wants to implement one new type, then it could be beneficial for both individuals. I guess I feel this way because students are basically with the student teacher a shorter time frame and it would cause less disruption in what they are used to.

Mary and Don both suggested that student teachers should be familiar with as many methods of assessment as possible. Don stated that "I feel our job as cooperating teachers is to give the student teacher all our knowledge about how we

assess students" and suggested student teachers should be "exposed to various types of assessment." After having Mark in the classroom for two weeks, Don was willing to let Mark use a different assessment if he wished for "up to 10 percent of the grade."

Mary mentioned that "before they begin to teach during their student teaching, student teachers should be required to contact several teachers and interview them to find out what they are doing, how they are assessing and how they are assigning grades." After observing Paula teach for a couple of weeks, Mary stated she would be willing to let Paula try a different method of assessment. "I would try to encourage her to try things in my room as long as I felt the students and parents were informed." Mary stated more that once that "I am aware that my way is not necessarily the best and am open to learning from my student teacher."

Student Teacher's Perceptions about Opportunities to Experiment with Assessment Practices Different from his/her Cooperating Teacher

Prior to student teaching, Paula and Mark stated concerns about implementing assessment techniques different from what their cooperating teachers were using. Paula mentioned "horror" stories from returning student teachers who didn't have the support of their cooperating teacher. Cooperating teachers would say "...do it my way" and "you would have to follow their instructions because they are the ones grading you."

Mark talked about his concerns:

If I were to walk in during the middle of the semester and say I wanted to start it, I don't believe that would be right. That's not fair for the students or the cooperating teacher to disrupt the daily routine that was going on at the time. Now a place where it might work out would be if you were taking over at the beginning or end of a semester, where there would be a transition period.

Prior to student teaching, Paula and Mark indicated they were both interested in experimenting with a different type of assessment during their student teaching. Paula mentioned she "would like to try to get some experience with journals because I have a lot of ideas, and unless you implement and try them, it is hard to say if they work." Paula was unsure whether her cooperating teacher would be using journals to the extent that Paula was interested.

When asked how she would approach Mary, Paula replied, "I would share my ideas and say this is what I would like to do and maybe instead of homework tonight, could I give them a writing assignment?" Paula indicated she would be interested in experimenting a couple of times "to see what I get back."

She hoped her cooperating teacher would give her a lot of support and "help me if I need help." When Paula wanted to try a new assessment technique, she hoped her cooperating teacher would say "this is how I have done it in the past or how I would do it now and this is why."

I hope she really encourages it because it is a learning process for me. The more I get to see, the more I will have a better idea of what I want to use. With her experience, she can tell me if it is going to work at all, even if it is worth trying."

Prior to meeting his cooperating teacher, Mark anticipated his cooperating teacher would be using the traditional assessment methods consisting of homework, quizzes, and tests. He stated a reluctance to "rock the boat" and indicated a concern about outside influences when attempting to implement assessment methods different from the methods already being used by the cooperating teacher. Mark mentioned, "I will probably use homework, quizzes, and tests. And if I can convince them, I will try to get five percent in there for portfolios and/or notebooks."

When asked, "by them, who do you mean?" He replied, "Them being the teacher, and/or principal. Certain schools have certain policies dealing with how a student is going to be graded."

Mark stated he lacked the confidence to implement a different method of assessment. He thought it might create havoc, and thus fail, if the assessment went on more than a couple of days.

I could do that for a day or two, but to do that for a week and a half to two weeks during the quarter, I didn't want the teacher to feel that the two weeks had been a flop and a waste on some students. I didn't feel at this time, since I will be stepping aside now and letting the cooperating teacher come back that I should.

He felt that several factors go into deciding whether to approach his cooperating teacher about implementing a different type of assessment.

First of all, it is probably going to depend on exactly what the assessment is. They are probably going to be curious about exactly how the assessment is going to be graded for the computer. I would probably have to unfortunately, look at how long the teacher had been around, and that's going to be something of a personality thing. If the teacher has been around for a long time they can get set in their ways and not want to bring any of this other stuff in. And yet, a younger teacher might still want to experiment.

Mark did not implement the use of journals that he talked about prior to student teaching. When asked why, he replied,

I could not get the cooperating teacher to say, but I didn't ask him, "Can I do an assessment that is different from what your standard is?" No, if I had more freedom, I might be willing to try that on a unit or something.

When asked why he did not ask his cooperating teacher, Mark replied,

Students have a schedule they are accustomed to. I didn't stimulate them enough as I probably should have, by breaking the balance of what they are

accustomed to. So I kept the classroom smooth-flowing. I felt there was a certain balance that I didn't want to cross. I wanted to keep things flowing smoothly.

Assessment Practices used by the Student Teacher

Paula and Mark continued to use assessment practices similar to their cooperating teachers. Mark's assessment practices were dominated by homework, quizzes, tests, and a classroom notebook. Although at the time he was unsure as to the extent or format, prior to student teaching, he indicated an interest in implementing journals and/or notebooks.

Mark did not use journals during his student teaching. However, he did initiate the use of a classroom notebook. Each day, at the beginning of the period, Mark would ask the class who was responsible for the class notebook for that day. The student who responded was handed the class notebook and took notes for the period.

As to the reason for implementing this notebook, Mark replied,

My cooperating teacher and I got talking about a class notebook for people who are absent. To save the teacher time, it would be nice to have a notebook that students could refer to the lectures for that day. Somewhat of an incentive for the students. The student who took notes for the class notebook received ten bonus points.

When asked if he considered changing the way homework was graded, Mark replied, "It has been done this way for over one hundred years, so it must be an 'OK' method to use." Mark stated the purpose of homework was to "make sure they know how to do the stuff on the day's lesson."

Unless there was a school activity, every Friday was quiz day, with the quiz questions conceptually similar to the problems covered in the homework. Mark

gave quizzes on Friday "so people would keep up to date on their homework." Another purpose of the quizzes was to "see how the students are progressing and to give them a preview of the test." Mark graded the quizzes over the weekend and returned them the following school day. He would take about five minutes of the next class period to go over the quiz before introducing the day's lesson.

For the first exam, Don exclusively wrote the exam over the material Mark had been teaching. As a template for the exam, Don used test items from the previous year's test and items provided by the book publisher. After the first exam, Mark was responsible for writing his own exams. When asked how he intended to write his exams, Mark replied, "When making up the exam I will try to get a sample representation of each section. When finished writing my exam I will compare it with that of my supervising teacher's exam from the previous year. Because of Don's experience, he knows what problems should be assessed or thrown out."

Mark stated that a test should be a culmination of the material covered in the homework and emphasized on the quizzes. As such, his unit tests were aligned with the content covered during the unit.

During the Algebra II class, Mark followed his cooperating teacher's assessment methods of homework, quizzes, and tests. However, he did mention using an alternate form of assessment in a teaching episode in the Pre-Algebra class. He indicated the assessment was motivated from an activity in the textbook. Students were divided in two different groups. The activity involved each group taking a map of the world, finding questions within the chapter, and assigning them to various continents. The groups then swapped their maps and attempted to go from one end of the map to the other end by answering the questions about each

continent along the way. Mark reported students worked diligently to find questions that would stump the other group, thereby denying them the opportunity to go directly across the continent.

Mark judged the activity as a failure because his expectations were different than what actually happened. Asking him what he meant, he replied,

I ended up working with about fifty percent of the class. The other fifty percent of the class didn't do any of the work. It was a group project, so if a group wanted to let one person sit back, it was up to them. And I thought that they wouldn't do that as much, but it still happened. I think next time I will let the group members assess each other."

Paula also used homework, participation, quizzes, and tests as other assessment methods. Describing the participation grade, she said, "We had a system where they got 2 points a day for the whole quarter if they completed their homework and worked cooperatively in their groups." Homework was used as an "everyday assessment" and quizzes were used to collect data on whether students were making connections between different concepts. Tests were given at the completion of each module and were written by the SIMMS project.

Paula had students make journal entries a minimum of three times per week. Entries were limited to three to five sentences and were in a response to a prompt provided by Paula. She was interested in shorter entries than Mary had expected of the students because "then I have the time to read them more often."

Journals helped Paula "know where students were at, how fast to go, how slow to go, and what to go over again." In response to a particular prompt, students wrote about how confused they were with factoring polynomials. After reading the journal entries that evening and noting their confusion, Paula had the

students graph the polynomial on their calculators and showed students "how factoring can give them the roots."

Paula also instituted the use of journals in the Algebra I class she was teaching under the supervision of a different cooperating teacher. According to Paula, the cooperating teacher "didn't say much" when Paula implemented the use of the journal. She decided to implement a journal because "the class is very frustrated and it gives them a chance to ask me questions without being embarrassed and to tell me if something is bothering them."

Paula continued with portfolios in the integrated mathematics class exactly the way Mary used them. At the completion of each module, students would choose their best pieces to be included in the portfolio. Also included were the students' write-up discussing why they chose this piece and what criteria they used.

Students' use of Calculators, Computers, and Manipulatives in the Assessment Process

Prior to student teaching, Mark and Paula looked forward to using computers and calculators in the classroom. They both discussed how students need to know the 'basics' before they use the calculator. Mark commented on how to incorporate technology into the assessment process.

A person should still know how to do the basics before they use the calculator or computer to do the math. But at the same time, I can believe if you are going to teach them and you are going to allow them to use technology while teaching them, you almost have to let them use the calculator when it comes time for the assessment. I would assess them close to the same way you would otherwise. I mean, say you hand them out a sheet of paper with so many directions to follow. You are going to let them go, and the directions are there and then they follow each step through them. Give them whatever it might be, 4 or 5 days to work through that, either before school or after school. Then you come back with a short quiz,

either in class or back on the computer, to see if they spent the time on the computer or if they just have a printout of something they did on the computer.

Paula commented, "I don't have a problem with students using calculators and computers everyday as long as they know the basics." She stated the most difficult aspect about using technology is "to get students familiar with all that the technology can do."

Paula and Mark used TI-82 calculators in the classroom on a daily basis. In Mark's classroom, students were observed using the calculators exclusively as a computational aid for the four basic operations. Paula was observed having students use the calculator to fit equations to data, solve equations, and collect data from the CBL unit. Paula mentioned another way in which they were used, "...in the modules, students found an equation from the data and then evaluated it at a different point."

Both student teachers allowed students to use calculators in the assessment process in ways similar to how they were used in the daily work. Paula used a variety of activities where it was necessary for students to utilize calculators or computers. For example, a lesson involved using the Calculator Based Learning (CBL) device, a data collection device which attaches to the TI-82, to graph the motion of an object. For the assessment component, students were given an arbitrary graph indicating the motion of an object and were required to move an object using the CBL unit to monitor the motion of that object in order to "fit" the predetermined graph.

Neither student teacher used manipulatives, other than technology, during the study. Mark stated he was unprepared and uncomfortable to work with Algebra II manipulatives in the classroom. "Although they may be appropriate, as

a student teacher or beginning teacher, I would probably steer away from those unless I were to introduce one a week until I became familiar and comfortable with them." When asked on how he would use manipulatives in the assessment process, Mark replied, "Unless they could relay through English, on a piece of paper how the manipulatives and the formulas are related, I think that it is appropriate that they not use the manipulatives."

Student Teachers' Beliefs about Assessment

Student Teacher's Beliefs about Assessment Practices Prior to Student Teaching

During the initial interview prior to student teaching, Paula described her definition of assessment as "collecting data to make judgments on a student's improvement over time." She felt that "homework, quizzes, tests, journals, and portfolios" are all appropriate and it is important that all methods of assessment "should be interrelated" and teachers should not "stick to just one of them."

Paula described her experiences with assessment in high school and college mathematics classes as "pretty much homework, tests, and quizzes." She talked about how the information was used.

Homework was used to make sure students know how to do the stuff on the day's lesson. Quizzes were more of a weekly thing to see how students are progressing. So you know where they are at and to give them a preview of the test. The test was used to see how they mastered the material in the chapter.

Paula indicated her experiences with other types of assessment such as journals and/or portfolios were "minimal". She gained an interest in using journals in a mathematics classroom from a session at a regional conference of the National

Council of Teachers of Mathematics. She stated journals are used on a "more of a one to one basis, where the kids tell you what they think and if they think things are fair." When asked for an example of a journal prompt, she replied, "This is what we learned today and this is how I could apply it, how I understand it, or how I am totally lost." Another way to use the journal would be to have students after the completion of a test "go home and write down what they know how to do and show me they know how to do it."

Paula explained that she knew the least about portfolios and their purposes and expected to learn about and experiment with them during student teaching. She anticipated having difficulties with parents and students when using journals and/or portfolios because "when people think of math they think of numbers and not writing."

Parents will come in and say, you are making my child do extra writing. I would try to relate to the parents that their child will be communicating in the real world, not just working with numbers.

Students don't like to write and haven't had to before. I am going to approach them with, whether you are writing numbers or writing words, you are going to be graded.

Mark defined assessment as "a gathering of information to make a decision about a student's grade." He was very adamant about homework, quizzes, and tests as appropriate assessment methods in a high school mathematics class.

Homework, yeah. Obviously you have assignments due. It might be a problem a day or it might be a list of homework assignments they are supposed to do. Homework directly affects how the student is going to be doing on the tests. Quizzes are a direct relation back to what the assignments covered. They can be used for self-evaluation or areas that need to be looked at. Finally, a test incorporates everything you have done.

They are necessary for the teacher to make a decision on what the student knows.

Mark stated that his beliefs originated from past experiences in high school and college mathematics classes. Recalling previous experiences dominated by homework, quizzes, and tests, he remarked on how these past experiences helped to develop his definition of assessment, "...when you get in a math environment, it relates you back to other math environments, and what took place there."

Mark discussed his reluctance for using, what he phrased, "newer" assessment methods such as portfolios and/or journals. He felt that "if a student is set on being graded a certain way and these journals or portfolios don't happen to fit with, let's say, their personality, there could be a conflict in how the grade is calculated." He also discussed concern with parents interpreting these "new" methods of assessment.

Parents are used to old customs of A, B, C, etc. and can relate to what they mean. And so when you say assessment, even though I think portfolios are great, I can see sticking with grades, math quizzes, homework, etc. that a parent can read and interpret how their child is doing in class.

Student Teacher's Beliefs about Assessment upon the Completion of Student Teaching

Paula indicated an interest in continuing to use the methods of assessment implemented during student teaching in her first couple of years of teaching.

I suppose I will incorporate all of these: tests, quizzes, homework, and journals. Another assessment I would use are student notebooks. If they are organized that way, it shows that they can find stuff easier, and it helps them in the long run.

Paula stated her favorite method of assessment "would have to be journals, because I could really tell if students understood" and they are an excellent "way to communicate to students one to one without them being embarrassed."

I don't think I will use journals as much as Mary did. She did them every day. I don't think I will have time. I feel journals are only effective if you give them input right back, and I would only be able to get them back in a week or two weeks, and to me they don't fit the purpose if you do that.

Although Paula mentioned "I will have some way of grading participation", she discussed how it would be different from Mary's format "Because now here at the end the kids that haven't lost any points get a hundred point test grade, and it's going to affect their grade, but it isn't going to show what they learned, it's going to show that they were there."

In concluding her exit interview, Paula discussed what she thought were appropriate assessment purposes in a high school mathematics class.

I feel that two different things are being assessed. Tests, quizzes, and homework are the more traditional which assess an overall concept. The journals are more day-to-day, you know, this is what I learned yesterday, not this is what I learned a week ago.

At the conclusion of student teaching, Mark stated the purpose of assessment is dependent on whether the mathematics course is a "college track" course. In these courses, the purpose that drives the assessment practices is to prepare students for the type of assessment that occurs in college mathematics courses.

Teachers now are concerned with preparing the students that are going to be moving on to college. Now colleges lecture and you have two semester tests from what I remember. Mid semester, and end of semester tests, and that is where you have to be able to retain from the beginning of the semester to the end of the semester. If they can somehow incorporate a

different teaching style up in the college, then that is going to flow directly down to how the teachers are preparing them (the students) for college.

For non "college track" mathematics courses, the purpose of "assessment" is to provide data to make a judgment whether students have learned skills that will help them later in life.

I kind of look at it from a parent's point of view. If their child is going to learn something that is going to benefit them down the road, like, can they balance a checkbook when they get out of school, or can they do the basic math that they might need. That's what I view as appropriate material for assessment.

Mark indicated he is more interested in whether students learn the material rather than how they learned it. Although the purposes for assessment are different depending on the type of mathematics course, the methods used to get this information are similar.

I know things are in the process of developing, like portfolios, and I know that it is just a matter of time, but there will always be a significant emphasis on tests and quizzes and things that are concrete that people can deal with, instead of the abstract of student behaviors. I think what is appropriate for all math classes should be at least eighty percent tests, quizzes and homework, just because it's been there for hundreds of years, it must be the best way.

CHAPTER 4

IMPLICATIONS, DISCUSSION, AND RECOMMENDATIONS

Introduction

With the publication of the *Assessment Standards for School Mathematics* (1995), the *Professional Standards for Teaching Mathematics* (1991) and the *Curriculum and Evaluation Standards for School Mathematics* (1989), the National Council of Teachers of Mathematics has called for changes in secondary mathematics assessment, instruction, and curriculum. According to the *Standards* documents published by NCTM, computational algorithms, manipulations of symbols, and memorization of rules must no longer dominate school mathematics, rather mathematics reasoning, problem solving, communication and connections must be emphasized. Schoen (1990) and Goodlad (1990) suggest these changes place new demands on instruction and encourage teachers to re-evaluate and align the methods and manners by which students are assessed.

Goodlad (1990) and Crawford (1990) suggest that merely calling for change at the classroom level often fails to impact teachers' beliefs and practices. Ball (1989) found that future teachers' beliefs about mathematics instruction and assessment, formed over many years of observation and participation as students, are deeply held and difficult to change. To reach the vision of mathematics teaching and assessment as stated in the *Standards* documents, the National Council of Teachers of Mathematics and others recommend that preservice students be provided experiences during their student teaching which include

observing, experimenting with, and implementing assessment practices recommended by NCTM .

This research investigated student teachers' experiences and perceptions related to observing, experimenting with, and implementing assessment practices recommended by NCTM. Qualitative research methods were used to accomplish the four general objectives of the study:

- (1) to describe cooperating teacher's assessment practices and student teacher's perceptions of his/her cooperating teacher's assessment practices;
- (2) to determine cooperating teacher's willingness to allow his/her student teacher to experiment with assessment practices different from what the cooperating teacher was using and the student teacher's interest in experimenting with assessment practices different from what his/her cooperating teacher was using;
- (3) to describe student teachers' assessment practices used during student teaching;
- (4) to identify student teachers' beliefs about assessment at the beginning of student teaching and at the completion of student teaching.

This chapter conceptualizes how information obtained from this research which addresses these stated objectives might be used to provide appropriate experiences for preservice students to observe, model, and experiment with assessment practices that are aligned with the vision of NCTM and other reform agents.

This chapter is organized as follows. First implications and discussion are presented which address three topics: (1) student teachers' observations of their cooperating teacher's assessment practices, (2) opportunities for student teachers to

experiment with and implement assessment practices recommended by NTCM, and (3) student teachers beliefs about assessment practices. Next, recommendations are made regarding: (1) cooperating teachers, (2) mathematics preservice education, and (3) student teaching experience. This chapter concludes with recommendations regarding suggested areas for additional research.

Implications and Discussion

Student Teachers' Observations

Research studies (Joyner, 1991; Bush et al, 1990; Campbell and Wheatley, 1983) have shown that within the student teaching experience, cooperating teachers' performance has a major impact on how student teachers teach. This suggests that student teachers' observations of their cooperating teacher's assessment practices influence how student teachers begin to conceptualize and practice assessment strategies used during student teaching.

One objective of this study was to describe cooperating teachers' assessment practices and student teacher's perceptions of their cooperating teacher's assessment practices. Prior to assuming classroom responsibilities, student teacher Mark, observed Don's Algebra II classroom for two weeks, while student teacher Paula, observed Mary's Integrated Mathematics classroom for three weeks. During these observation periods, both student teachers took class attendance and began to memorize names of students, and prepare lessons in preparation for taking control of classroom activities.

A typical day in Don's Algebra II class would begin with him reciting answers from the homework while students graded their work. A question and

answer session on the homework would follow for five to ten minutes. Don would then lecture over the new material, leaving ten minutes at the end of the period for students to work on their assignments. Besides grading and collecting homework, other traditional assessment practices used included observations, homework, and tests. Don mentioned his preferred method of assessing students' performance in the classroom is by "testing of the homework material" because "I am comfortable using tests and I can tell from them whether students are learning."

After two weeks of observing Don in the classroom, Mark described his cooperating teacher's assessment practices as "concrete, with homework, quizzes, and tests." Mark mentioned a similarity between Don's assessment practices and the assessment practices he experienced during his high school mathematics career. When asked why there might be a similarity, he replied, "It has been done that way for 100 years, so it must be OK."

Mary's assessment practices observed during the study were less traditional in nature, and included observations, homework, tests, journals, portfolios, group work, and student self-assessment. A typical day began with students taking five minutes to make journal entries from a prompt Mary provided. Next, Mary would use approximately ten minutes, if necessary, to discuss with her students the day's lesson and any homework assignment. After the discussion, students would break into groups of three to either work at their desks or at the computer. While students worked, Mary walked around observing and helping them when necessary. The hour ended with Mary discussing any problems the class encountered during the lesson and what the students needed to complete in preparation for the next day's lesson.

After observing Mary for three weeks, Paula discussed her cooperating teacher's assessment practices as "giving students multiple chances to show what they can really do." She mentioned the assessment methods Mary used allowed for "communication between her and the students", "how well students connected to the material", "students to monitor their progress", and to "encourage participation."

Upon completion of their respective observation periods, both student teachers reiterated their preferences prior to student teaching about appropriate assessment practices for a typical high school mathematics course. It also happens that their respective cooperating teachers were already using similar assessment practices. The data appears to support the match between student teacher's stated preferences for assessment practices before they began student teaching and the assessment practices observed from their cooperating teacher helped to reinforce these two student teachers' beliefs about assessment practices.

*Opportunities during Student Teaching to Experiment With
and Practice Effective Assessment Practices*

The National Council of Teachers of Mathematics (1991) and the National Research Council (1989) recommend preservice students have opportunities during their student teaching to observe, experiment with, and implement effective assessment practices advocated by NCTM. One objective of this study was to describe student teachers' opportunities to experiment with and implement assessment practices recommended by NCTM.

Both cooperating teachers in this study were cautious in allowing their student teachers to experiment with assessment practices different from what they were currently using. Although their respective assessment practices differed in a

number of ways, both Mary and Don were concerned about how students might react to a different assessment practice. Both cooperating teachers discussed how students are with the student teachers for a shorter time period and there would be less disruptions if student teachers used the assessment practices the students are used to doing.

Both cooperating teachers were apprehensive about allowing student teachers to experiment with different assessment practices. However, they indicated a willingness to learn about assessment practices from their student teachers. Don mentioned that letting his student teacher implement a different assessment technique "could be beneficial for both the cooperating and the student teacher." Mary added, "I am always looking for different ways to assess, because my way is not always the best." The data shows that the two cooperating teachers in this study were open to learning about assessment practices from their student teachers and were willing to have student teachers make minor shifts in their present assessment practices.

The concern about how students would react to a different assessment method was also shared by the student teachers. Mark and Paula stated their concerns about implementing assessment practices different from what their cooperating teachers were using. Paula and Mark mentioned the potential difficulty for students to cope with an assessment procedure change in the middle of the year. They also indicated an interest in not "rocking" the boat.

Although both student teachers stated an interest in following the classroom norm, they did indicate an interest, prior to student teaching, in implementing various methods of assessment. During this study, each student teacher implemented assessment practices similar to their stated preferences prior to

student teaching. It also happens that Mark implemented an assessment practice different from what Don used, while Paula changed an assessment practice Mary used.

Mark indicated an interest in using a classroom notebook during student teaching, in addition to using homework, quizzes, and tests. He mentioned the idea for the notebook originated from one of his college mathematics courses where the professor kept his notes on file for those who were interested in using them.

Mark did implement the use of a classroom notebook during student teaching. Mark, after discussing the idea with Don, used the notebook "to save teachers time" by having a resource "that student can refer to" after being absent. Students took turns each day taking notes on the lecture in a designated classroom notebook. The notebook was made available for students to copy the notes they missed when absent from class. The student taking the notes for the class received ten extra credit points. When interviewed after the student teaching experience was completed, both Don and Mark indicated they plan to use the notebook in the same way next year.

During the interview prior to student teaching, Paula indicated learning about using journals as a "way for students to tell the teacher what they think" and whether "they think things are fair." Paula mentioned being introduced to the concept of using journals and portfolios during her secondary mathematics methods course and she also received additional information on their uses in the classroom by attending a session at a regional NCTM conference.

Mary used journals in her classroom prior to the arrival of Paula. Each day, students would make entries in their journals from prompts Mary would provide.

Everyday Mary would read the students' entries. Paula changed this method slightly by having students make entries every other day "so I have time to read them more often." Paula, under the supervision of a different cooperating teacher who used more traditional methods of assessment, also implemented the use of journals in her Algebra I class during the final four weeks of her student teaching. She indicated students in the Algebra I class were having difficulty with the material and were not asking questions, and therefore she used journals for "students to open up and tell me what they did or did not know about the lesson."

Although both student teachers indicated an interest in not "rocking the boat", shifts from the cooperating teachers' assessment practices showed these two student teachers would slightly modify or experiment with alternatives to the classroom norm.

Both student teachers modeled their respective cooperating teacher's daily classroom routines, as well as their assessment practices. Mark appeared very confident in front of the classroom early on during his student teaching. His cooperating teacher remained in the classroom observing Mark for his first two days of teaching. After the first two days, Don mentioned his confidence in Mark and purposely would leave the room "so Mark can get the feeling he has full control." During the remainder of the study, Don left the classroom approximately four days out of the week. Occasionally, he would "pop in" the classroom to get something off his desk and then promptly leave. On the days when he remained in the classroom, he worked on the computer at his desk.

Initially, Paula had difficulty with the workload in Mary's Integrated Mathematics class because "the material is different from what I am used to and so is the technology." For Paula's first six weeks of teaching, Mary remained in her

classroom three to four days per week. Mary was observed on at least three occasions helping Paula during class with questions about either the lesson or the technology being used. As the study progressed, Mary was observed less frequently in the classroom while Paula was teaching.

During the interview prior to Paula beginning her student teaching, Mary indicated how difficult it would be for any student teacher to use portfolios in the classroom. She mentioned the length of student teaching and the nature of portfolios as reasons for the difficulty. Because of these factors, Mary graded the portfolios. On cues from Mary, Paula would instruct students on what pieces of data needed to be placed in the portfolios. Other than using portfolios, the data showed the two student teachers in this study successfully imitated their cooperating teachers' assessment practices.

Student Teachers' Beliefs about Assessment

Prior to student teaching, both student teachers in this study indicated homework, quizzes, and tests were appropriate assessment methods in a typical high school mathematics course. Both based their judgment on previous experiences in their high school mathematics careers, stating the primary use for assessment in their high school mathematics courses was to gather data to make decisions about grades.

Prior to student teaching, Mark discussed his apprehension about using "newer" assessment practices. He stated, "...when you get in a math environment, it relates you back to other math environments, and what took place there." When discussing the difficulty with using various alternative assessments, Mark stated, "If a student is set on being graded a certain way and these journals or portfolios

don't happen to fit with, let's say, their personality, there could be a conflict in how the grade is calculated."

Paula stated an interest in using journals or portfolios during her student teaching, but because of her lack of experience in using them, was initially unsure as to their use. She questioned how a journal or portfolio could help students "learn the basics", and mentioned, as did Mark, the difficulty in assigning a grade to a journal or portfolio. The data shows that these two student teachers' initial beliefs about assessment were heavily influenced by previous experiences in their high school mathematics courses. The data also showed that these two student teachers were initially concerned about assigning a grade when using assessment methods with which they were inexperienced.

After observing their cooperating teachers teach and assess for two to three weeks, both student teachers reiterated their preferences for assessment practices in a typical high school mathematics course. Mark restated his preference for using traditional assessment practices, while Paula restated her preference for using traditional assessments, as well as learning about journals and portfolios. No change in student teachers' preferences for assessment practices may be attributed to the alignment of their stated preferences for assessment practices indicated prior to student teaching and observed assessment practices of their cooperating teacher during student teaching.

As the student teaching experience progressed, both student teachers reported "feeling" comfortable implementing their respective cooperating teacher's assessment practices. During the last week student teaching, Mark reiterated the difficulty in implementing alternative assessment because of his lack of knowledge in how to apply a grade. He then indicated an interest in learning about alternative

assessments during his first couple of years out "on the job." Mark stated he plans to use homework, quizzes, tests, and a classroom notebook as assessment practices in his first year of teaching.

Paula became more comfortable with alternative assessment practices as her student teaching progressed. She developed an awareness of various uses of assessment other than just generating a grade. Paula discussed using assessment practices to communicate with students on how they were progressing and what they may or may not understand. At the completion of student teaching, Paula indicated plans to implement homework, quizzes, tests, group and individual assessments, journals, and portfolios in her first year of teaching. The data shows these two student teacher's beliefs about assessment practices were reinforced by observing their cooperating teacher, followed by practicing their respective cooperating teacher's assessment practices.

Conceptions of Mathematics

NCTM advocates that mathematics teaching provide opportunities for students to form a deeper understanding of mathematics and develop mathematical power. The conception of mathematics advocated by NCTM is best characterized in the NCTM *Standards* documents as "doing" mathematics rather than "knowing" mathematics. To achieve this vision of mathematics and mathematics teaching, new demands on instruction should encourage teachers to reevaluate and align the methods and manner by which students are assessed.

Changing preservice students' deeply held beliefs of mathematics and assessment practices that have been formed over many years of observation and practice is no easy task (Ball, 1988). Both student teachers in this study indicated

that alternative assessment practices were not modeled in their mathematics content and/or methods courses. During this study, the researcher anticipated a change in student teachers' conceptions of mathematics when student teachers implemented alternative assessment practices during their student teaching. Data never materialized that suggested whether there was a change in student teachers' conceptions of mathematics.

Recommendations for Practice

Assessment practices currently being advocated by the National Council of Teachers of Mathematics require the attention and efforts of dedicated mathematics teachers if these practices are to be implemented. Many mathematics teachers and mathematics preservice students lack the experience and awareness of alternative assessment practices. If preservice students are expected to observe, experiment with, and model assessment practices recommended by NCTM, several recommendations on inservice education of cooperating teachers and preservice education of future mathematics teachers can be made.

Cooperating Teachers

The data from this study shows that cooperating teachers have an influential role in developing student teachers' beliefs about assessment practices. It is necessary that cooperating teachers provide learning experiences for student teachers which include opportunities for student teachers to observe, experiment with, and implement NCTM recommended assessment practices. The data has direct implications for the selection of cooperating teachers.

While both cooperating teachers in this study were knowledgeable about the *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989), neither cooperating teacher was familiar with the *Assessment Standards for School Mathematics: Working Draft* (NCTM, 1993). If the assessment practices recommended by NCTM are to be broadly implemented, it is essential that teachers who are eventually selected to be cooperating teachers be knowledgeable about and have in place NCTM recommended assessment practices for their student teacher to observe and implement. This implies that inservice opportunities in alternative assessment need to exist for teachers who are willing and interested in serving as cooperating teachers, but lack the knowledge and/or experience about innovative assessment practices. Inservice opportunities might include workshops for teachers to develop alternative assessment plans in conjunction with activities which promote reflection on current classroom practice.

Although Don's and Mary's assessment practices were quite different from each other, both cooperating teachers were apprehensive about allowing their student teacher to experiment with assessment practices different from what they were using. On the other hand, prior to student teaching, both student teachers indicated an interest in using assessment practices different from the current practices of their cooperating teacher. If student teachers are to be provided an environment in which to experiment with assessment practices that may be different from their cooperating teacher's assessment practices, this suggests that cooperating teachers must also be willing to allow, and hopefully encourage, their student teacher to experiment with assessment practices that may be different from the cooperating teacher's current assessment practices.

Preservice Education

Both student teachers in this study indicated that alternative assessment practices were not modeled in their mathematics content and/or methods courses. They also stated that past experiences in high school and college mathematics and education classes helped formulate their traditional beliefs about appropriate assessment practices in high school mathematics courses. This would suggest that instructors leading mathematics content or methods courses need to implement assessment practices currently being advocated by the National Council of Teachers of Mathematics.

For there to be chances for carry over to later classroom experiences, the data from Mark's student teaching experience suggest that if preservice students experience traditional assessment throughout their school career, which includes college, and then observe and implement only traditional assessments during student teaching, they will continue to use traditional methods in their teaching careers.

Student Teaching Experience

The data from this study showed the two student teachers (1) accurately characterized their cooperating teachers' assessment practices, (2) successfully implemented their respective cooperating teachers' assessment practices, and (3) stated an interest in implementing the assessment practices used during student teaching in their future careers as teachers. This suggests that if the goal is to prepare future teachers to use assessment practices recommended by the National Council of Teachers of Mathematics, it is imperative they have the opportunity to observe these assessment practices in action, as well as have the opportunity to implement them during student teaching.

Summary of Recommendations

If one of the goals of mathematics teacher education is to prepare future teachers for the classroom demands of using assessment practices recommended by the National Council of Teachers of Mathematics, it is necessary that preservice mathematics education programs prepare future teachers to use these assessment practices.

Preservice students need opportunities to observe these assessment practices implemented in their content, education, and methods courses. Preservice students also need opportunities during student teaching to observe, experiment with, and implement these assessment practices recommended by NCTM . To provide these opportunities, inservice for cooperating teachers prior to or in conjunction with supervising their student teacher is necessary if cooperating teachers are to provide the appropriate experiences for student teachers to observe, experiment with, and implement assessment practices advocated by NCTM.

Generalizations

The results of this study were participant and site specific to a considerable extent. The research design used for this study does not allow for casual generalization. However, insights from this research can be used to improve secondary mathematics preservice and student teaching programs by designing opportunities for student teachers to observe, experiment with, and implement assessment practices recommended by the NCTM *Standards* documents.

Recommendations for Future Research

During this study, both student teachers indicated minimal experience with and exposure to alternative assessments in their mathematics and education courses prior to student teaching. Research is needed on how alternative assessments implemented in preservice students' content, education, and methods courses impact preservice students' beliefs about alternative assessment.

Conceptions of mathematics presented in each of the NCTM *Standards* documents is best characterized by "doing" mathematics rather than "knowing" mathematics. Research (Thompson, 1992; Brown et al, 1988; Dossey, 1988) studies have shown students conception of mathematics is that of a subject dominated by rules, facts, and procedures. Since preservice students are in the transition from being a student to becoming a teacher, research is needed on how observing, experimenting with, and implementing alternative assessment during student teaching impacts preservice students' conceptions of mathematics.

To provide the best opportunities for student teachers to observe, experiment with, and implement assessment practices recommended by NCTM, it is necessary that cooperating teachers have alternative assessment practices in place in their classroom programs prior to working with student teachers. Research is needed on the most effective ways to inservice future cooperating teachers on implementing alternative assessment practices so student teachers can learn through observing, experimenting with, and implementing these practices.

Both student teachers in this study were placed in student teaching environments where assessment practices being used coincided with their stated preferences for assessment practices prior to student teaching. Research is needed on the influence of student teaching on student teachers' beliefs about assessment

when the cooperating teachers' assessment practices are not aligned with student teachers' stated preferences for assessment practices.

All four participants indicated a concern with the impact on high school students when implementing assessment practices in the middle of the year which are different from what the students are accustomed to using. Research is needed on the impact of student teachers' assessment practices on students when these assessment practices are different from what the students expect.

Student teachers, Paula and Mark, stated concerns with parents and administrators understanding and interpreting alternative assessment. Research is needed on the impact of outside influences on student teachers' beliefs and practices about alternative assessment practices.

Paula implemented the use of journals from Mary's Integrated Mathematics classroom into an Algebra I classroom under the supervision of a different cooperating teacher, who was using more traditional assessment practices. Research is needed on the impact of student teacher's beliefs on the same student teacher operating in multiple environments using contrasting assessment practices.

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APPENDICES

APPENDIX A

RESEARCH QUESTIONS & RELATED

PROCEDURES AND METHODS

OBJECTIVE ONE: To describe cooperating teachers' assessment practices and student teacher's perceptions of his/her cooperating teacher's assessment practices.

QUESTIONS:

RELATED PROCEDURES AND
METHODS:

- | | |
|--|--|
| 1. What assessment techniques, formats, and rubrics were used by the cooperating teacher? | 1. Classroom Observations
2. Document Analysis
3. Formal Interview
(Cooperating Teacher) |
| 2. What were the ways in which the cooperating teacher used assessment information? | 1. Classroom Observations
2. Informal Interviews
3. Formal Interview (CT) |
| 3. How did the cooperating teacher incorporate students' use of calculators, computers, and manipulatives in the assessment process? | 1. Classroom Observations
2. Informal Interviews (CT)
3. Formal Interview (CT) |
| 4. What was the student teacher's perception of their cooperating teacher's assessment practices? | 1. Formal Interview
(Student Teacher)
2. Informal Interviews (ST)
3. Participant Journal (ST) |

OBJECTIVE TWO: To determine the cooperating teacher's willingness to allow his/her student teacher to experiment with assessment practices different from what the cooperating teacher was using and the student teacher's interest in experimenting with assessment practices different from what his/her cooperating teacher was using.

QUESTIONS:

1. What was the cooperating teacher's willingness in allowing his/her student teacher to experiment with different assessment practices?
2. What was the student teacher's interest in experimenting with different assessment practices?

RELATED PROCEDURES AND METHODS:

1. Formal Interview (CT)
2. Informal Interviews (CT)
1. Classroom Observations
2. Formal Interviews (ST)
3. Informal Interviews (ST)

OBJECTIVE THREE: To describe student teachers' assessment practices used during student teaching.

QUESTIONS

RELATED PROCEDURES AND
METHODS:

- | | |
|--|--|
| 1. What assessment techniques, formats and rubrics were used by the student teacher? | 1. Classroom Observations
2. Formal Interview (ST)
3. Informal Interviews (ST) |
| 2. What were the ways in which the student teacher used assessment information? | 1. Classroom Observations
2. Participant Journal
3. Informal Interviews (ST) |
| 3. How did the student teacher incorporate students' use of calculators, computers, and manipulatives in the assessment process? | 1. Classroom Observations
2. Participant Journal |

OBJECTIVE FOUR: To identify student teachers' beliefs about assessment at the beginning of student teaching and at the completion of student teaching.

QUESTIONS:

1. Prior to student teaching, what are the student teacher's beliefs about NCTM recommended assessment practices?
2. Upon the completion of student teaching, what are the student teacher's beliefs about NCTM recommended assessment practices?

RELATED PROCEDURES AND METHODS

1. Formal Interview (ST)
 2. Informal Interview (ST)
-
1. Formal Interview (ST)
 2. Informal Interview (ST)

APPENDIX B
INTERVIEW PROTOCOL
PRE-PILOT STUDY

1. Now that you've completed student teaching, what surprised you most about the experience?

Technology

2. Did you have an opportunity to use technology in your classroom?
3. If no, skip to number five.

If yes, can you describe a situation in which you used technology?
4. Do you feel that you used technology appropriately?
5. To what degree did your cooperating teacher encourage or discourage you to use technology?
6. In what ways could your cooperating teacher have helped you in implementing technology in your student teaching?
7. Any other factors which you may not have discussed that encouraged or discouraged your using technology in your student teaching?
8. To what extent do you plan to use technology when you teach?
9. If you choose to use technology in your teaching, what areas of support are necessary to facilitate their use?

Assessment

10. Did you have the opportunity to use alternative assessment in your classroom?
11. If no skip to thirteen.

If yes, can you describe a situation in which you used alternate assessment?
12. To what degree did your cooperating teacher encourage or discourage your using alternate forms of assessment?

13. In what ways could your cooperating teacher have helped you in implementing alternate forms of assessment?
14. Any other factors which you may not have discussed that encouraged or discouraged your using alternate forms of assessment in your student teaching?
15. To what extent do you plan to use alternate forms of assessment when you teach?
16. In what areas do you feel a need for help in implementing alternate forms of assessment in your teaching?

Cooperative Learning

17. Did you have an opportunity to use cooperative learning in your student teaching?
18. If no, skip to number five.

If yes, can you describe a situation in which you used cooperative learning?
19. To what degree did the cooperating teacher encourage or discourage the use of cooperative learning?
20. How do you think your cooperating teacher could help future student teachers to use cooperative learning?
21. Any other factors which you may not have discussed that encouraged or discouraged your using cooperative learning in your student teaching?
22. To what extent do you plan to use cooperative learning when you teach?
23. What areas of support do you feel are needed to help you to use cooperative learning in your teaching?

APPENDIX C
INTERVIEW PROTOCOLS
FOR
THIS STUDY

Cooperating Teacher Formal Interview
(Prior to Supervising Student Teacher)

1. Describe what classroom assessment means to you.
2. Please differentiate between your definition of evaluation and assessment.
3. Please describe the different methods of assessment you use in the classroom and their corresponding purposes.
4. To what extent do you use the following in your classroom teaching:

Computers?
Calculators?
Manipulatives?
5. To what extent are each (computers, calculators, and manipulatives) used in the assessment process?
6. Describe, as you see it, the role of the cooperating teacher in his/her student teacher's education and experiences as it relates to classroom assessment.
7. Prior to student teaching, with what assessment methods and purposes should preservice teachers be familiar?

From your experience, how familiar are they?
8. Which areas, if any, of assessment do you foresee student teachers having the most difficulty implementing in their future classrooms?

Why is that?
9. To what extent do you expect your student teacher to use your methods of assessment?
10. How would you describe your attitude towards allowing a student teacher to use assessment methods different than you use?

Why is that?

11. To what extent are you familiar with the NCTM Curriculum and Evaluation Standards?

How about

- a. Professional Teaching Standards?
- b. Working Draft of the Assessment Standards?
- c. SIMMS Project?
- d. SIMMS Assessment Handbook?

12. Is there anything else you would like to add related to your experience with your student teacher?

Student Teacher Formal Interview
(Prior to Student Teaching)

1. Can you describe what classroom assessment means to you?
2. Can you describe the different methods of classroom assessment with which you are familiar?
3. From where did you learn these methods of assessment?
4. What were the purposes of the assessments used?
5. What methods of assessment do you feel are appropriate in a high school mathematics course?
6. Which methods of assessment do you foresee having the most difficulty implementing in your classroom?
7. What methods of assessment do you plan on using during your student teaching experience?
8. To what extent do you plan to allow students to use the following during your student teaching experience?

Computers?

Calculators?

Manipulatives?

Follow up: To what extent do you plan to allow students to use them in the assessment process during your student teaching?

9. To what extent do you expect your cooperating teacher to encourage or discourage you with respect to using various methods of assessment different from the methods they use?
10. In what ways could your cooperating teacher provide support to use different methods of assessment different from the methods they used?

Student Teacher Formal Interview
(After Observing Cooperating Teacher)

1. Describe a situation where you observed your cooperating teacher implementing a method of assessment.
2. How was the information from the assessment used?
3. Describe other assessment methods used by your cooperating teachers.
4. How was the information used from each of the assessments?
5. To what extent did your cooperating teacher allow students to use the following in the assessment process:

Computers?
Calculators?
Manipulatives?

Follow Up: Describe situations where students were allowed to

6. How would you describe your cooperating teacher's assessment philosophy?

Student Teacher Interview
(Exit Interview)

1. Describe a situation during your student teaching experience where you used a particular method of assessment.
2. How did you use the information from this assessment?
3. What other methods of assessment do you recall using during your student teaching experience?
4. What was the purpose of the assessment?
5. To what extent did you allow students to use the following during student teaching?

Computers?

Calculators?

Manipulatives?

Follow up: To what extent did you allow students to use them in the assessment process during your student teaching?

6. Was there a type of assessment you wanted to use during your student teaching experience but didn't get a chance to use?

Why is that?

7. How could your cooperating teacher have helped you to use that particular method of assessment?
8. From your discussions with your cooperating teacher and observations of their teaching, how would you describe your cooperating teacher's assessment philosophy?
9. What methods and purposes of assessment do you feel are appropriate in a high school mathematics course?

10. What methods of assessment do you plan on using in your first year of teaching?

How about the first five?

11. Which methods of assessment do you foresee having the most difficulty implementing in your classroom? Why is that?

APPENDIX D
GOALS AND OBJECTIVES OF PROJECTS
RELATED TO THIS STUDY

Six Through Eight Mathematics (STEM) Project

The Six Through Eight Mathematics (STEM) Project is an National Science Foundation funded (1991-96) project designed to develop a mathematics curriculum for this level. Students who complete the STEM curriculum will have acquired the mathematical skills necessary to:

1. solve problems;
2. reason inductively and deductively;
3. apply the numerical and spatial concepts necessary to function according to their needs in a technological society;
4. be independent learners who are well prepared for both work and further schooling;
5. function as life-long learners and intelligent citizens;
6. explore mathematics at the secondary level;
7. think mathematically;
8. become decision makers;
9. view mathematics as relevant to their lives and connected to other content areas. (STEM Handout)

For more information about the STEM project, please contact:

Dr. Rick Billstein, Director
Mathematics Department
University of Montana
Missoula, MT 59812
(406) 243-2603

Systemic Initiative for Montana Mathematics and Science (SIMMS) Project

The Systemic Initiative for Montana Mathematics and Science (SIMMS) Project is a National Science Foundation funded (1991-96) curriculum writing and professional development project for grades 9 - 12. The project goals are:

1. promote reform in science and mathematics education;
2. redesign the 9-12 mathematics curriculum using an integrated, interdisciplinary approach for all students;
3. develop and publish curriculum and assessment materials for grades 9-16;
4. incorporate the use of technology in all facets and at all levels of mathematics education;
5. increase the participation of females and Native Americans in mathematics and science;
6. establish new certification and recertification standards for teachers;
7. redesign teacher preparation programs using an integrated, interdisciplinary approach;
8. develop an inservice program on integrated mathematics to prepare teachers of grades 9-16;
9. develop the support structure for legislative action, public information, and general education of the populace necessary for effective implementation of new programs. (SIMMS Handout)

For more information about the SIMMS project, please contact one of the project directors:

Dr. Johnny Lott
Mathematics Department
University of Montana
Missoula, MT 59812
(406) 243-2696

Dr. Maurice Burke
401 Linfield Hall
Montana State University
Bozeman, MT 59717
(406) 994-5330

Systemic Teacher Excellence Preparation (STEP) Project

The Systemic Teacher Excellence Preparation (STEP) Project is a five year National Science Foundation funded (1993-98) project designed (1) to bring about large-scale improvement in the preparation of mathematics and science teachers in Montana and (2) to serve as a national model for rural areas with significant minority populations. The project goals are:

1. provide early career support for mathematics and science teachers, in a rural setting, during their first 4 years of service;
2. create School (K-12) Field Sites that effectively model mathematics and science teaching strategies (building on the State Systemic Project - SIMMS and the Six Through Eight Mathematics Project - STEM);
3. recruit and support future mathematics and science teachers from Native American Communities;
4. utilize Montana's extensive telecommunications network as a key component in the development of a teacher preparation model for rural states;
5. use a team approach in redesigning the mathematics, science, and methods courses for preservice students;
6. design, implement, evaluate, and disseminate new ideas in preparing mathematics and science teachers at all levels;
7. significantly increase the number of women and minority teachers in mathematics and science;
8. use the Model Field Sites in K-12 schools as "living laboratories" for research on effective mathematics and science teaching, and preservice teacher supervision, as well as for the training of university mathematics and science educators interested in innovation in rural settings.

(STEP Proposal, 1992, pg. 1)

For more information about the STEP project, please contact one of the project directors

Dr. Elisabeth Charron
401 Linfield Hall
Montana State University
Bozeman, MT 59715
(406) 994-6768

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APPENDIX E
SAMPLE DATA COLLECTION

Goetz & LeCompte (1984) recommend multiple methods of data collection to provide the triangulation or cross reference of data desired in qualitative studies to create a diverse source for and reinforcement of researcher observations. Included in this appendix are samples from data collected through classroom observations, formal and informal interviews with cooperating teachers and student teachers, and participant journals used to analyze the research questions which address objective two of this study.

Objective Two: To determine the cooperating teacher's willingness to allow his/her student teacher to experiment with assessment practices different from what the cooperating teacher was using and the student teacher's interest in experimenting with assessment practices different from what his/her cooperating teacher was using.

Research Question 5 (see page 5): Was the cooperating teacher willing to allow his/her student teacher to experiment with different assessment practices?

Formal Interview - The following is an excerpt from an interview with Don, Mark's cooperating teacher, on January 4, 1995. The interview was held prior to Mark beginning his student teaching.

Interviewer: Describe, as you see it, the role of the cooperating teacher in his/her student teacher's education and experiences as it relates to classroom assessment.

Don: I feel our job is to give the student teacher all our knowledge about how we assess. I do feel the student teacher should follow fairly closely to his/her supervising teacher's assessment plan.

Interviewer: Prior to student teaching, with what assessment methods and purposes should preservice teachers be familiar?

Don: I feel a student teacher should be exposed to various types of assessment. Testing is probably the most used means of assessment and student teachers should have some practice writing tests before coming out to teach.

Interviewer: To what extent do you expect your student teacher to use your methods of assessment?

Don: I feel about seventy-five percent of assessment should follow the supervising teacher's plan. If a student teacher wants to implement one new type, then it could be beneficial for both individuals.

Interviewer: How would you describe your attitude towards allowing a student teacher to use assessment methods different than you use?

Don: I feel it is fine as long as it is not more than roughly twenty-five percent of the student's grade. I guess I feel this way because students are basically with the student teacher a shorter time frame and it would cause less disruption in what they are used to.

Formal Interviews - The following is an excerpt from an interview with Mary, Paula's cooperating teacher, on January 5, 1995. The interview was held prior to Paula beginning her student teaching.

Interviewer: Describe, as you see it, the role of the cooperating teacher in his/her student teacher's education and experiences as it relates to classroom assessment.

Mary: I believe in being very flexible in allowing the student teacher to assess students in a way that he/she is comfortable with. I would encourage the student teacher to continue with journals, notebooks, and other classroom assessment I use. It is hard on the kids to have someone come in the middle of the year and change everything.

Interviewer: Prior to student teaching, with what assessment methods and purposes should preservice teachers be familiar?

Mary: All forms of alternative assessment. Student teachers should be required to contact several teachers and interview them and find out what they are doing and how they assess students and how they assign grades before they begin student teaching. They should be very familiar with assessment techniques and if possible they should be placed with teachers who use alternative assessment. Student teachers tend to do whatever their cooperating teacher does.

Interviewer: To what extent do you expect your student teacher to use your methods of assessment?

Mary: I expect her to require and grade notebooks but otherwise I just encouraged her to use my other techniques.

Interviewer: How would you describe your attitude towards allowing a student teacher to use assessment methods different than you use?

Mary: I would have to be comfortable with her in the classroom and then I would encourage her to try them when I am in the classroom.

Research Question 6 (see page 5): What was the student teacher's interest in experimenting with different assessment practices?

Formal Interview - The following is an excerpt from an interview with Mark held on December 8, 1994. The interview took place prior to Mark beginning his student teaching.

Interviewer: What methods of assessment do you plan on using during your student teaching experience?

Mark: Methods of assessment I will use during student teaching will probably include homework, quizzes, and tests. And if I can convince them, I will try to get five percent in there for notebooks.

Interviewer: To what extent do you expect your cooperating teacher to encourage or discourage you with respect to using various methods of assessment different from the methods they use?

Mark: Depends upon how I would present it. If I were to walk in during the middle of the semester and say I wanted to start it, I don't believe that would be right. That's not fair for the students or the teacher to disrupt the daily routine that was going on at the time. Now a place where it might work out would be if you were taking over at the beginning or end of a semester where there could be a transition period.

Interviewer: In what ways could your cooperating teacher provide support to use different methods of assessment different from the methods they used?

Mark: First of all, it is probably going to depend on exactly what the assessment is. They are probably going to be curious about exactly how the assessment is going to be graded for the computer. I would probably have to unfortunately, look at how long the teacher had been around, and that's going to be something of a personality thing. If the teacher has been around for a long time they can get set in their ways

and not want to bring any of this other stuff in. And yet, a younger teacher might still want to experiment.

Classroom Observation - The following is an excerpt from fields notes of observing Mark teaching on January 23, 1995. Mark was reviewing for the test on Wednesday. During this teaching episode, the researcher first became aware of Mark's use of the classroom notebook.

At the beginning of class, Mark announced, "Today, I will quickly review for the test. Whose turn is it to write in the notebook today?" During the remainder of the period, Mark reviewed problems from a list he had on a small index card. For the most part, Mark would state the problem, work the problem, and then ask for questions. Students remained at their desk and appeared to be writing the problems in their notebooks.

Participant Journal - The following is an excerpt from Mark's participant journal on January 25, 1995. On January 23, Mark was observed asking his class whose turn it was to write in the notebook. At the completion of the class period on January 23, the researcher stated two questions for Mark to reflect on in his journal.

Question 1: At the beginning of class, you asked, "...Who is taking notes today?". Where did you get this idea?

Mark: I asked Don if he had anyway to get extra credit points. He had mentioned no. Then we go onto the class notebook for people who are absent. To save the teacher time, it would be nice to have a notebook that students could refer to with lectures for that day. We then thought we could give points to the person who took notes for the day. Somewhat of an incentive. If you take notes in the class notebook you may receive ten bonus points.

Question 2: What is the purpose of the notebook?

Mark: The purpose is to allow the students that missed class, for whatever reason, to be able to refer to the notes for the class that day. After they refer to the notebook, they may ask the teacher questions on the assignment. It also allows me to see what I have done.

Informal Interview - The researcher next visited Mark's classroom on January 30, 1995. Prior to the beginning of class, Mark handed the researcher his notes from the journal (see above). After reading his comments, the researcher asked Mark more about the origin of the notebook idea.

Interviewer: Mark, you mentioned that Don helped you decide how much credit the notebook was worth. Where did the idea for the notebook originate?

Mark: It was from one of my math classes in college. The professor would leave his lecture notes available for anyone to look at.

Formal Interview - The following is an excerpt from an interview with Paula held on December 6, 1994. The interview took place prior to Paula beginning her student teaching.

Interviewer: What methods of assessment do you plan on using during your student teaching experience?

Paula: Well, depending on my cooperating teacher, I want to get some experience with journals so when I go out to teach, I have a little bit of experience. I have a lot of ideas, but unless you implement and try them, it is hard to say if they work.

Interviewer: To what extent do you expect your cooperating teacher to encourage or discourage you with respect to using various methods of assessment different from the methods they use?

Paula: I would be scared to ask. I have heard horror stories about student teaching.

Interviewer: Where did you hear these horror stories?

Paula: From other student teachers when they come back. This one guy went in the first day and the class was turned over to him and he didn't have any support and you do what you want. He had never taught before so how did he even know what he wanted to do. Other places do it my way and it's the only way and you have to do it because they are the ones grading you.

Interviewer: In what ways could your cooperating teacher provide support to use different methods of assessment different from the methods they used?

Paula: I want a cooperating teacher that is going to give me a lot of support and help me if I need help. I don't want him/her to say, "Here is everything, do what you want." I want him/her to say this is how I would do it when I offer suggestions. I hope she really encourages it because it is a learning process for me. The more I get to see, the more I will have a better idea of what I want to use. With her experience, she can tell me if it is going to work at all, even if it is worth trying.

Informal Interview - The following is an excerpt from a conversation with Paula on January 24, 1995. The conversation involved her discussing her Algebra I class, under a different cooperating teacher, and how the students seemed to be lost.

Interviewer: How is Algebra I going?

Paula: The students seem lost. My cooperating teacher practically reviews the entire test the day before she gives to them?

Interviewer: Why is that?

Paula: If she didn't, nobody would pass.

Interviewer: How would you approach her if you wanted to do some type of assessment she doesn't do?

Paula: I would like to share my ideas and say this is what I would like to do and what I want to and I want to try it, maybe instead of homework tonight, could I give them a writing assignment. Just a couple of times to see what I get back.

Participant Journal - The following is an excerpt from Paula's participant journal on March 2, 1995. On February 28, Paula mentioned she had been having students in her Algebra I class write in journals. She was given five questions by the researcher to reflect on in her participant journal.

Question 1: Why did you decide to do a journal?

Paula: I decided to do a journal because the class is very frustrated and it gives them a chance to tell me what bothers them. Many of them won't ask questions and this way they can without being embarrassed. They have really been open with me.

Question 2: Did the cooperating teacher have any input on the decision?

Paula: No. She has been so busy with volleyball, she really hasn't said much. Although when Mary has her class do journals, she makes them write more. I only ask two or three sentences where she will ask for a full page.

Question 3: How is the information from the journals used?

Paula: I use the information in many ways. I know what is confusing them so I can go back over it. I also hear if they are having a bad day and could have done better and I try to encourage them so that they don't get frustrated.

Question 4: What do students write about in their journals?

Paula: If they like the material, like me, are confused, having a bad day, or anything else. Usually my question pertains to school but sometimes not.

Question 5: To what extent do you plan on using journals in this format next year?

Paula: Much in the same way. I feel it gets the students on task right away. I also feel like they are more open about school on a one-to-one basis.

Classroom Observations - The following are excerpts from the field notes taken while observing Paula's Algebra II class on March 7 & 10, 1995. Paula had previously mentioned she was using journals in this class. Because of time constraints, the researcher observed the first fifteen minutes of these two class periods. On both classroom visits, Paula was observed giving prompts on which students were to write.

March 7: Students came in and sat at their assigned desks. The overhead projector was on with the following prompt. "What are you confused about in this chapter?" While each student wrote in their journal, Paula took attendance, and wiped the whiteboard. After

approximately five minutes, the students passed their journals forward.

Next, Paula stated, "Please exchange your papers with the person in front of you." Paula then recited the answers to the homework. This was followed by students returning the papers to correct person. Paula then asked if there were any questions from the homework. A couple of students asked questions and Paula worked the problems on the board. End of observation.

March 10: Students came in the classroom and sat in their assigned desks. On the overhead projector Paula had written the prompt, "How do you feel you did on yesterday's test?" While students wrote in their journals, Paula took attendance, and cleared the whiteboard.

Next, Paula handed back the tests taken the previous day. Students were given about five minutes to look at their exam. Students were mostly observed comparing their grades with their neighbors. The observation ended with Paula going working the problems from the test on the whiteboard.

APPENDIX F
DATA COLLECTION SCHEDULE
&
TIMELINE

Researchers Data Collection Schedule

Codes

- P = Prior to student teaching
 O = While student teacher observed cooperating teacher
 A = When student teacher assumed teaching responsibilities for the course to be included in this study
 D = Anytime during the student teaching experience
 E = End of Student Teaching Experience

Participant Journal

Student Teacher D

Observer Field Journal

Researcher D P

Classroom Observations

Student Teacher	D	(Min. once per week)
Cooperating Teacher	O	(Min. twice per week)

Informal Interviews

Student Teacher	D	(When appropriate)
Cooperating Teacher	D O	(When appropriate)

Formal Interviews

Student Teacher	B A E
Cooperating Teacher	B

Document File

Student Teacher	D	(When appropriate)
Cooperating Teacher	O	(When appropriate)

Timeline for the Study

November 7-18	In consultation with MSU Student Teacher Placement Office, selected and contacted student teachers for study. Contacted Cooperating Teachers
December 1-9	Interviewed Student Teachers involved with the Study (Formal Interview # 1)
January 4-6	Interviewed cooperating teachers and started observing their classroom
January 16 - 27	Conducted second formal interview with student teachers at the completion of their observation period
January 30 - April 10	Observed student teachers a minimum of once per week through the completion of the student teaching experience.
April 10 - 14	Conducted formal interview #3 with student teachers.
April 15 - June 6	Further analyzed data, completed writing, and dispersed to reading committee
June 19 - 30	Defended, made editorial changes, dispersed copies to committee, graduate school, and library

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