ACTION RESEARCH IN MATHEMATICS EDUCATION:

A STUDY OF A MASTER'S PROGRAM FOR TEACHERS

by

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April 2009

DEDICATION

I dedicate this dissertation to my father, Donald Ultan, who did not complete his dissertation, but impressed upon me the value and importance of using my mind, thinking, and obtaining my degrees. He lives on in my heart and always will. I would like to also dedicate this to my family: William Bennett, my fiancé whom I met in the 8th grade in California and discovered he too was in Montana, and to my son, Elliot Donald Segal. Both of them work so well with me. I also dedicate this to and thank my mother for putting up with me. Her love and affection stays steady. I appreciate all that she has done.

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ABSTRACT

Action research is a methodology that has been found to be valuable as a problem-solving tool. It can provide opportunities for reflection, improvement, and transformation of teaching. The purpose of this study is to better understand these claims about the benefits of action research. Several research questions stand out: How is action research experienced by teachers? Is it beneficial and practical for teachers who use it? How are action research findings typically validated? What factors influence whether teachers are able to continue to practice action research? What kind of change has it initiated for teachers? And, how does action research focused on improving student achievement affect high need students?

For the past five years, forty-five teachers completing master's degrees in mathematics education at a northern Rocky Mountain land-grant university have been required to conduct an action research project, referred to as their "capstone project." By studying this group of graduates, gathering both qualitative and quantitative data through surveys and interviews, I have examined the effectiveness of action research. This data, combined with graduates' capstone projects, has provided partial answers to the above questions, restricted to faculty-mediated action research within master's programs for mathematics teachers. The extent to which such action research projects impact teachers' practices has not been investigated before.

While acknowledging that this research relied primarily upon self-reported data, the results strongly support what the research literature generally asserts about action research. (a) It is beneficial and often transformational for teachers as a professional development tool by allowing them to engage in a focused study of their own practice. (b) When done less formally it becomes more practical. (c) Communicating with others in the field builds confidence in teachers as professionals. (d) It makes teachers more actively reflective and more aware of their teaching and their students' learning. (e) It is effective in understanding and addressing the particular needs of high need students. Continued practice was highly dependent on time and support for action research within the school. Teachers often expressed the importance of having an action research community while conducting their capstones.

CHAPTER 1

STATEMENT OF THE PROBLEM

In this chapter, a general introduction is given followed by an explanation of the context and the focus of the study. The statement of the problem is then discussed and the research questions are presented. A discussion of the significance of the study and its limitations is provided. Research assumptions are described and the researcher's position is clarified. The hypothesis, variables, and the measures of variables are given, followed by the definition of terms and an explanation of the organization of the study for the chapters that follow.

Introduction

Action research is a methodology that is considered to be a valuable problem-solving tool in most of the literature on action research. For the teacher in the classroom it can provide opportunities for reflection and improvement, a testing ground for improving the teacher's practice. Implemented in this way, action research is also seen as a personal transformational tool for a teachers' professional practice. The purpose of this study is to better understand these claims about the benefits of action research. Several questions stand out as one delves into such an investigation: How is action research experienced by teachers? Is it beneficial and practical for the teachers who use it? How are action research findings typically validated? What factors influence whether teachers are able to continue to practice action research if they have found it to be worthwhile?

And, what kind of change has it initiated for teachers in their careers?

The North Central Regional Educational Laboratory defines action research as, "inquiry or research in the context of focused efforts to improve the quality of an organization and its performance. It typically is designed and conducted by practitioners who analyze the data to improve their own practice. Action research can be done by individuals or by teams of colleagues. The team approach is called collaborative inquiry." (NCRL, 2008, para. 1) This definition of action research will be assumed in this study.

For the past five years teachers completing master's degrees in mathematics education at a northern Rocky Mountain Land-Grant university have been required to conduct an action research project, referred to as their "capstone project." The capstone project is based upon a classroom problem that is relevant to student achievement. The underlying goals of the capstone project are to improve student achievement in the teacher's classroom or to improve the teacher's understanding of the teaching and learning process. The first step of a capstone project is a capstone proposal, which must be approved by the student's graduate committee before work can proceed. The results of the work are presented in a seminar or other suitable forum approved by the student's committee. Approximately fifty teachers have completed these projects. In this dissertation, I examine the group of graduates who completed their capstone projects between 2003 and 2007. The extent to which their action research project impacts their practice has never been investigated.

This master's program in mathematics education is designed for teachers who currently teach mathematics and who seek a master's degree in mathematics education.

The program was created with the goal of better equipping teachers in mathematical content knowledge and in mathematical pedagogical knowledge. The capstone project, which I refer to as faculty-mediated action research, is the only part of the program considered in the present study. In faculty-mediated action research, students collaboratively conduct teacher action research in a school setting at the university but it can also be considered as professional development because teachers are collecting and analyzing data that are used to inform practice, improve student learning, and encourage reflection. In this approach, a faculty member works with each student, guiding him or her in the design of the project and providing checkpoints along the way. The faculty member provides support, guidance, expertise, and validation.

Context and Focus of the Study

Several themes emerge as important focal points from studying the literature on action research: benefit, practicality, validity, continued implementation, and change in teacher practices. Action research is claimed to be beneficial for teachers and their students, and, when shared, the educational community. The literature discusses ways to make action research more practical, and thereby more useful for teachers. Suggestions are made for increasing the validity of one's research such as collecting different types of data and discussing with others in the field (Whitehead, McNiff, 2006). Because action research requires significant time and effort, discussions on continuing to implement it are included in the literature, especially if the initial project was externally funded. Action research is described as transformational (Whitehead, McNiff, 2006), leading to

permanent change in a teacher's practice. Through a comprehensive survey covering these topics, an examination of the action research capstone projects published online, and in-depth interviews with program graduates, I investigate these themes as they pertain to the students from this program.

Statement of the Problem

There is a growing body of research literature on action research. However, only one reference was found on faculty-mediated action research, and yet it is used throughout the country in many university programs investigated for this study. With the faculty-mediated model, the teacher has more guidance and checkpoints in his or her study than one would otherwise. It is a sound first experience with this kind of research and is unique in that way. Practicing teachers are not always able to discuss their research plan with a knowledgeable colleague. But in a faculty-mediated model they do, and they are able to obtain guidance as well. The literature portrays action research as an effective professional development strategy for improving teacher practices. But it is not clear how teachers perceive it when used on a broad scale under the faculty-mediated model. Also, teachers need relevant professional development, and action research potentially offers exactly that. It is not clear what aspects of action research, at least under the faculty-mediated model, teachers find to be most relevant.

Action research is portrayed in the literature as very beneficial, and as a useful kind of professional development because of its' direct applicability to a teacher's classroom practice. Since many professional development schools teach courses on action research,

one goal of this project is to examine the faculty-mediated model of action research to determine how it compares to the profile offered by the literature. This present study follows up with teachers who have engaged in action research to ascertain how their experiences compare with the literature, to see if teachers' characterize action research as a useful form of professional development, and to for universities to learn about the programs they are teaching.

Research Questions

The research questions I am investigating are the following:

1. Under the faculty-mediated model, what types of action research projects do teachers typically see as important and engage in within their specific educational settings?
2. How does the teacher researcher ensure that all aspects of the research design are well aligned with the research questions? What standards of validity are appropriate for action research in educational settings for teacher practitioners?
3. How do teachers benefit from action research?
4. How practical are the requirements placed on teachers to do it well?
5. In what ways do teachers continue engaging in action research, in the absence of outside funding or faculty support?
6. How does teacher practice change as a result of doing action research?
7. How does action research affect teachers' ability to address the needs of diverse or high need student populations?

Significance of the Study

A master's program is often the most significant component of formal professional development in a teacher's career (Burke, 2008). Therefore, it is valuable to the research field to investigate how theory and practice overlap in the professional development context of master's programs. Claims such as action research is 'personally transformational', 'it's the best form of professional development', 'it builds community', and it 'makes one more reflective' are made throughout most of the literature on teacher action research. But these claims have not been examined with specific reference for the faculty-mediated model.

The goal here is to determine whether and how the impact on the teacher doing action research is similar to the impact when action research is embedded in a master's program. If action research is a highly effective tool for K-12 and higher education, then more could benefit from using it. At the same time many teachers don't know it exists. In this regard, it is critical to investigate ideas, practices, and experiences to see what is of value, what is meaningful, and what truly makes a difference. This study contributes to the body of knowledge on action research by providing much needed information about the faculty-mediated model.

It is clear that many professional development schools recognize the value of educating students in action research. An investigation conducted by this researcher found many master's programs in mathematics and science have an action research component: University of Maryland, Washington, Southern Illinois, NYU, Illinois Institute of Technology, North Dakota University, Texas Tech University, Purdue, Penn

State, Hood College, Brown, Michigan State, Indiana University, Ohio University, University of Virginia, University of Albany, George Mason, University of California at Santa Barbara, and University of Missouri - to name a few. It is of great importance to look carefully at faculty-mediated action research through the eyes of the teacher researcher, in order to learn more about its effectiveness. By carefully examining teachers' experience with action research and determining how significant it has been in the professional lives of the graduates of the master's program in mathematics education, we can learn more about the significant and lasting effects of action research.

Specifically, this study provides information on (a) how action research is and is not beneficial for the teacher and the students, (b) how to make action research practical so teachers can practice it, (c) how teachers typically ensure that their research is reliable and valid, (d) the ability and inability of teachers to continue to practice action research along with ideas for increasing sustainability, and (e) what changes in teaching practice take place by doing action research. In this study, the types of action research that teachers deemed productive in educational settings are described. Lastly, by questioning how action research affects diverse students (defined to be students who are eligible for free or reduced lunch) we can better find ways to reach and assist this group of students as well. To be able to examine at an entire program of participants over a five-year period is a valuable opportunity, and the results of this investigation may prove to be important for all faculty-mediated action research programs.

Because a master's program is such an important element of a teacher's professional development during his or her career, this research will contribute to the

literature on professional development of teachers. While limited in scope, I believe this study will provide valuable information. The mathematics department will benefit from receiving feedback about the program. The science departments at this university have a similar program that can benefit from this research as well. Further, similar programs in terms of audience, design, and context at other universities nationally may benefit from these findings. Other master's or professional development programs may find this study useful for their programs. Indeed, there is much to be learned about faculty-mediated action research as an introduction to doing action research.

Limitations of the Study

A limitation of this study is that this group of teachers being examined has gone through a specific graduate program in a relatively narrow time frame. Of the many of people who use action research, this study looks at forty-five individuals. Also, many teachers from this group have done action research only once so they have very limited experience. Most teachers are too busy and they might not have time to explore action research more fully in their teaching practice. Teachers have to make time while in this program but there are no guarantees they will have time after they leave the program.

The focus here is a case study of one university program's action research component within a master's program. While this program is primarily on-line, nearly all of the students reside in the United States, and many in Montana. Instead of working with highly experienced action researchers, this is a relatively inexperienced group, many of whom will be reflecting on a first-time experience or an only experience. This

population is predominately Caucasian. However, these limitations will also help to address specific issues related to this population and to their experience level. This study could lead to further research with other groups in terms of experience, diversity, region, etc.

Another limitation is that this study is based on self-perceptions from the teacher, to a large extent. If the distances allowed me to visit these geographically dispersed teachers' classrooms, the site visits would help bring more valuable data to the research, more importantly, the data would not be a self-perception.

Research Assumptions

One research assumption was that this group of students would be responsive, willing, and able to be examined. While this is an assumption to be cautious about, I found that in working with the pilot group of science education graduates, they were very willing and responsive. The pilot group consisted of an intentional sample of recent graduates. These assumptions were appropriate because the research group was responsive and willing to participate in the survey and interviews. Also assumed is that participating teachers would trust that their answers would be kept anonymous so they feel comfortable in being honest. Lastly, I assumed that participating teachers would have useful things to share about action research, even though their comments would often be based on only one experience. These graduates would also provide a collective perception that may agree or disagree with the literature.

Researcher's Position and Hypothesis

My position in this research project is one of inquiry and confidentiality. I am biased to the extent that my review of the literature on action research left a certain impression. I wanted to investigate this further. I am examining one case, the action research component of a single teacher education program. I do not know the graduates in this study, and their participation will remain completely confidential. I am not involved in the master's program in any way. I know several of the professors who teach in the master's program, and I am not hesitant to inform them of all the outcomes of this research, good or bad. The results will be based on observations from the surveys, capstone projects and interviews. My position is the same as if an outside evaluator was looking at the program, except that I am acquainted with several of the professors who work in the master's program. Moreover, some of these professors are reviewing and evaluating my dissertation work. While I have read supporting literature for action research, my position is one of inquiry to see what the graduates' experiences have been and how they align with the literature.

My hypothesis is that action research appears to be a problem-solving tool that changes practice and increases confidence and effectiveness in one's own practice.

Variables

The graduates included in this study are fifteen pilot students that participated in a pilot survey, and 45 graduate students who graduated between 2003 and 2007 in the program I have examined. I understand that when asking participants to express their

views and their recollections, answers can vary and are limited in that they offer one perspective. Also, perceptions can change over time and are not the most reliable form of data gathering. However, by surveying forty-five views and recollections I hope to find some dominant trends and viewpoints.

Definition of Terms

1. Action Research is inquiry or research in the context of focused efforts to improve the quality of an organization and its performance. Typically, it is designed and conducted by practitioners who analyze the data to improve their own practice. Action research can be done by individuals or by teams of colleagues. The team approach is called collaborative inquiry. (Graduate School of Education, George Mason University, 2008)
2. Capstone Project at this university is an action research project, based upon a classroom problem that is relevant to the student. The underlying goals of the capstone project are to improve student achievement in the teacher's classroom or to improve the teacher's understanding of the teaching and learning process. The first step of a capstone project is a capstone proposal, which must be approved by the student's graduate committee before work can proceed. The results of the work are presented in a seminar or other suitable forum approved by the student's committee. (Montana State University, 2008)
3. Faculty-Mediated Action Research is where students collaboratively conduct teacher action research in a professional development school setting by collecting and

analyzing data that are used to inform practice, improve student learning, and encourage reflection (University of Maryland, 2004). Further, faculty-mediated action research is overseen by faculty and has critical checkpoints in place to help monitor the students.

4. High need student populations can be defined as possessing at least two or more of the following characteristics: "(a) a high proportion of low-income families; (b) a high proportion of minority students, including those with English as a second language; (c) a low mean student test performance or a large performance variation, with low-income and minority students over-represented at low performance levels; or (d) inadequate teacher access to professional development and educational resources due to location (rural and urban)" (National Science Foundation, 2008).
5. Professional Development is the opportunity offered to educators to develop knowledge skills, approaches and dispositions to improve their effectiveness in their classrooms and organizations. (Loucks-Horsley, 1996)

Organization of the Study

Chapter 1 provides an overview of the study, including background information about action research and the need to study it further. Assumptions and limitations inherent in the research design are described. The research questions are stated, and key terms are defined.

In Chapter 2, relevant literature related to action research is discussed. Studies and examples are organized under the categories of major themes that arose from the

literature, the key elements of action research. The theoretical framework that guides the study is depicted. Different models of action research are described and the five major elements discussed in detail: benefit, practicality, validity, continued practice, and change.

Chapter 3 describes the pilot study and the actual study conducted. Participants, data collection methods, instrumentation, and data analysis procedures used in this study are discussed. The research questions are restated, and the results of the pilot study are shown.

Chapter 4 details the results of the present study. Data from the survey, the capstone projects, and the interviews are presented in detail and in summaries. Selection of interviewees is also discussed.

Finally, Chapter 5 summarizes the study and provides conclusions. A discussion of the implications of the findings for researchers, teachers, and university programs that have an action research capstone project is included.

CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

In this chapter action research and its historical background are described. This is followed by an explanation and examples of what educational action research is, particularly action research conducted by teachers. The differences between action research and other types of research are discussed as well as how action research can be a form of professional development. Finally some major themes that emerge from the literature on action research - validity, benefit, practicality, and continued practice - are described. The chapter concludes with critiques of action research and conclusions regarding the connections between the current study and the broader scope of action research that emerges from the literature.

Description of Action Research

There exists much literature on the subject of action research. It is written in the contexts of various occupations such as education, health, social work, organizational development, planning, architecture, and economic growth. After some background and definitions, the focus of this review will be educational action research that considers issues of validity, benefits, practicality and sustainability.

Since its inception in the work of Kurt Lewin in 1946, the meaning and purpose of action research has taken on many forms:

- "Action research is the study of a social situation with a view to improving the quality of action within it." (Elliot, 1991)
- "Action research is a form of collective self-reflective inquiry undertaken by participants in social situations in order to improve the rationality and justice of their own social or educational practices, as well as their understanding of those practices and the situations in which the practices are carried out… The approach is only action research when it is collaborative, though it is important to realize that action research of the group is achieved through the critically examined action of individual group members." (Kemmis & McTaggart , 1988)
- "It is an approach to improve your own teaching practice. You start with a problem you encounter. Faced with the problem, the action researcher will go through a series of phases (reflect, plan, action, observe) called the Action Research Cycle to systematically tackle the problem. Usually you discover ways to improve your action plan in light of your experience and feedback from students. One cycle of planning, acting, observing and reflecting, therefore usually leads to another, in which you incorporate improvements suggested by the initial cycle. Projects often do not fit neatly into a cycle of planning, action, observation and reflection. It is perfectly legitimate to follow a somewhat disjointed process if circumstances dictate." (Center for Enhanced Learning and Teaching, 2009, para. 4).
- Action research...aims to contribute both to the practical concerns of people in an immediate problematic situation and to further the goals of social science simultaneously. Thus, there is a dual commitment in action research to study a system

- concurrently with collaboration among members of the system in changing it in what is together regarded as a desirable direction. (Gilmore, Krantz, and Ramirez, 1986)
- Action research is also called other names such as: participatory research, collaborative inquiry, action learning, and contextual action research. All are variations on the same theme. In essence, action research is a form of problem solving: a problem is identified to work on, with the aim to improve or to solve it. The researcher gathers information on the problem and tries out new procedures or makes some other change in practices to see if they result in a solution. Often, a group identifies a problem, does something to resolve it, and assesses how successful their efforts were. If they are not satisfied, they try again. This form of research has a history that is rooted in problem solving in social and organizational settings.

History of Action Research

The term action research was introduced by social psychologist, Kurt Lewin. In his paper, "Action Research and Minority Problems," published when he was a professor at MIT, he described action research as "a comparative research on the conditions and effects of various forms of social action and research leading to social action" that uses "a spiral of steps, each of which is composed of a circle of planning, action, and fact-finding about the result of the action."(Wikepedia 2009, para. 3)

It is because of Kurt Lewin that action research was associated with research where the goal was to promote social action through a democratic process and have active participation of practitioners in the research decisions. Action Research flourished

through the 1950's under Stephen Corey at Teachers College, Columbia University (Feldman, 1994). Later, in the 1960's, action research was not as popular because it was associated with radical political activism, and there were concerns about both the level of rigor used and the training involved for those who lead action research projects (Stringer, 1999). In the 1970's, action research reemerged under the influence of Laurence Stenhouse and John Elliott in Britain. The emphasis shifted to that of practical deliberation, focusing on human interpretation, negotiation and detailed descriptive accounts in place of measurement and statistical analysis (Center for Enhanced Learning and Teaching, 2009, background of action research). In the 1980's action research gained popularity once again, partly due to the work in Britain, but also because of the tradition that was started by Lewin and Corey in the US (Feldman, 1994).

Groups doing action research include field workers, teachers, administrators, and supervisors. The goal has been to change and improve practice. It is usually seen as a group process enabling cooperative work to influence both thought and action among the group members. Action research has become a form of research that describes how humans and organizations behave and it has also become a change mechanism, helping people and organizations reflect on and enact change (Reason & Bradbury, 2001). Since its inception, there have been many key people studying action research. There are hundreds of books on the subject and numerous web sites.

Educational Action Research

In educational settings there are a variety of action research methods available to

use, depending on the group and the goals that are identified. It can involve a single teacher investigating an issue in his or her classroom, a group of teachers working on a common problem, a team of teachers working with others focusing on a school, or an even larger group working on a district-wide issue. Ferannce (2000) classifies these different types of action research as follows:

Individual teacher research usually focuses on a single issue in the classroom. The teacher may be seeking solutions to problems of classroom management, instructional strategies, use of materials, or student learning. The problem is one that the teacher believes is evident in his or her classroom and that can be addressed on an individual basis. The research may be such that the teacher collects data or might look at student participation. One of the drawbacks of individual research is that it may not be shared with others unless the teacher chooses to present his or her findings at a faculty meeting, a presentation at a conference, or by submitting written material to a journal. It is possible for several teachers to be working concurrently on the same problem with no knowledge of each other's work. The major focus of this dissertation is individual and faculty-mediated action research.

Collaborative action research may include as few as two teachers or a group of several teachers, along with others interested in addressing a classroom, a department, or a school-wide issue. This issue may involve one classroom or a common problem shared by many classes. Teachers may have support from individuals outside of the school, such as a university or a community partner.

School-wide research focuses on issues common to everyone in the school. For

example, a school may have a concern about the lack of parental involvement in activities and is looking for a way to reach more parents to involve them in meaningful ways. Or, the school may want to address its organizational and decision-making process. Teams, from the school staff, work together to narrow the question, gather and analyze the data, and decide on a plan of action. An example of action research for a school might be to examine its state test scores to identify areas that need improvement and to determine a plan of action to enhance student performance. Teamwork and individual contributions to the goal are very important in this form of action research. Problems can easily arise as the team tries to develop a process and make commitments to each other. Though challenging, there is a sense of ownership and accomplishment in the results that come from a school-wide effort.

District-wide research is more complex, utilizes more resources, and is shared by more people. Issues can be organizational, community-based, performance-based, or focused on decision-making processes. A district may choose to address a problem common to several schools or to examine a problem of organizational management. Potential disadvantages are the amount of documentation and communication required to keep everyone in the loop and the work involved to keep the process in motion. Collecting data from all participants requires a commitment from the staff to do their fair share responsibilities and to meet agreed-upon deadlines for assignments. An advantage is school reform and change built upon common understanding and inquiry. The involvement of multiple groups can provide fuel for the process and create an environment of interested and motivated members as well.

There are different models used in the teaching profession for conducting action research. By considering some of these prominent models and posing questions about them, we can gain a better understanding of how and why to participate in this type of research.

Action Research for Teachers - Definitions, Models, and Examples

Allan Feldman provides a definition of action research. "Action research happens when people research their own practice in order to improve it and to come to a better understanding of their practice situations. It is action because they act within the systems that they are trying to improve and understand. It is research because it is systematic, critical inquiry made public" (Feldman, 2002, p. 240). Feldman explains that action research can help to develop a professional community, illuminate the power of relationships in educational situations, and help one recognize their own expertise.

Dr. Michael Brody, a professor at Montana State University, has overseen numerous teacher action research projects in the field of science education. He states that, "Action research is the reflexive process by which educators systematically study their problems in order to guide, correct and evaluate their decisions and actions regarding the improvement of teaching and learning in their individual professional context. Action research is a collaborative, cyclical process of: strategic planning, action, implementing the plan and observation, evaluation and self-evaluation, critical and self-critical reflection on the results and change in social, cultural, political systems" (Brody, 2006).

Mills (2003, p. 4) gives the following definition of teacher action research:

"Action research is any systematic inquiry conducted by teacher researchers to gather information about the ways that their particular school operates, how they teach, and how well their students learn. The information is gathered with the goals of gaining insight, developing reflective practice, effecting positive changes in the school environment and on educational practices in general, and improving student outcomes."

In the research literature, it is clear that various models or working definitions of action research exist. However, all of them capture the same concept, some have more steps and articulate them more fully, but the essence of learning through action, gathering data, reflecting on the outcomes, and reworking as needed exist throughout. Thus, for the teacher or educator, a few models for doing action research are presented here:

Model 1

Identify the problem - find the general or initial idea

Evaluate the problem - observe, survey, investigate the problem

Make a recommendation – make a plan

Practice the recommendation – take the first action step, try it out

Reflect on the practice - evaluate the recommended practice or action step

Reevaluate if needed - modify the plan, take a second action step if needed i.e. another iteration (Gorski, 2006).

Example 1

An example using this model was documented in a geology class where the teacher noticed that the students were not very interested in the subject. The teacher was

teaching out of the textbook, and his students were not performing well on the subject exams. The problem was *identified*: as the lack of student interest in geology. An *evaluation* was done, by examining test scores and work relative to other subjects. An anonymous survey given to the students confirmed the proposed problem. The teacher met with other geology teachers at the school to discuss this problem. A few recommended doing some hands-on activities and field trips to interesting geological sites or museums. The *recommendation* was made to take two geology field trips. The *practice* took place. The teacher took his students on two field trips over the next month. One was close to school grounds and the other was a trip to the local museum. The teacher took notes, making observations after each field trip. A month later the teacher gave an exam and the students performed better. He did a follow-up survey and found that the interest level had gone up in geology. He felt he had positive results but did not want to confirm any biases he might have and did not want to rely only on his survey and impressions. After the field trips the teacher *reflected* on the actions, surveys, and the grades students received. In his *reevaluation* of the problem he decided to try to have three geology-based field trips that year, and to include more hands-on materials and specimens in the class when learning about this subject. He continued to take notes on student interest and student performance on this subject. Improvements in attitude, interest, and achievement were made.

Model 2

Plan - Act - Observe - Reflect. This comes from Kemmis and McTaggart (1988).

Example 2

An example using this model comes from two mathematics teachers, each of who taught two sections of the same mathematics course. Both noticed that their first period classes did not do as well as their second period classes. The first period classes were early in the morning and early in the afternoon, respectively. The two teachers met and made a *plan* to change the tests in their second periods, thinking that maybe the increased performance was because students from the earlier period were sharing information with students from the later period. The teachers *acted* by giving the new tests. They *observed* the results. Their first period students still did not do better than their second period students on the new tests. They *reflected* on this outcome and couldn't understand what might be causing this situation. In the next iteration, the teachers met with their first period classes in an open discussion explaining that the earlier class was not doing as well. Some students offered that they are tired and not yet fully engaged first thing in the morning and just after lunch. Together, the class and the teachers decided to try a plan of having some warm-up problems the first 10 minutes of class to get the students engaged in and focused on doing mathematics. Both teachers found an improvement in the grades by following this plan. The four classes became about equal in student performance. This is an example where the teachers were misled by their biases and by working with their classes found the real problem and a solution.

Model 3

Look - Build a picture and gather information. Define and describe the problem to be investigated and the context in which it is set. Describe what all the participants

(educators, students, faculty, etc.) have been doing.

Think - Interpret and explain. Analyze and clarify the situation. Reflect on what the participants have been doing. Look at areas of success and any deficiencies, issues, or problems.

Act - Resolve issues and problems. Judge the worth, effectiveness, appropriateness, and outcomes of the activities. Act to formulate solutions to any problems. Repeat the cycle as needed. (Stringer, 1999, p.18; 43-44;160)

Example 3

In this example, the school staff and faculty decided to gather weekly for an hour during the school day. Because Fridays were early release days, an hour was designated on this day for professional development. The principal and teachers were concerned about the level of violence and misconduct in the school. Teachers brought data on incidents that occurred in their classes. The principal shared other reports of problems that came through her office. The staff and faculty *looked* at both sources of data. They discussed the students who were clearly acting problematically. They tried to define and describe the disruptive situations and the contexts in which they happened. Descriptions of what all the participants (staff, students, and faculty) had been doing were written. Next came *thinking*. The staff and faculty tried to interpret and explain these situations. How much did these incidents have to do with the students, how much with the setting at school, and what role did the situation itself play, i.e., were there triggers that happened which set these students off? In analyzing and clarifying the incidents, suggestions were made. Maybe these students felt marginalized, or maybe they needed extra attention,

tougher rules and consequences, etc. Further reflection on what the teachers had been doing revealed that perhaps the teachers were treating the troublemakers differently and this was also exacerbating the situation. Looking at areas of success, they found that when the students were closer in proximity to the teachers, the incidents did not happen as often. The staff and faculty decided to try a few different plans. *Action* was taken. The teachers and principal came up with unified procedures for misconduct and shared these with all of the classes, so the students clearly understood the rules and that these rules would be applied consistently. The school began a program of emotional and social development. It included conflict resolution, and letters were sent home, informing parents about the program and its goals. Half of the teachers tested an intervention that brought the students who were acting up closer to them by appointing them their aides in class. By having clear rules, providing education and outreach, and having the students be teachers' aides, resolutions to the problems were attempted. The staff and faculty continued to meet weekly to share how the interventions were coming along. They found that the teachers who made the problem students their allies had better results than those who did not. This was seen in attitudes, performance, and the frequency of incidents with these students. In judging the worth, effectiveness, appropriateness, and outcomes of these activities (rules, education, outreach, and aides) the faculty and staff decided to have aides in all their classes. The weekly faculty and staff meetings continued, providing a time and place to discuss and collaborate on problems that arose in the school.

All three models capture the essence of action research and it is possible to choose

from any of them. They all fit with Ferrance's classifications; so whether a teacher, a group, a school, or a district engages in action research, all of these models can be appropriate. An advantage of action research is that the project and how elaborate it is depends on who is conducting it and what they are doing. It is a customized methodology that can be kept quite simple or become very elaborate depending on those involved and how they want or need to proceed.

How Action Research Differs From Other Types of Research

Action research differs from other types of research in at least four ways. First, it embeds the researcher into the practices of the people involved. The teacher-researcher is inclined to learn more and be more willing to apply what he or she learns, when they do something themselves. So action research has a good chance of changing teacher practice. Second, action research has a social dimension often not seen in other forms of research. The research takes place in everyday situations and is aimed at improving everyday problems in the classroom or in the school. Third, the initiating researcher does not need to remain completely objective. They can openly acknowledge their biases to other participants. Fourth, this type of research is more likely to have lasting effects on the group involved because often the group is involved in the change that is taking place. Like behavior modification, practice helps pave the way to a new method or assists in enabling the change that is desired.

John Elliot argues that educational action research has some features not present in other forms of research: "It has a pedagogical aim which embodies an educational

ideal and which all those participating are committed to realizing. It focuses on changing practice to make it more consistent with the pedagogical aim. It gathers evidence about the extent to which practice is consistent or inconsistent with the aim. In identifying inconsistencies between aspiration and practice, it problematises the assumptions and beliefs (theories) tacitly embodied in the latter. It involves teachers in a process of generating and testing new forms of action for realizing their aspirations, and thereby in reconstructing their practical pedagogical theories. It is a pedagogical process characterized by teacher reflexivity. From an action research perspective, teaching is a form of research and vice versa". (Elliot, 1994, p.136)

As with any type of research, problems exist with action research as well. Shirley Grundy (1994) explains that it is necessary to understand that the improvement of the quality of education is a responsibility for the school community as a whole. The importance of school community will come up again in the findings that school environment is key to sustained action research. It is not sufficient to think of such improvement as a collection of the work of individual teachers doing their own action research. She also argues that this kind of research offers a set of principles upon which the work of improving the learning environment of a school can progress. She considers some examples of whole school action research initiatives that include possibilities and problems associated with school level action research. She finds that there can be problems associated with state-initiated action research projects. Like any research it is important to consider the possible outcomes from a variety of different perspectives and to think critically about the impact on those involved.

In conclusion, Grundy states, with an emphasis on scientific study, the teacher-researcher is not conducting general professional practice, consulting, or daily problem solving. It is very important to study the problem systematically and to make certain that the intervention is informed by theoretical considerations. Much of the researcher's time needs to be spent refining the methodological tools to suit the needs of the situation. Collecting, analyzing, and presenting data in ongoing, cyclical iterations is part of the work involved. These are the components that are critical in conducting accurate action research.

Professional Development and Action Research

In doing a web search for literature on professional development and action research it is immediately evident that a plethora of books exists on the subject. Yet, it appears these books have not made it into the hands of as many administrators or teachers as would be useful and beneficial.

At an international conference on teacher research, Frances Rust (professor, Department of Teaching and Learning at New York University) argued that action research or teacher research is the "best form of professional development I have ever been involved in." By making time for action research in busy teachers' schedules, this treats teachers as professionals and stresses that we need to do that. When teachers are involved in their own problem solving inside their own classrooms the gains are better and greater. Whether doing action research or teacher research, the distinction is merely a matter of semantics since both inform and aim to improve practice and the teacher

learns to ask questions.

North Central Regional Educational Lab states that, evaluation of professional development efforts need not be a terribly complicated process requiring the assistance of outside experts. Mullins (1994) notes that teachers, counselors, and other professional staff can provide important information concerning the appropriateness of topics and the effectiveness of staff developers. Action research is an example of a powerful evaluation process that typically can be conducted by the school faculty with little or no outside assistance. Calhoun (1994) suggests a five-phase evaluation cycle: (1) selecting an area or problem of collective interest, (2) collecting data, (3) organizing data, (4) analyzing and interpreting data, and (5) taking action based on this information. Data is then collected again to determine the effectiveness of these efforts.

Further, David Townsend (2000) proclaims that action research allows teachers to engage in professional development, model problem solving for their students and their colleagues, prepare excellent records of their professional development plans, and develop high levels of expertise in selected areas of curriculum, instruction and organization. It's a proven way for teachers to take greater ownership of their continuing education and their school and district professional development agendas.

In Rock & Levin (2002) research investigated how collaborative action research projects affected five pre-service teachers' professional development while working with on-site teacher educators within a professional development school. Data from interviews, conferences, journals, action research, student writings, and field notes indicated that these experiences helped pre-service teachers gain valuable insights about

themselves as teachers, students, curriculum, teaching, and teacher roles and responsibilities. The study found that collaborative action research projects enhanced pre-service teacher development in professional development schools.

We now turn to the themes that emerged in the literature: validity, benefit, practicality, and continued practice.

Validity

Example 1

In Feldman's paper, "Erzberger's Dilemma: Validity in Action Research and Science Teachers' Need to Know", he describes a group of physics teachers who meet regularly to discuss their teaching, their knowledge of physics, and to engage in a systematic inquiry of their teaching. One of the teachers, Erzberger, is paying close attention to what she has asked her students to do and how they've responded to her assignments and requests. She feels successful but she wants to know whether what she is doing differently this year is more effective than what she has done in the past. Her dilemma is, "The data that she collects, or that others collect for her do not meet the warrants for validity that she expects from her work in the physical sciences. She is caught in a void between the uncertainties of the observations made in practice and the demands that she puts on propositional statements before she will accept them as knowledge. The dilemma that she is faced with is that she wants to inquire into her practice to gain a better understanding of her educational situation and to get better at what she does, but yet finds teacher-research, and particularly action research, inadequate

to the job. Why should she attempt to be more systematic? What does she gain from interviewing students or analyzing tapes of her lessons?" (Feldman, 1994, p. 5) This dilemma is not unique to Erzberger and gets at the problem many teachers face.

Feldman continues to describe this predicament as being driven by a "need to know" on the part of the teacher. For the teacher-researcher there is a strong "need to know" regarding the work they do. They seek both new understanding of their educational situations and valid reasons for their actions (Feldman, 1994). Teachers feel a "need to know" in order to pursue good practices. Many teachers are concerned about what to do, how to do it, and have a desire to increase the intellectual, political, and moral growth of their students.

Feldman discusses the challenge, "how to do this in a way that adequately tests the hypotheses with limited data about a highly particularized and fluid situation" (i.e. teaching) (Feldman, 1994, p. 8). According to Winter teachers engaged in research collect data which they use to gain new understanding of their educational situations and to have defensible reasons for their actions (Feldman, 1994). One problem is that if the sample size is small, it may undermine the value of any conclusions. He claims this is a problem if one is using a positivistic epistemology (theory of knowledge which assumes that reality is objective against which researchers can compare their claims and ascertain truth).

How can a teacher prove something if the sample size is small? The teacher-researcher stands to be criticized. Feldman suggests that perhaps this is not the best epistemology for the action researcher to use. Maybe the goal is less, "prove to others based on large numbers," and more, "show and experience improvement where needed

and share this experience with others". It is therefore a problem to use methodological criteria from other fields of research that are not an appropriate fit.

Criticism of the Validity of Action Research

There is a perception that action research lacks rigor. Keating discusses a belief that exists about teachers not being qualified to design objective studies with the clear direction that is needed (Keating et al., 1998). As Feldman and others so eloquently discuss, part of the beauty of action research is that it does not need to be objective in this way and that teachers are perfectly qualified to conduct this kind of research. Teachers, in fact, are exceptionally well situated to carry out action research. Learning to design studies with clear directions is something that any practitioner learns with time and experience.

Toulmin (1982) argued that studies should be formed from positions that are rationally warranted, reasonable or defensible, i.e. well founded rather than groundless opinions. The examples of action research discussed in this chapter, made sense, were reasonable, defendable, and well founded. All had very clear outcomes that were not based on groundless opinions.

Isaac and Michael (1987) noted that action research lacks scientific rigor because its internal and external validity is weak ... with little control of independent variables. They discuss the issues of internal and external validity.

In summary of the previous results, action research is best not viewed under the same light as other forms of research where the goal is to prove a result that is

reproducible. Part of the advantage of this type of research is that it does depend on the particular group and it is timely. Since the researcher does not have to prove something is right or wrong or reproducible, a collective effort is legitimate in obtaining progress. Further, if a teacher is trying to improve their own practice or their students learning, some of these issues of validity are not appropriate. Thus, action research can be customized for the individual, the group, the school, or the district to make progress on pertinent issues facing them.

In a similar criticism, Applebee (1987) suggests that teachers are part of, rather than removed from, the context and therefore lack objectivity. Applebee's point about objectivity has been addressed earlier in that it's okay to not be completely objective. There is benefit too in not being totally removed from the situation you are studying. The three criticisms above come from Keating et al.'s article.

It is important, to counter these concerns, and any others, by assisting teachers in acquiring direction in the process of doing research. This can be obtained through course work, in-service training, and by guiding the experience. Teacher preparation programs are ideal situations in which to provide this training (Keating et al. 1998).

The literature is quite strong in its support of the idea that action research is valuable and could even be a critical piece in elevating the teaching profession to a new and much needed rank in American society. In Japan, teaching holds greater status, higher pay, and teachers actively engage in improving their practice through collaborative, reflective, group effort and meetings (Stigler & Hiebert, 1999). Action research appears to help improve the experience and outcomes for teachers and their students. If enough teachers engage in action research, maybe our society could see a

real benefit, not from the top down, but from the people in schools, who know best the problems they face and how they might fix them given the opportunity. Perhaps, action research provides the right tools for fixing problems in the classroom. Working with experienced people makes a difference too, especially when learning how to engage in action research for the first time.

Suggestions for Increasing Validity From the Literature

Patti Lather suggests constructing research designs that demand vigorous self-reflexivity. Four ways to encourage this are: triangulation, construct validity, face validity, and catalytic validity (Lather, 1991). Triangulation involves using multiple sources of data and multiple perspectives. The theory is that if you look at something from a few different angles, you will see a clearer and more accurate picture. Construct validity refers to awareness by the researcher of the ways in which theories and other constructs are created. Face validity means realizing that what is being described or explained rings true. And catalytic validity represents the degree to which the research process focuses and reorients participants toward knowing the situation in order to transform it, energizing the participants (in Feldman, Lather, 1991).

Feldman discusses one problem of an insider doing research; we are biased and nonobjective. One cannot be a dispassionate outsider finding objective truths in action research. The object of the research is the educational situation. Thus, the researcher, the research, and the teaching are usually immersed into one. This has benefits and we need to acknowledge that this is the situation. This is the setting for the researcher as a teacher in their own classroom, and it is different from other forms of research.

Further, in physical sciences there is an assumption that if research is repeated a number of years later it will likely elicit the same or similar results. However, in the social sciences if a study is repeated it is not necessarily possible to make the same generalized conclusions. Though we may like to assume both branches of science work the same way, they do not. The community that the ethnographer studies changes with time as people interact and the ecosystem fluctuates. It is important to keep in mind that the purpose for the teacher engaged in research is to come to a better understanding of educational situations that will thus improve his or her practice (Feldman, 1994). The emphasis is on the present situation. The ethnographer focuses on what has happened, and the teacher focuses on what is happening. They are reflecting in practice, not on practice.

Gone should be the need for the type of data and analysis that is part of standard research in the social sciences. The teacher-researcher does not need to *prove* or to *generalize*. They are able to examine avenues to project from their educational situation in ways that will generate new educational situations. These situations include others in a manner that allows for a merging of goals, understandings, and practices - visions reached together. The task becomes to test an action and to see if the modified situation is what was envisioned. If not, a new iteration of the research occurs, with another cycle of - the three, the four, or the six-step method. The teacher-researcher proceeds via continued discourse with the situation at hand, to gain a better understanding of it, and to improve his/her own practice.

Elliot (1991) addresses this issue of validity of data in his book, *Action research for educational change*. He recommends increasing validity by, "(1) Monitoring

techniques that provide evidence of how well the course of action is being implemented and (2) using techniques that provide evidence of unintended as well as intended effects, "using a range of techniques that will enable one to look at what is going on from a variety of angles or points of view" (Elliot, 1991, p. 76). It is important to present alternative descriptions, interpretations, and explanations of events and practices in one's action research. For example, crosscheck (or member-check) eyewitness accounts of events and observations. Give individuals opportunities to reply to accounts of their activities and views, and have them incorporated into documents and reports. Consult individuals about the contexts in which their actions and views are represented and reported. (Elliot, in Feldman, 1994)

By taking these steps to enhance validity, ownership of data is brought to the forefront of the research exhibiting the democratic process and collaboration involved as well as the contributions of the individuals.

Altrichter and Posch (1992) have four criteria for conducting educational action research (1) consult alternative perspectives - consult with other persons concerned or other researchers, (2) test through practice - try results out and evaluate them in practical action, (3) ethical justifiability - have the research process be compatible with educational aims and human interaction, and (4) practical compatibility - have a research process and instruments of investigation structured such that it can be used by professional practitioners for the further development of their practice without excessive additional time. Here is the addition of ethical considerations and practicality so that others may gain from and use the research is valued. Triangulation and testing or monitoring are still part of the key ideas to enhance validity.

Summary of Findings on Validity

Because action research is a cyclical process of challenge and refinement, the recommendations from research for increasing validity can be combined into a single framework for action research.

Monitor & Test through practice - Carefully track what is being implemented. Try results out and evaluate them.

Intended and unintended outcomes - Note the outcomes, all of them.

Triangulate & alternative perspectives - Gather data several different ways if possible and consult with other people concerned or other researchers. Alternative perspectives can act as a validity group with which to check your research plan and progress.

Ethical - Have high ethical standards in the work being done.

Group involvement - Welcome and report all views and perspectives.

Member checking - Check data with the person it is gathered on.

Practical - Structure research so others can benefit from it.

With these precautions, if the researcher can be confident that the validity of her or his work is increased and it will be more substantial. With improved validity, the research is more beneficial because it is more accurate.

Benefit

Example 2

An ongoing example of beneficial educational action research is seen in the work of Lipka, Mohatt, and the Ciulistet (teacher-leaders) Group. They work on incorporating Yup'ik language of instruction, pedagogical approaches to teaching, the use of Yup'ik

knowledge for the teaching of mathematics and science, and recognition and inclusion of Yup'ik community members in matters affecting schooling. Yup'ik teachers, work together in the Ciulistet group and in collaboration with outside researchers. They find ways to build on and to improve their schools. While the examples are specific to Alaskan Native culture, the process and practices can be exemplary and inspirational for teachers and situations elsewhere.

The Ciulistet group is a collaborative community-based action research group including elders as well as teachers. Its goal, is "the inclusion of ancient knowledge, Yup'ik ways of knowing, and ways of connecting this knowledge to modern schooling... to create a contemporary and compatible system between the two" (Lipka, 1998, p. 26-27). There is a need for indigenous teachers to organize in groups, work with the local community, document and analyze their experiences, and share this with others. Many of the teachers have stories that describe what oppression felt like by often well-meaning but ignorant instructors, and how these teachers have worked around and overcome obstacles to create classrooms and curricula that work, for them, for their students, and for their communities.

When working on developing a Yup'ik immersion program, the action research group invited outside experts in bilingual education to audio conference with school, community, and university participants to decide if Yup'ik or English should be the first language of instruction. The community-based meetings were instrumental in opening these issues to the school district. They used community surveys, interviews, and group discussions on the community's preference of language. After the data was collected and analyzed, the group met again to discuss its implications. The outcome was that the

community strongly supported a bilingual program, and wanted to begin with a Yup'ik immersion program. They also actively attempted to put into practice what they were learning from their group meetings about their classroom practices.

The collaborative action research project included organizing and encouraging community interest in achieving a Yup'ik immersion program, conducting community-wide interviews regarding the desire of the community to have a Yup'ik immersion program, and recording their meetings with the community, school, and the university. The analysis of this action research showed important differences in perception about the role and function of Yup'ik language instruction. This phase of work resulted in difficult political questions about power and legitimacy. After the Yup'ik immersion program was instituted, the research agenda changed. The new question became, "What does Yup'ik everyday and subsistence knowledge have to do with schooling?" This can be seen as the next iteration in their action research.

Some of the benefits have been the following. The process of documenting Yup'ik teachers teaching Yup'ik children has led to a number of publications and has reinforced these ways of teaching as legitimate. By including certain school district personnel in meetings, recognition of cultural differences in teaching is seen as an acceptable alternative. The development of pedagogical and content approaches emerging from Yup'ik traditions and ways of knowing has had a positive impact on the schools. Today, the local school district includes these ways of knowing as part of its district's goals and objectives. The inclusion of Yup'ik teachers and elders demonstrating this knowledge to others is a sign of this change. Elders have commented that knowledge that was hidden is now being revealed. This is directly due to the changing role that the

elders have in relationship to schooling. Now, their knowledge is not only being revealed, it is valued. (Lipka, 1998) The group has developed Math in a Cultural Context (MCC), a supplemental elementary school mathematics curriculum. MCC brings local knowledge into a core academic curriculum. This project has been a success on multiple levels: repeated findings show that classes using MCC's modules outperform classes that use the existing curriculum. The data, quantitative and qualitative, shows the overall impact of MCC in closing the gap between rural Alaska Native students and their urban counterparts.

Through 14 years of collaborative work, the Ciulistet, elders, school administrators and university consultants have demonstrated and documented that cultural differences don't need to be viewed as a barrier to schooling, but can be an asset. With many more Yup'ik and other indigenous teachers working together in formal and informal groups, they believe a difference is being made that is having a positive impact on students. Standardized test scores and grades reflect this positive improvement. Parents and community members have requested that they continue their work of bringing this knowledge into the schools. Through their action research, this group is evolving a bilingual/bicultural educational system, creating equal education for all.

Natural Consequences of Action Research that Provide Benefit

Because of the personal involvement with the data, the teacher-researcher is likely to find more satisfaction with the research being conducted. It is an ideal opportunity to engage in research in one's own practice. This supports with the intrinsic reason for pursuing research – the "need to know" that Feldman writes about. The desire to look at

the effectiveness of ones own practice. To be able to work on the development of one's practice allows for valuable gains to be made. Further, being able to test hypotheses while teaching is natural and critical for the teacher. Testing through practice is a logical process for the teacher-researcher (Feldman, 1994)

Because the teacher-researcher is in the classroom, they have more experiential knowledge - the knowledge that is gained from being there in the field. While being in a situation does not mean one has a privileged view necessarily and, of course, different people have different views, there is no one view or one right view. However, by living an experience in a particular context, the epistemic privilege grows (Feldman, 1994). Teachers have this privilege because they have a view of what happens in schools that an outside researcher does not. So, how does the teacher with this privilege know that their view is an accurate one? This goes back to the drive and the "need to know" for a teacher that Feldman discusses.

As a researcher, the teacher is conducting self-developmental research and insider research. The research is being turned on the researcher. Cochran-Smith and Lytle state, "Teacher research is concerned with the questions that arise from the lived experiences of teachers and the everyday life of teaching expressed in a language that emanates from practice. Teachers are concerned about the consequences of their actions, and teacher research is often prompted by teachers' desires to know more about the dynamic interplay of classroom events" (in Feldman, Cochran-Smith & Lytle, 1993 p. 59).

By having the opportunity to gain a better understanding of one's educational situation as a teacher-researcher, one can increase their knowledge and improve their practice. As a result of research, one can generate new knowledge about their role as a

teacher and learn to better perform their role by gaining personal understanding of what it is they do and the situation within which they do it (Feldman, 1994). This beneficial new knowledge about one's own teaching practice is part of what we are interested in for this dissertation. We want to see what the graduates have to say about what they learned and gained from doing action research. According to Shulman (1992), the teacher stands to gain by becoming a contributor to the knowledge base of teaching, provide other teachers with an opportunity to share in the knowledge that they have gained in their research, and receive critical feedback, along with concrete knowledge in the "need to know." As a teacher, case research reports may be valuable to others in the field. The opportunity for the teacher researcher is that they can work with their students, faculty, or school towards a common goal. Instead of trying to shift the other's paradigm, they get to work together towards a common paradigm. These are the benefits action research can offer that other forms of research cannot.

Summary of the Findings on Benefit

Listing Shulman and Feldman's work, teachers using action research will find it more beneficial if they:

- Structure case reports so they can be of value to others.
- Are able to contribute to the knowledge base of teaching.
- Improve their practice by sharing information that is learned.
- Get opportunities to receive critical feedback.
- Fulfill the "need to know" with concrete examples and results.
- See that even case research reports may be valuable to others in the field.

- Have the opportunity to work with students, faculty, or a school towards a common goal.

Practicality

Example 3

Norman Weston (1998) writes about the Illinois Alliance of Achievement Network (IAAN), a group that was formed with the assistance of grant money from the Chicago Annenberg Challenge, along with the Academic Development Institute, three Chicago public schools, and the Chicago Teachers' Center. This project enabled over one hundred K-8th grade teachers to come together to display, discuss, and exhibit their research. The event represented the results of over forty, group and individual, action research projects. Examples of work included project reports, photographs, charts, graphs, newly developed teaching materials, informational handouts and videos. The topics covered homeless children, imagery and its positive effects on education, connecting mathematics with musical sounds, writers workshop, the student as storyteller, creating a web page, a study of test preparation materials, integrating music with study of the planets, buddy reading for emergent readers, oral language development and critical thinking, multiple intelligences and learning centers, motivating writing through art, letter writing to promote self-esteem, and peer tutoring, to name a few.

At the end of the day of sharing, many teachers said they had been inspired both by the projects and by the interactions with their Alliance colleagues. One teacher said, "It also was beneficial for me to be exposed to all these great ideas. It recharges and motivates me to try some in the new school year." The facilitator of the event stated, "It

was energizing to see how meaningful these projects were to the teachers who worked on them. Walking from exhibit to exhibit, I was impressed by the quality of work and the knowledge gained from every project. Teachers became engaged in meaningful reflective dialogue about what worked and what did not. Teachers also came away from the conference as active learners. The excitement and curiosity to learn became contagious." The event capped off the first year of a long-term project designed to promote the concept of learning communities within and between the three schools. (Weston, 1998)

In this project they found that action research fostered an increased sense of community in schools. Inner city teachers in the Chicago Public Schools become involved in teacher action research, sharing their teaching practices and growing professionally.

Weston (1998) explains that the IAAN's goal was to create a network that would help to break down the traditional hierarchical structures that usually exist in large urban schools and to replace them with smaller, more intimate groupings of teachers, students, parents, and staff. The belief is that teachers, parents, and students, learn better in small more personalized settings. In pursuit of this vision, three Chicago Alliance schools, (Bethune Elementary - 560 students, 98% African American. Piccolo Elementary - 930 students, primarily Hispanic and African American. And, Spry Community School 850 students, predominately Hispanic) engaged in the three-year project. The goals were to create a number of smaller "schools", i.e. groups of teachers and students, within the larger school, provide training in action research to help the small schools and groups achieve their goals, and to unite all of the small schools and groups within the three larger

schools into a network of learning communities.

Specific action research goals were to "generate educational initiatives which draw upon the expertise and creativity of faculty to achieve the school's instructional focus," and to "assess the effectiveness" in achieving those goals. Crucial to the success of the project was a team of substitute teachers who were hired so that schools could release its regular teachers (two hours in the afternoon for six days over the course of six months) to learn about, design, and conduct action research. As part of the larger project, the substitute team would also be involved in creating parent education programs and community-sponsored, after-school programming for students. While the grant money allowed for this to happen, the action research was still a valuable springboard to spark and enable change to occur. The question arises though how can action research be initiated and sustained on a significant scale in a school or district when grant money is not available?

Two of the schools in the project were on probation for having lower test scores. The question was asked, how practical is it to do an action research project when you have to be concerned about raising test scores? After a short period of discussion where the teachers used words like "humiliated," "intimidated," and "denigrated" to describe how they felt about being on probation, the conversation returned to what they wanted to do for their action research projects. The approach of allowing individual teachers and small groups to choose the area they wanted to research was invaluable. In the end, some teachers and groups did focus on test-related problems.

The experience of the three Chicago Alliance schools supports the notion that teachers must play a major role in selecting topics for their research - including topics

that the research consultant might not be especially excited about. Trust and belief in both the teachers and the principles and processes of action research are necessary preconditions for real and lasting school reform. As one teacher remarked "I see action research as the 'wave of the future' for school reform because it comes from inside the school, from the bottom up, not being told this is what we have to do by somebody else." This is the best way for reforms to work. (Weston, 1998)

Real and lasting change takes time. It often takes as long to create the conditions for change as it does to implement the change. In the initial year of this project, a lot of time was spent on getting teachers to feel comfortable - with each other and with the action research process. It was clearly a necessary step for the teachers to take to be able to commit to the project. Central to establishing comfort, trust, and commitment was having teachers choose their own topics to research. Action research can be an antidote to what is negative in the teachers' professional lives.

Teachers in the three schools enthusiastically embraced the concept of action research in the very first year of the project. This example suggests that increased teacher autonomy has a major role to play in creating and sustaining long-term educational improvement. Teachers' evaluations of the project revealed consensus around four themes: satisfaction in knowing that this was their own work, the value of meeting regularly with other teachers to discuss practice, a desire to connect more often with other Alliance schools, and the desire to meet together in their particular groups more often. (Weston, 1998)

Natural Consequences of Action Research that Increase Practicality

One of the practical benefits of reflecting upon their actions is that "professionals enhance their learning and add to their 'repertoire' of experiences, from which they can draw in future problem situations" (Kernaghan, 2006, p. 2). Schon believed that this ability to reflect both in and on action is what separated the effective practitioners from the less effective ones (Kernaghan, 2006, p. 2). While Dewey and Schon believed that people learn by doing, Dewey felt knowledge is gained by reflecting on action afterwards and Schon felt that knowledge is gained in reflecting on action while doing it. In action research one has the opportunity to learn by doing as well as by reflecting. Schon believed that in order to educate the effective practitioner, one uses knowledge-in-action by self-instruction, apprenticeship, and mentorship. Action research has the ability to give teachers the opportunity to develop their practice and promote self-directed learning for both the teacher and the student. By bringing theory and practice together, enriched learning and informed change occur in a practical way.

Marilyn Cochran-Smith explains that because education and teacher education are "social institutions that pose moral, ethical, social, philosophical, and ideological questions... the teacher educator needs expertise and knowledge about a wide array of issues related to research and its role in the construction of wise practice and policy" (Cochran-Smith, 2005, p. 225). Action research gives the teacher this expertise and knowledge about research and its role in teaching.

When teachers rigorously plan, design, research, evaluate, and prepare teaching materials together, the result is higher-quality solutions to instructional problems, increased confidence among faculty, increased ability to support one another's strengths

and accommodate weaknesses, more systematic assistance for beginning teachers, and the ability to examine an expanded pool of ideas, methods, and materials (Fullan, in Schmoker, 2004).

Jean McNiff states that action research comes from a decision to investigate what you are doing with a view to improving it. The research questions have an underlying question, "How do I improve what I am doing?" This is a practical question whose answer will generate viable results applicable to the teaching situation. The intention is to help others based on these principles:

- You decide to investigate what you are doing with a view to improving it. This will help you to understand the situation more fully. Your developed understanding will help you to evaluate your work and change it as necessary.
- Your way of working might influence others; how can you show this? You do this by checking your perceptions of what is happening against theirs.
- You change your way of working in light of their perceptions. You negotiate this with them.
- Your collective agreement about these things helps you all to understand the situation better.
- You learn from colleagues, and they learn from you. They decide to try things out for themselves. They invite you to become their critical friend, and help them evaluate their work.
- Collectively you are now a community of inquirers. You have changed your social situation, and this is bound to have consequences for wider social contexts. Your individual 'I-inquiry' has turned into a collective 'we-inquiry'. You have moved

from ‘I’ to ‘we’ (McNiff, 2006).

Example 4

Another example of the practicality or applicability of action research to particular teaching/learning situations is seen with DIME (Dialogues in Mathematics Education). This example of action research comes from John Easley (2000). He led a team of clinical interviewers who worked directly with children to learn more about the ways primary-school children discover and talk about their concepts of number and the numeral system. The group came up with their own rules. They saw that it was important to remember a number of guidelines: divergent views should be respected, that everyone has something to contribute, that no standpoint is privileged, no one makes a second point until the group has a chance to discuss the first point, and that good learning activities can foster dialogue (Bertram & Easley, 2000). Because of the successful collaboration of the educational researchers, teachers, mathematicians and children, the collaborators learned from each other, and the research had a richness and inclusiveness that is not possible in other kinds of research. One finding was that there was a large gap between mathematics educators and children’s ways of thinking about mathematics (Bertram & Easley, 2000). It is the dialogue and other communications that occur in action research that build the bridges of collaboration and improvement within a community. What occurs is that by having a workable structure or model to follow with the goals, interests, and the concerns of those engaged in the action research, practical and useful outcomes are able to emerge. Furthermore, dialogue is an essential element. Not only does it enable the exchange of information but it also helps to define the

participation of the members.

Summary of the Findings on Practicality

The ability of teachers to reflect on their own actions and to collaborate, with the goal of improving teaching, a school, relations, and learning, are essential aspects of action research making it practical and applicable to the specific educational setting in which it occurs. Educational action research can be used by an individual teacher, a collaborative group of colleagues sharing a common concern, or by an entire school. Educational action research is practical because it:

- Creates the reflective practitioner
- Makes progress on school-wide priorities and issues that concern the teacher
- Builds professional cultures
- Professionalizes teaching
- Enhances the motivation and efficacy of the faculty
- Addresses the needs of an increasingly diverse student body
- Achieves success with "standards-based" reforms (Sagor, 1992)

It is important for the practitioner, the students, the school, and the district that the action research in which they engage is effective and feasible. A teacher can benefit from doing action research and find the time to do it if it is an integral and natural part of his or her day. Curriculum design, assessment, teaching practices, and other daily events of the teacher can be a part of action research that will help the teacher be more effective. It can be a natural part of mentoring, teacher-induction programs, and support programs - contributing to the culture and environment of the school, and to the success of the

teacher. As seen in the IAAN and the DIME examples, the opportunity to work together, to communicate, and to share ideas and experiences in practical ways can have far-reaching effects in the success of the teachers and students. It is with these types of research projects, conducted in pragmatic ways, that this work can sustain itself.

Continued Practice

Feldman and Atkin (1995) list the barriers and challenges to classroom action research as the following: the push toward standardization, an emphasis on assessment and accountability, budget pressures, and time. These are the prominent features of policy debates in education these days. Feldman and Atkin's view is that action research must become part of the "natural and regularized activities of the school." It needs to be self-sustaining and have a broad impact otherwise it will become a "historic curiosity" (p. 1). The situation is that the professional satisfaction must outweigh the prominent obstacles in today's schools. By having an association with "an identifiable, active, inquiring, and supportive community," a significant condition for becoming self-sustaining is established. The "sense of belonging to a like-minded and respected group, when added to the self-developmental features of action research.... begin to provide the kinds of conditions that are necessary for action research to become part of the ongoing professional lives of teachers" (Feldman & Atkin, 1995, p. 8).

Teacher enthusiasm, energy, and ownership are necessary prerequisites for school improvement and often signals the first step toward sustained reform. Challenges and questions for the second year of the Weston IAAN example discussed previously in Example 3, p. 29, became: How does one make action research part of the continuing

culture of the school and of the Alliance Network? How does one build upon the work teachers have done so far? It was important not to disregard the teachers' first attempts at action research. Fostering a climate of action research in schools, teachers need to feel that their research efforts are ongoing, continuous, and connected. Teachers involved in activities that promote genuine professional discovery, growing together while also building stronger learning communities, is what lies at the heart of this type of research.

These ideas are similar to "lesson study" popularized in the TIMSS literature (Trends in International Math and Science Study, see Stigler & Hiebert, 1999), in which the teacher-researchers create, test, and refine lessons. Both share the same goal of bringing people together in an effort to improve and work on a system. Learning communities, lesson study, or action research, the task is democratic and community building, with the sharing of ideas and working towards an improved goal.

If action research is part of the teaching activities then much can be gained for the teacher, the students, and the school community. For lasting effects, and to encourage research, it is important to construct projects in ways that match a model of sustainability. If action research is seen among teachers as the monitoring and adjusting of good practice then it will be able to be maintained with little extra effort (Feldman, 1994). This will create a climate where the teacher-researcher movement will have a lasting effect on professional practice.

Summary of the Findings on Continued Practice

Weston concludes from the IAAN in Example 3, p. 29, that what is needed to sustain action research in educational settings is:

- *Supportive Leadership* - To have a chance of surviving at all, principals and district administrators have to be supportive of the process. Research can be a vital part of professional development helping to build a quality school.
- *Time* - Teachers need time to meet and discuss their research on a regular basis. To be sustained, action research cannot be seen by teachers as an add-on.
- *Collaboration and Sharing* - Teachers need opportunities to share their research with a wider community. Typically, most teachers work in isolation, often unaware of what others in their own buildings are doing. Built-in mechanisms to regularly exchange ideas, share problems, and report progress create the conditions which allow for shared understandings and new knowledge to emerge within the group, while also reducing feelings of isolation.
- *Teacher Ownership of the Research* - The chances of action research to become self-sustaining are minimal unless teachers see a potential for improving their own practice as being a direct result of the process. It is critical that the research agenda come from the teachers. Unless the research agenda is one's own, a teacher will have little reason or motivation to follow through.
- *Action Research is Self-Initiated Professional Development* - Action research respects, and is built upon, the unique wisdom and practical knowledge possessed by classroom teachers. It is a process by which teachers begin to systematically focus on their professional practice. An important intrinsic reward for engaging in this process is that it allows teachers to better understand what they do and what effect they have. The motivation becomes internal and self-sustaining because the situation, or problem has meaning and value to the teacher.

- *Access to Information* - Part of the action research cycle is gathering information relevant to the topic. While the teachers are able to generate a lot of ideas and problems to investigate, they sometimes lack access to sources of information on their topics (Weston, 1998).

Conclusion

The literature review informed my study. Five prominent themes arose in the literature review: validity, benefit, practicality, continued practice, and change. By detailing the various methods to increase validity in action research studies, by describing the benefits to be gained from action research, by illustrating how it is pragmatically attuned to teacher concerns, and by suggesting factors influencing teachers to continue to practice action research I was provided specific attributes with which to examine the characteristics of teacher action research under the faculty-mediated model. These attributes helped in the formulation of questions to be asked of teachers as I probed the effects of their action research experiences. The literature established validity in my research questions. And, as pointed out for good action research, I gather three different types of data in this study. Further, being a relatively objective bystander, this helped the validity as well in my study.

Whereas the literature on action research suggests that it is very beneficial and practical for those involved in terms of their particular situations, very little research has been done on the faculty-mediated model. At this point, I have come across only one study of the model, a dissertation completed at the time of the literature review. We know very little about action research that is initiated within the faculty-mediated model.

It is not clear that (a) benefit holds in this model or what the benefit might be. The action research might be simply looked upon by teachers as a required hoop to jump through in their path toward a degree and might be minimized by the teacher to survive teaching while getting a degree. (b) We do not know how practical or applicable it is since perhaps teachers design their action research to satisfy the wishes of a professor for specific design details, such as treatment-control groups, when such design factors would never be considered again by that teacher given the context of their teaching. (c) We do not know the extent and nature of their action research if teachers continue to practice action research after doing a capstone project. And, (d) we do not know how action research under the faculty-mediated model changes teachers in their practice, nor what affect it has on their students.

The present study essentially focuses on whether the conclusions found in the literature are still valid under the faculty-mediated model, at least in the perceptions of the teacher participants. These features of the faculty-mediated model (working with a professor, having to chose a topic for a program of study, etc.) compared to the models found in the literature raise doubts about the validity of the conclusions found in the literature on action research regarding benefit, practicality, continued practice, and change, when action research is conducted under the faculty-mediated model. Some of the general conclusions that came out of the literature can be used to compare with the data gathered in this study.

Perhaps, the biggest factor in the success of sustaining action research in a school setting is the climate and culture of that school environment. The most important feature of action research that came out of the literature review is for teachers to have the

opportunity to work together, to collaborate, and to share information. Similar to the success of lesson study and learning communities, one successful teacher action research model includes teachers meeting regularly, weekly if possible, to discuss, share, and stimulate research ideas. This is different than the faculty-mediated model and the value of community will be seen again in the findings for continuing to practice action research. The faculty-mediated model normally does not satisfy this condition for success, but we will investigate those teachers who continued to engage in action research to identify the key for them in doing so.

Another important feature in the literature is that action research MUST be done in a way that is integral with the tasks and goals of the teachers' daily work. Here again, if a teacher picks a topic to get the grade that is not really integral to their main concerns, then this condition is also not satisfied. I will investigate the kinds of topics teachers picked and how they viewed its importance. The research states that if this occurs, it will become a key factor in the success of the school and in the field of action research.

As Sagor explains, through action research we can build reflective practitioners, make progress on school-wide priorities, and build professional cultures. Action research can increase the professionalization of teaching, enhance motivation and efficacy of the faculty, and help teachers to meet the needs of an increasingly diverse student body, while achieving success with "standards-based" reforms. However, the faculty-mediated model is different from what is seen in the literature, especially the motivation and conditions surrounding it. It is unclear how any of the major findings in the literature will translate to this model, and that is why it is important to study it more closely.

CHAPTER 3

METHODOLOGY

Introduction

In this chapter, the research design is presented, including a description of the population and the sample size. The data collection process calls for a detailed discussion of the survey and the pilot survey that were used, along with the method for rating capstone projects. Post-survey interview questions and the interview selection process are then described along with questions that were specific to each interviewee. This is followed by a discussion about how the data was analyzed.

Research Design

This research is a mixed method explanatory study (Creswell, 2002). Such studies combine both quantitative and qualitative methodology and explain or describe a situation. The research is similar to the definition of a case study provided by McMillan (2004, p. 271): "An in-depth analysis of one or more events, settings, programs, social groups, communities, individuals, or other bounded systems." In this instance the case study is the capstone program at this Land-Grant University. Although the term 'case study' has generally been identified as a form of qualitative research to gather data in order to obtain a detailed description and to gain understanding of the case, a combination of both qualitative and quantitative methods can also be used in the same case study. According to McMillan (2004, p. 288), using a mixed-method design is considered to be appropriate to gain a more comprehensive picture of the phenomena

being studied and greater accuracy in the research findings. In this study the qualitative data is used to enrich the descriptive findings from the quantitative data. This should provide a more comprehensive explanation of the findings.

The three sources of data gathered in the present study are surveys, published online action research work, and interviews. The following procedures were used to support validation of the research design:

- *Explore outliers* - Outliers in both the qualitative and quantitative data were examined to provide insight about why they diverged from the other cases.
- *Instrument development* - The researcher obtained themes based on the literature review and created a survey instrument grounded in the literature. The pilot survey was administered to participants in a similar program. Changes in the survey were made based on the responses of the participants in the pilot survey. The survey instrument was validated with a second on-line pilot survey administered to the same group.
- *Examine multiple levels* - following a concurrent nested model (Creswell, 2002), the researcher collected survey data and then conducted interviews to explore the responses of specific individuals.

The survey was designed to examine action research through the five different lenses discussed in the review of literature. The survey provides the pivotal data for this study. After an examination of the survey results and based on these results, certain key individuals were identified for interviews and their capstone projects marked for closer scrutiny. The purpose of the survey was to provide a detailed snapshot of action research from the perspective of the graduates: what they perceived as beneficial and practical;

how they dealt with validity issues; how the capstone project led to continued action research and teacher change, and the effects of action research for high-needs students. Their survey answers were used to construct a general profile that could then be compared against the key components of action research that emerged from the literature. More specifically, the survey answers shed light on the faculty-mediated model of action research.

Bell (1993) points out that a survey can be considered good only if it is designed specifically to suit the aims of research and the nature of the respondents. Related surveys and works in the area of action research were examined (Zambo & Zambo, 2006; Wideman & Aquino, 2006; Graves, 2006); however, a new instrument was needed to capture the particular themes that emerged from the literature review. By looking through the five lenses portrayed in the literature, information can be gathered that relates specifically to this program, as well as to the students in it, and yet connects to what is known already about action research. In addition, Hoinville and Jowell (1987) noted that a questionnaire is designed to be clear and unambiguous so that the respondents can understand exactly the questions being asked. Therefore, the wording used in this survey was deliberately made simple, clear and unambiguous, and the survey was thoroughly evaluated for these traits through an extensive pilot study.

In the phase following the survey of this program's graduates, their capstone projects were studied and evaluated in order to further understand the nature of their action research projects. Most of the capstone projects from recent years were available to view online, with each graduate's project listed in (almost) alphabetical order along with the date of submission. A total of 45 capstone projects were listed, with three of

those dated from 2002; these were outside the range of the study (2003-2007) and were not considered. On the program's website, each folder links to a collection of presentation pages for each graduate, requiring a reader to find the home page for a given project that then links in the correct order to the rest of the presentation. Some presentations also included a link to a PDF of the entire capstone report.

Interviews were then conducted with selected students. While surveys provide important data, there is a need to look more deeply at rationales behind the responses to the survey, to further understand what was said and why. This is especially valuable so wrong conclusions will not be drawn from the results of the survey. By gathering both quantitative and qualitative data, the researcher is more likely to get a clear understanding of the phenomenon under study and to be able to clarify and to confirm the conclusions that are drawn. While this is an ideal scenario, sometimes mixed data sources, and/or triangulation across data sources, leads to greater clarity, and sometimes to contradictions and new layers of complexity. I acknowledge the complexities that may arise and will be described further in the methodology and research findings.

Population and Sample

The population of interest for this study consisted of graduate students from a research-intensive land grant university located in the northern Rocky Mountains. The program is described as follows on the website: The mathematics education faculty in the department characterizes its work as "applied mathematics education," oriented toward the preparation and professional development of mathematics teachers and the development of effective school mathematics curriculum. The faculty actively pursue

grants to fund research focused on delivering effective professional development and developing curriculum materials for K-12 mathematics teachers. Areas of emphasis include teacher preparation, coaching and mentoring in-service teachers, on-line learning among practicing teachers, technology-supported classroom instruction, problem-based learning, and curriculum development for K-12 mathematics. Graduate students design research projects in alignment with faculty interests and current projects. Students in the master's degree option will engage in school-based action research, while the doctoral program includes both qualitative and quantitative experimental research.

Students who pursue the Master of Science in Mathematics in Mathematics Education are active teachers in secondary and junior college mathematics. These students typically come from all over the United States and from other countries as well. Many live in the northern Rockies. The sample for this study consisted of all forty-five graduates from the program spanning the years 2003 - 2007. It was recommended by the program faculty that data for this time period would be more reliable because by 2003 the program had reached a stable and consistent state in terms of course requirements and delivery.

To strengthen validity and reliability of the researcher's survey, a pilot survey was administered to a group of graduates from a similar program at the same university. Although this other program has a different disciplinary focus, it is offered in a similar format to a teacher audience, and thus was an appropriate choice for pilot testing. An intentional sample of fifteen graduates from a similar program at the same university was chosen as the pilot group to survey. An administrative coordinator for the program selected this sample, choosing graduates who would be responsive and helpful in taking

and retaking the pilot survey and provide useful information for the revision process.

Design of the Survey

The Survey

The survey used in this study was designed for the specific purpose of looking at the five areas of focus in the review of the literature. These topics surfaced as the most significant aspects of teacher action research and provided a scope with which to study the faculty-mediated approach in particular. The work of two research teams (Zambo & Zambo, 2006; Wideman & Aquino, 2006) were used as aids in designing a survey appropriate for this research study. Zambo & Zambo (2006) surveyed 30 students using a four-point Likert-type scale representing five groups of topics: doing, thinking, professional development, mentor, and future. The literature review suggests that these five areas are paramount to the success of action research. The survey consists of both qualitative and quantitative questions and statements such as: "I have become a better problem solver from doing action research" and "action research has been beneficial for my students because…." The inclusion of both quantitative and qualitative statements gives more information, and deeper results may be ascertained from posing questions in different formats.

The second research team, Wideman & Aquino (2006), conducted a longitudinal study with two teachers over five years. The teachers came to see professional development as something teachers do for themselves through investigation and in collaboration with colleagues. The researchers' findings provided evidence that action research can have substantial long-term effects on teachers' practice, impacting

professional attitudes, beliefs, and values. This article provided background for development of the survey and interview questions in terms of what happens over time to teachers who do action research.

Statements for the survey were intended to assess the action research experiences of graduates in light of the five themes derived from the research literature: benefit, practicality, validity, continued practice, and change. The questions and statements were modeled after these themes. The graduates and other faculty also made recommendations on the subject of action research. The quantitative questions use a 5-point Likert-scale ranging from "strongly disagree" to "strongly agree." The following table shows a breakdown of the survey questions by theme.

Table 1. Survey: Number of Questions by Type

Section	Quantitative	Qualitative	Total
Descriptive Data	12	2	14
Benefit	7	4	11
Practicality	5	3	8
Validity	4	4	8
Continued Practice	4	4	8
Change	8	4	12
Additional Information		1	1
Total	40	22	62

Pilot Survey

A pilot survey was given first to a similar group of teachers enrolled in a Master of Science program at the same university. The pilot study audience was similar in gender groupings of males and females (4 males, 11 females for the pilot and 18 males, 29 females for the study) and spanned the same range of graduates (2003–2007). The pilot survey was therefore representative of a group similar to the actual study group.

In March 2007 the pilot survey was sent to a preselected group of teachers who had completed a similar program to the one in this study. These graduates were selected with input from the program's directors using the criteria that (a) they would be responsive and (b) they would represent a good cross section of graduates from the program. The administrative coordinator of the program contacted the fifteen selected students, all of whom provided their permission to participate in the survey. The researcher then contacted this group to provide more information about the study, and later sent them a survey using regular mail. To maintain confidentiality, a numbering system was used to correlate each name with a numbered survey. Only the researcher had access to the list of names and numbers.

In mid-April, at the end of three weeks, only six of the fifteen surveys had been completed and returned. One of the suggestions was to make the survey online. After doing so along with making other suggested changes, it was emailed to the same 15 graduates. Twelve of the 15 pilot participants completed the survey. The original 6 responses were compared with the 12 for reliability in their answers. Their comments and suggestions aided in changes made to the survey. The revised survey was given to the group of graduates with the goal of improving the reliability of the first pass of the

survey. After the second time administering the survey, final revisions were made and the survey was ready to be given to the graduates from the program in this study. The revised survey is provided in Appendix A.

The Survey

The distribution of graduates over the span of years used in this study is as follows: ten graduates in 2003, nine graduates in 2004, seven graduates in 2005, twelve graduates in 2006, and nine graduates in 2007. Two of the graduates could not be contacted and were dropped from the study. The final group of 45 graduates who were contacted had a 100% response rate on the survey.

Table 2 shows how graduates answered a set of questions that were critical in deciding whom to interview. Because the research questions included a focus on teachers of high need students (defined as traditionally less engaged, less successful, or having a history of being underrepresented), closely examining survey responses to the related questions is important. It is also valuable to examine how teachers continue to practice action research.

Table 2. Survey Questions Used for Interview Selection

Survey Question/Statement	
Q44	Aside from the capstone project, how many action research projects have you done?
Q45	How many action research projects before the capstone project?
Q46	How many action research projects after the capstone project?
Q63	Please give an estimation of the percent of free or reduced lunches students are eligible for.

Graduates 2, 5, 13, 22, 23, and 28 had the most students eligible for free and reduced lunch. They estimated that 40% or more of their students were eligible, increasing the likelihood that they worked with a high-need student population. High-need students were also identified in the type of capstone project a teacher did. For example, some projects focused specifically on high-need populations working with African American or Native American students who live below the poverty line.

Looking at the number of action research projects that a teacher has done, a total of four graduates, [12, 15, 20, and 22] completed multiple projects. However, quite a few graduates self-reported continued action research after their capstone experience. And a total of eleven graduates, [5, 17, 19, 20, 21, 23, 31, 37, 39, 40, and 43] performed two or more action research projects after completing the capstone project. Six graduates identified as, [19, 21, 23, 31, 39, and 40] claimed to have conducted at least three action research projects after leaving the program. This information is summarized in Table 3. The highlighted rows signify graduates who were interviewed.

Table 3. Graduates reporting two or more action research (AR) projects, 40% or higher students eligible for free or reduced lunch, or both

Graduate	Total AR projects	# capstones before AR project	# capstones after AR project	% Free/reduced lunch
2	3	2	1	75
5	3	1	2	40
10	2	1	1	NA
12	4.5	4.5	0	(left blank)
13	0	0	0	98
17	2	0	2	32
19	3	0	3	35
20	2	0	2	0
21	3	1	3	35
22	0	0	0	40
23	5	2	3	100
28	0	0	0	70
31	6	2	4	NA
37	2	0	2	35-40
39	4	0	3	12
40	3	0	3	NA
43	2	0	2	10

Examining this data, the following groups of graduates emerge. The subjects with the most experience doing action research (four or more projects) to date are Graduates 12, 23, 31, and 39. The subjects with the most action research experience prior to completing the project are Graduates 2, 12, 23, and 31. The subjects who attempted the most action research after the capstone experience are Graduates 19, 21, 23, 31, 39, and 40. Finally, the subjects with the highest estimation of students eligible for free or reduced lunch are Graduates 2, 5, 13, 22, 23, and 28.

Based on the union of these groups, a pool of potential interview candidates was created. Graduates 2 and 23 had high scores in action research experience and a higher

estimate of students with free and reduced lunch. Graduates 12 and 31 had significant action research experience before the capstone project (two or more). Graduates 19, 21, 39, and 40 increased their practice of action research after the capstone project (three or more). And graduates 5, 13, 22, and 28 had experience teaching high-need students (40 - 100%). In the end, Graduates 2, 12, 13, 19, 21, 22, 23, 28, 39, and 40 formed the interview pool of ten subjects. Graduates 2, 12, 13, and 23 were ultimately interviewed as described in a later section.

The plan was to examine a cross section of graduates, including those who stood out in areas of interest to the researcher, such as continued practice of action research. Graduates who had completed four or more action research projects were given special attention as outliers. This study also sought to determine how (if at all) action research helped teachers working with high-needs students. For that reason, teachers who were working with a large percentage of students eligible for free and reduced lunch were also given special consideration.

Plan for Rating the Capstone Projects

A rubric was designed to categorize the 45 capstone projects based on their relevance to the five themes of action research identified in the literature. Categorizing the projects not only provided a background for interpreting the survey results but also assisted in deciding which teachers to select for interviews. The capstone project data was expected to provide more evidence about the degree of action research that each teacher engaged in as well as valuable information about the kinds of projects that were completed, how data was collected, and what was learned by the teacher researcher.

The capstone projects were organized according to the five literature-based themes to determine how the teacher approached each of the five areas. Because the program expectations were for capstones designed to improve achievement for students, nearly all of them could be measured in terms of the first two research themes (benefit and practicality). Further, supervision by the faculty addressed the validity issue, helping to guide the teachers and ensure that their projects were well designed and the data gathered would accurately address the research questions. However, the themes of continued practice and change were not necessarily addressed in the online capstone presentations. Difficulties quickly arose with this method due to the wide range of capstone-presentations as well. Some of the presentations were a set of slides in an outline form while other presentations were extremely detailed. In addition, not all of the papers were available.

It became clear that the most informative approach would be to begin with the survey data, which was more current and directly aligned to the research themes. The capstone projects were then used as a source for further information in deciding whom to interview and what specific questions might be asked based on an individual project. For example, in the survey, a person might not identify themselves as working with high need students. However, if his or her project shows evidence of a high need student population, or if the online capstone presentation remarks on further research ideas with high need students, questions could then be posed during the interview pursuing these observations.

Table 4. Rubric for Rating Capstones - 1

0 = weak + = strong

Evidence of Theme	Rater #1	Rater #2
Benefit		
Practicality		
Validity		
Continued practice		
Change		

The definition of each theme and the guidelines given for rating evidence are as follows:

+ = positive or some evidence - = negative or no evidence

Benefit: Ideally, favorable or advantageous outcomes, results, or learning. The research does not have to demonstrate beneficial results, but some benefit from the process at least needs to have occurred. Evidence of some kind of benefit may be observed by the rater or mentioned by the teacher/researcher.

Practicality: The project experiment is likely to succeed or is likely to be applicable in real circumstances. Evidence of some practical use of the research either from the results or from what was learned. This may be based on the rater's assessment of practicality or feasibility or mentioned by the teacher/researcher.

Validity: Evidence that the research actually supports the intended claim. Was data gathered from different sources (such as journals, tests, interviews, etc.)? Does the data support the research questions?

Continued Practice/Research: Evidence that more action research will occur. Ideas for future practice or research must be mentioned. This evidence must appear in the

capstone project or be mentioned by the teacher/researcher.

Change: Evidence of professional or personal change that has occurred (e.g., reflective comments by the teacher/researcher regarding personal or professional change, or both). This too must come from the teacher/researcher and cannot be extrapolated by the rater.

In addition to looking for evidence of the five literature-based action research themes, the raters noted evidence of five additional characteristics (see Table 4).

Table 5. Rubric for Rating Capstones - 2

0 = weak evidence + = strong evidence

Project Number	Did the project follow the guidelines for faculty-mediated action research?	Did the teacher researcher visibly reflect on practice?	What was the key topic of the research?	Other notes	Did the research involve teachers, students, or schools addressing issues of diversity & equity?	Researcher's perceptions

Reliability of the Rating System

Each capstone project was rated as weak or strong according to this rubric (see Table 4 & 5). The rating system was designed, tested and revised until there was inter-rater reliability. This was done with the aid of another doctoral level mathematics educator. The two raters (researcher and doctoral student colleague) each rated one capstone presentation from the website and then compared our ratings and redesigned the guidelines as needed so they were clear for any rater to use and to obtain similar results. Table 5 was designed to give information about six other qualities and if they were

evident or not. Two other colleagues in mathematics education were asked to apply the rubric (see Table 4) and rate the same capstone project individually and without discussion. They rated the capstone project with exactly the same scores, using pluses and minuses. I assumed this one test was sufficient, because two individuals rating the same project made the same ratings. At this point the rubric was ready to be used by the researcher to rate all of the capstone projects.

Description of the Capstone Projects

It soon became apparent that all 45 teachers had followed the faculty-mediated model per the program's guidelines in completing their projects (see Appendix B for action research guidelines). Because they worked closely with the faculty, the teacher/researchers were mindful of good research design and met the requirements for structure and quality that were outlined in the guidelines. Further, the professors worked with the students on developing a sound research project, and this, too, became a moot point in assessing the capstones. It was usually possible to find evidence of benefit within the written capstone report, particularly in the conclusion or results pages. Some evidence also appeared supporting continued practice of action research and reflection on practice, and indicating that change had occurred in a teacher's practice. Finally, it was sometimes evident if the project dealt with diversity and equity issues, although this was more evident in the survey data where questions specifically referred to this theme.

An attempt was made to note titles of the projects that might be researched further in the interview phase of the study, based on the topic the student chose. However, ultimately it became clear that the capstones should inform the interview decision process

and the interview questions, but they should not be a deciding factor for interview selection. Instead, survey data was used to determine which capstones might warrant further investigation. Specific capstones were reviewed a second time after determining who would be interviewed based on responses to the survey data. Upon this second review, the capstone informed the interview process, suggesting further questions to ask and providing background on the teacher to be interviewed. Because nine graduates were interviewed, those nine capstones were carefully reread to refresh the researcher about the project and what further individual questions might be asked of each graduate.

Constructing the Interview Questions

All interviews with the graduates were recorded and literally transcribed. Identifying statements were omitted because the transcripts are in Appendix D. Paraphrasing is used where identifying comments were made. The interviews gave me the opportunity to more deeply pursue the initial data found in the survey responses. The interviews followed a semi-structured protocol, with a standard set of questions asked of each interviewee in addition to specific questions for individuals regarding their capstone projects and action research experiences. In some cases there were no additional questions. The interview questions were designed for the purpose of uncovering teachers' views and perceptions on the process of doing action research nested in the themes of benefit, practicality, validity, continued practice, and change. Other topics that the interviewees wanted to discuss related to their work with action research were also included.

The interview questions were constructed from the literature on action research,

from the research questions, and from the survey and the individual capstone projects. The interview questions were read and revised by three doctoral committee members for further refinement and clarity. The literature on action research discussed why and how action research was beneficial. The research questions addressed this discussion of benefit. The interview questions were then designed to further question these ideas from the literature, such as, why and how action research was beneficial to the graduate. From examining the capstone projects and from reading the survey results, other questions arose to include in the interview, still with the aim of obtaining data for the research questions. For example, for the section on change, the interview questions asked about change in practice, personal change, professional change, and changes in student learning. From the surveys, these were areas to target more deeply on the theme of change. Since the teachers commented on how much they had changed in the survey, the interviews could address specific areas more fully. Also, if a graduate commented in their capstone project that they had plans to do further research, one could follow up in the interview and ask if they have. The full set of standardized interview questions, grouped according to research theme, can be found in Appendix C. The standard interview protocol is followed by examples of individualized questions for each interviewee.

The Interviews

The process for selecting interviewees was described earlier in this chapter. Prior to conducting interviews, I carefully read each of the online capstone presentations for these twelve graduates. The link for one capstone did not work, and after an email query

produced no response, that person was dropped from the list. It was also discovered that Graduates 22 and 28 were no longer teaching. After careful consideration with research advisors, it was decided to only interview active teachers. That brought the number of potential interviewees to nine, each of which agreed to participate in a telephone interview in September of 2008. After carefully reading their capstone presentations and their survey answers, I designed specific interview questions for each of the nine graduates. A thorough review of each interviewee's capstone presentation followed by a close examination of that person's survey responses proved to be an effective way to prepare for the interviews.

A few negative cases were also examined. I reviewed the survey data again to see who stood out in this way. One graduate, number 24, had the most negative responses to the survey questions. This person wrote, "I seriously doubt if I will ever do another action research project," and when asked if there was anything else he or she would like to say about action research, or the capstone, or their experience in the program, this graduate wrote, "(1) I do not have "gender"; neither do any humans. I am of the male 'sex.'" Another comment made was: (2) The use of questions pertaining to "ethnic" categories should be totally eliminated. I am fully aware that programs of "affirmative action" are rampant within American universities. The fact that such programs are essentially omnipresent does not alter the fact that "affirmative action" is simply a euphemism for "legal racial discrimination"." This person, who also assigned the lowest scores to the quantitative statements, was obviously dealing with issues beyond the scope of the survey.

After deciding to omit this graduate as a negative case, I searched for the next

most negative set of responses. I first reviewed the quantitative sections of the survey, Graduate 24's extreme comments were followed by Graduates 27, 6, and 35 (who mostly selected "3" (neutral) for the quantitative statements and/or left some of the qualitative statements blank). I then examined the few qualitative statements to see what was written. As an example, these graduates all answered the question "Who has benefited from your action research?" Graduate 24 wrote, "No other person has directly benefited from my research" and Graduate 27 wrote, "I haven't really seen much benefit from others nor have I seen disadvantages." Graduate 6 wrote, "Myself and my students" and Graduate 35 gave no answer.

After reviewing several responses in a similar manner, I determined that Graduate 27 best represented the negative case. Interviewing Graduate 27 would allow me to better understand why he or she gave more negative and critical responses about action research.

In the end, I individually interviewed a total of nine graduates: numbers 2, 12, 13, 17, 23, 27, 31, 34, and 37. Graduate 23 was remarkable in the quality of the capstone project, in responses to the survey, in having experience with action research, and in having a high number of students who qualify for free or reduced lunch. Graduate 31 stood out in three of the above four areas; Graduates 2 and 12 stood out in two areas, and Graduates 13, 17, and 37 earned special interest in one of the four areas. Graduate 27 was the negative case. It is worth noting that Graduate 34 slipped through the screening process based on the survey data because he/she did not answer key questions, but Graduate 34 worked with a high percentage of high need students as revealed in the demographic data.

All nine interviews were conducted by telephone and ranged from 20 minutes to 90 minutes in length. The interview questions (both standardized and individualized) were sent to each graduate ahead of time so that he or she could be prepared to respond fully during the interview. Data was collected in the form of written notes as well as audiotape using a speakerphone. These notes were typed and the interviews eventually transcribed. Any identifying statements were removed from the transcriptions.

Analysis of Survey Data

In analyzing the survey data, I referred to Zambo & Zambo's (2006) analysis of data on pre-service teachers' perceptions of action research. In their survey, the value of each variable was defined as the mean of the scores for all of the items related to that variable. Since the Zambo & Zambo (2006) questionnaire used a four-point scale, they considered means greater than 2.5 (the mean for their scale) to indicate agreement and means below 2.5 to indicate disagreement. Both mean scores and standard deviations were reported.

Analysis of the current survey imitated this procedure for the themes of benefit, practicality, validity, continued practice, and change. Means of the scores for all of the items related to each group were provided, allowing an opportunity to compare the groups to each other as well as reporting data for each statement in the survey. I also considered means greater than the midpoint to indicate agreement and means below the midpoint, disagreement. In this case of a survey with a five-point Likert-scale, the midpoint value is three. (If considering a positive affect to fall in the positive rating side of the scale, not the neutral or half way mark, then a 4 would be used to count as having a

positive affect.)

The survey provided both qualitative and quantitative data. To analyze the quantitative results, I developed a table showing each survey statement along with the frequency of the five possible responses, the calculated average response, and the standard deviation. The average and standard deviation for each question and group of questions based on a section/theme (for example, for the section/theme on benefit) are also reported for each of the five literature-based action research themes

The 45 graduates replied to several open-ended survey questions within each theme: five in the benefit section, three addressing practicality, four regarding validity, and two each regarding continued practice and change. There were three additional open-ended questions at the end of the survey. All open-ended responses were analyzed from a qualitative perspective. The purpose of the open-ended questions was to allow the graduates to give their views on each theme without being guided by a specific statement. Once they understood the theme by responding to Likert-type statements, it was important to allow the teachers an opportunity to share without prompting. This provided additional data that was distinctively different from the quantitative data and in many cases more specific.

One aspect of my approach to the analysis was to group the open-ended statements by theme for each person. For example, under the benefit theme, I analyzed all five open-ended responses as a collective group. I read the survey responses across all questions for one person, across a single question for all participants, or clustered together by theme. The survey was designed to investigate each of the five themes separately, so unlike the interviews, where new themes based on the responses could

emerge, the survey responses were already organized by "self-imposed" themes. The open-ended questions allowed variations within each theme, however (e.g., Who has benefited from your action research? How did action research benefit your students?).

In further analyzing the open-ended survey data, I tallied responses where it was feasible to quantify what was countable. I also recorded my overall impression of what each teacher said and how the responses contributed to an overall image of each teacher. Lastly, I noted the negative outliers and marked them for further consideration. Since the group's responses as a whole were positive, the positive outliers were less distinct than the few negative ones.

In summary, my method for analyzing the open-ended survey data was to read and reread each group of statements, to note unique cases (both positive and negative), to record my overall impression, to quantify responses where possible, and finally to identify examples of statements that articulated the themes and categories that emerged. As an example, in the continued practice section, I noted that time, lack of support, and a feeling of isolation were mentioned repeatedly. These characteristics formed my overall impression of the responses on that section.

As a form of cross-cutting linking, I considered what similarities were evident across the five themes. For example, support was a key aspect of continuing to practice action research; the issue of support also arose under some of the other four themes.

Analysis of Interview Data

The methodology used to analyze the interview data was taken from Patton (2002). I conducted interviews on the telephone while taking handwritten notes and,

with permission, recording the conversation. I transcribed the interviews, capturing what was literally said but leaving out identifying comments. In order to validate that my transcription was what the interviewee intended and was willing to share, I used the procedure of member checking. This validation was accomplished by emailing a copy of the transcribed interview to each interviewee for review and confirmation. Interviewees had the option to edit or to add to the transcription. Few changes were made; most of them involved minor word changes or removal of complaints about current work conditions.

The major purpose of the transcript analysis was to organize responses in such a way that themes were identified and overall patterns were clear (Patton, 2002). I organized the interview data by themes that arose from the interview questions and from the responses to the questions. For example, since questions about working with high need students were answered in terms of being beneficial, those responses were categorized in the benefit section. Along with the five action research themes derived from the literature, new categories were identified and combined. For example, the themes of benefit, practicality, and continued practice were combined with new categories of "helpful" and "useful" to create one overarching theme titled "values."

To assist with analysis, I (literally) cut up the interviews by question and sorted them into piles by the themes given above and by various subtopics within the theme. I then read each different group of answers for each theme, identifying notable remarks for later quotations and quantifying information where possible. I did not consider every response separately, but I looked for conclusions representing all of them together. See the full transcriptions of the interviews in the Appendix D.

Phenomenological analysis was applied to the interviews, as discussed by Patton (2002) in his chapter on qualitative analysis and interpretation. By "seeking to grasp and elucidate the meaning, structure, and essence of the lived experience of a phenomenon for a person or group of people" (p. 482), the whole picture of action research as conducted in a teacher education program can be better understood. By holding the phenomenon of action research up for serious inspection, taken out of the context where it occurs and is carefully dissected, its elements and essential structures can be uncovered, defined, and analyzed. Specifically, I followed the process of "bracketing" as described by Husserl (in Patton, 2002):

- Locate within the personal experience, or self-story, key phrases and statements that speak directly to the phenomenon in question.
- Interpret the meaning of these phrases, as an informed reader.
- Obtain the subject's interpretations of these phrases, through the interviews.
- Inspect these meanings for what they reveal about the essential, recurring features of the phenomenon being studied.
- Offer a tentative statement, or definition, of the phenomenon in terms of the essential recurring features identified (Denzin 1989, p. 55-56).

Using these established methods of data analysis helps to ground the results of this research. In addition, drawing from other similar studies such as Zambo and Zambo (2006) has strengthened the credibility of my study.

Results from the Pilot Survey

As discussed earlier, fifteen pilot surveys were distributed to teachers in a similar

science education program. Only six surveys were returned in the first round of pilot testing. However, even this small group offered data from which to learn and improve. One strong suggestion was to put the survey on-line. After immediate modification, I "distributed" or "administered" the pilot survey in the new format. The goal was to obtain more responses to bring the number of pilot respondents closer to fifteen. It was also helpful to use Harpster's (1999) methodology of following up with reminders and phone calls to encourage participants to complete the survey.

I refined the survey to be shorter and clearer. I removed a question from each of the five sections on the survey, as well as a few from the demographic section as well. I omitted questions that produced wide-ranging answers and/or did not contribute much useful information. After receiving the revised on-line survey, I compared the first six responses with the latter twelve to see if the two groups were similar.

Among the twelve graduates who responded to the second and final pilot survey, the average years of teaching are sixteen, the average age is 44, and the average number of students taught daily is 150. The survey took an average of 35 minutes to complete, including time to make some suggestions for changes.

Overall, the qualitative answers from the students of the pilot group are quite positive about action research and their experiences with it. There were many comments about action research requiring a lot of time and that it is difficult to balance with schedules and other teaching demands. This did not change my research questions or survey questions, but it was something I wanted to investigate further in the group that I was going to use as my research study group. Did they have similar responses as well? The results from the group being studied showed similarities with the pilot group, as we

will now see in chapter 4.

CHAPTER 4

RESULTS

This chapter details the results of data collection and analysis, and reports findings in relation to the research questions for this study. Background information on the survey is presented first, followed by survey results. The content of the interviews with their related findings are then discussed. The chapter ends with a discussion of the capstone projects and their contribution to the study. The results of the study will be summarized and further discussed in Chapter 5.

The Survey – Schedule and Results

On January 8th, 2008, a postal letter was sent to all teachers who graduated from the program between 2003 and 2007. A copy of the letter can be found in Appendix E. The letter explained the purpose of the study and included a Web address at which the survey could be found. The letter encouraged teachers to participate in the study by taking the survey and it explained that their participation was voluntary and confidential. As a thank you gift, those who completed the survey would receive a magazine and poster for mathematics teachers.

By mid January, I had received five confirmations that surveys were completed. The confirmations came in the form of an email from the teacher with the address where they would like their gift to be sent. By the end of January, 11 participants had completed the survey. I then mailed a follow-up letter to the 34 graduates who had not yet completed the survey.

At the end of February, I sent the third and final follow-up letter to the teachers who had not yet responded. Three letters had been returned with out-of-date addresses. I did find updated addresses for these three. One survey respondent stated in an email that emailing the letter would be more efficient since most teachers spend much time online. I managed to find email addresses for the remaining graduates and sent them the same letter via email. In two months' time I had received 32 completed surveys, and in two and a half months, I had 41 completed. By April, I had 100% response for the surveys.

Results of the Survey

Survey findings will be reported in five parts corresponding to the five themes identified in my review of the literature. Response options for the selected-response survey questions were strongly disagree, disagree, neutral, agree, and strongly agree. These options were assigned values 1 through 5 respectively. Some teachers did not answer every question. In most cases the skipped question was the reverse or negative form of the question that was just asked. For example, teachers were asked how action research had been beneficial; the next question asked how it had not been beneficial. Frequently, the reverse question was left blank. It appears, however, that teachers left such questions blank because they did not feel the statement applied to them.

The first set of findings reported here provides some general information on the survey participants. Based on recommendations by an experienced survey writer, these background information questions were placed last on the survey. An experienced survey designer suggested that answering such questions first can discourage a

participant from continuing. Teachers may see the questions as personal and taking too long before getting to the main survey questions.

Background Information on the Participants

Close to the same number of students graduated from the program each year. Eleven of the graduates finished their degrees in 2003 and in 2006, and 10 finished in 2007. Seven finished in 2004, and four in 2005. The pool of graduates is comprised of 28 women and 15 men. Two people did not answer these questions.

The number of years of teaching experience varied from two years to thirty years. Figure 1 shows the number of years of teaching experience for the graduates. Note that most have four to eight years of experience with the majority falling in the four year to twenty-year range. Surprisingly, 15 (one third) of the graduates reported having four to eight years of experience.

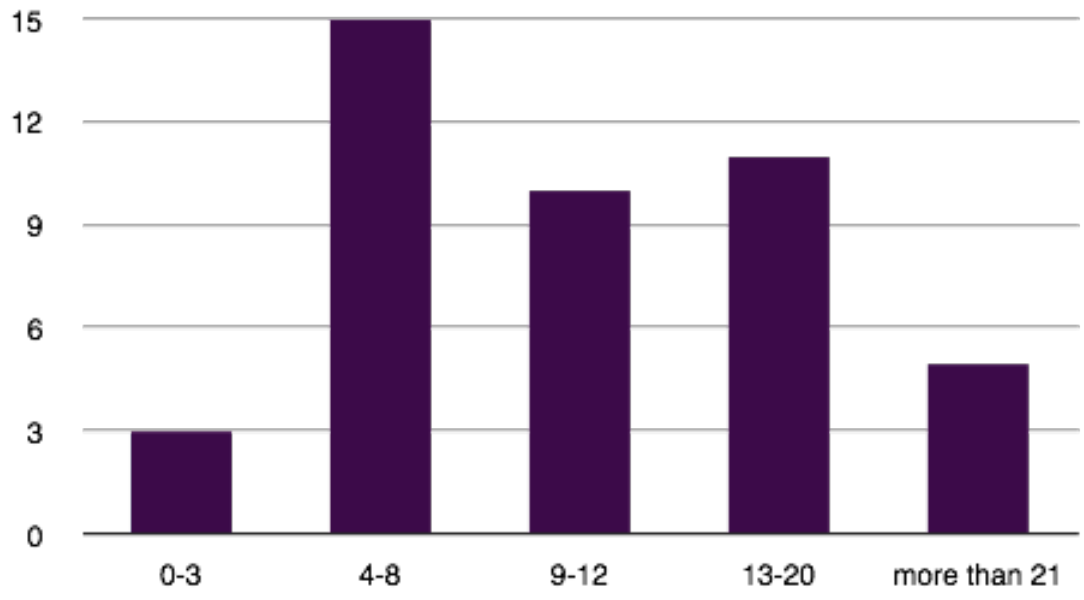


Figure 1. Number of Years of Teaching Experience (*x*) by Number of Graduates (*y*)

The range in ages is from 30 to 62, a 32-year span as shown in Figure 2. One respondent stated, "You guess that one." The most commonly reported age (seven responses) was 44 years old.

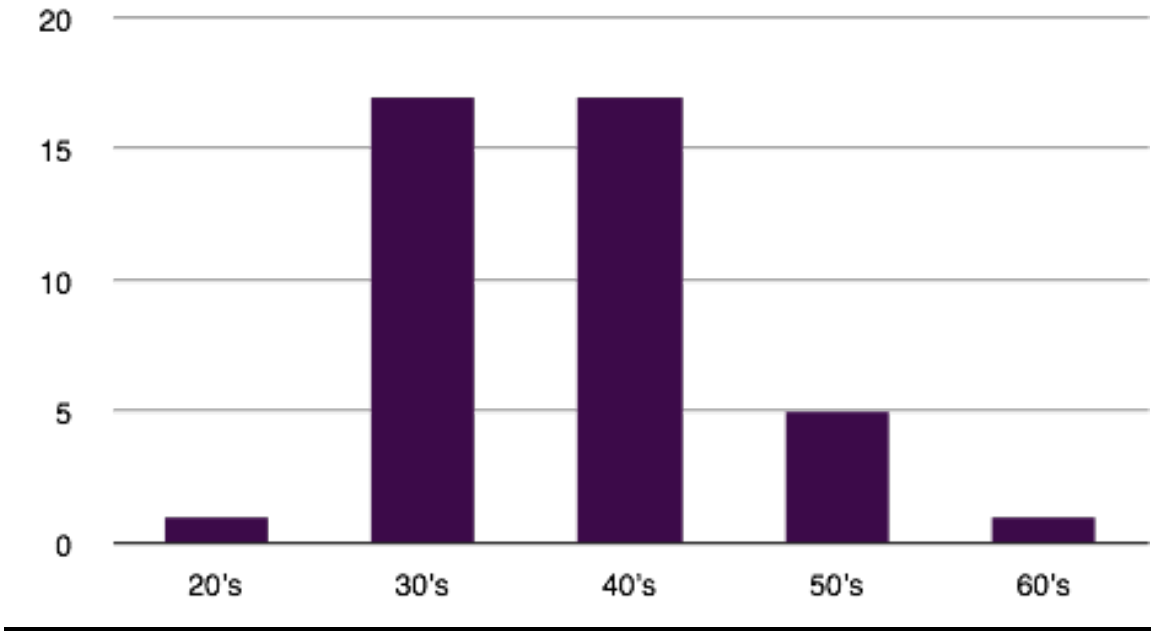


Figure 2. Age Range of Graduates (x) by Number of Graduates (y)

The largest number of students taught per term was reported as 170. The size of the communities where the graduates teach varied widely. Five teach in a metropolitan center with population over 1,000,000, and five teach in a big city with 100,001-1,000,000 residents. Most (13 or 30%) teach in a medium-size city with population 20,000-100,000 (13 or 30%), or in a city of similar size adjacent to a metro area or big city (8 or 19%). Seven participants (16%) teach in a small city with population 2,500-20,000. Only five participants (12%) teach in a rural community with fewer than 2,500 people. Two did not provide this information. Based on program admissions data,

roughly one-third of the participants teach in Montana, another third in the western United States, and the remainder across the nation or overseas.

Participants were asked what grade level they taught while completing their capstone project (they could select as many as apply). The majority of 26 (61%) teach grades 9-12 and 13 (30%) teach at university or college. In addition, eight (19%) reported teaching adult learners, seven (16%) teach grades 6-8, and two (5%) teach grades 3-5. Two teachers did not respond. There was clearly overlap in some of the responses, perhaps because teachers carry multiple teaching roles or changed positions during the capstone period.

When asked about the learners in their classrooms, most teachers indicated that their classrooms are mixed. The term "mixed" was not defined in the survey so it could be interpreted in different ways, but it was most likely interpreted to mean a combination of the other response options that were presented. Thirty-eight participants (88%) said they teach mixed classrooms of students. Twelve (28%) self-identified as teaching special needs students, and ten (23%) teach gifted and talented students. Several teach in special settings (e.g. college prep students at a charter school, independent/private schools, Montessori). Once again, two teachers did not provide answers.

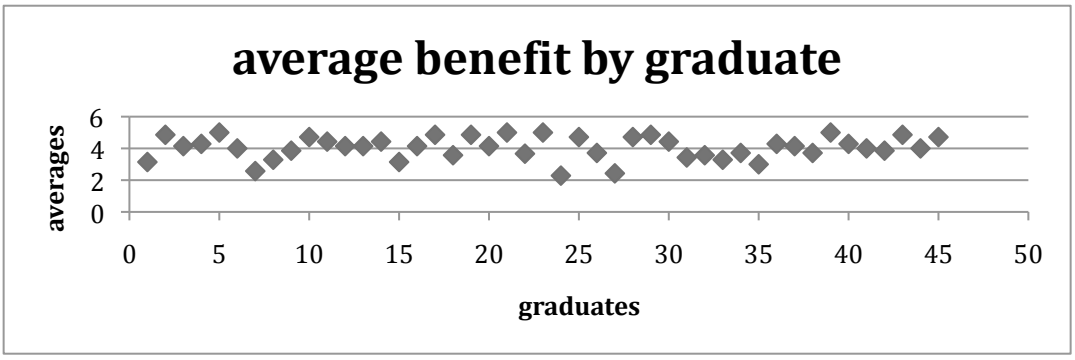
Most of the teachers describe their racial identity as "White" (38 or 88%). Three teachers (7%) identified themselves as Asian or Asian American, two (5%) stated American Indian or Alaska Native, and three selected European ancestry.

Similarly, most of the teachers identified their students as "White." A few teachers (numbers were not given) work with African American, Alaska Native or American Indian, or Asian students. Responses to these questions did not produce clear

data and could not be further categorized. The question asking for an estimation of the percent of student's eligible for free or reduced lunches was open ended, so the answers varied considerably. Thirty-two percent of the respondents wrote "Other."

Figure 3 displays scatter graphs representing quantitative responses for each survey participant group and averaged by theme. Averages are reported for each of the five sections of the survey: benefit, for example, the graph titled "Benefit" below displays 45 dots, one representing the average of a single teacher's answers to the survey question in the "Benefit" section. Forty-five dots on each graph represent the 45 respondents.

Recall that a "3" rating is neutral, a "4" shows agreement, and a "5" indicates strong agreement. Note that "0" and "6" are not response options, but are shown in the graph for ease of reading the data. Also note that an average of "0" appears in the validity section because one respondent left the answers blank. This did not affect the overall averages. It is clear from these graphs that overall, the individual graduates responded with strong agreement in each section of the survey. The sets of survey questions related to validity and benefit produced the highest averages.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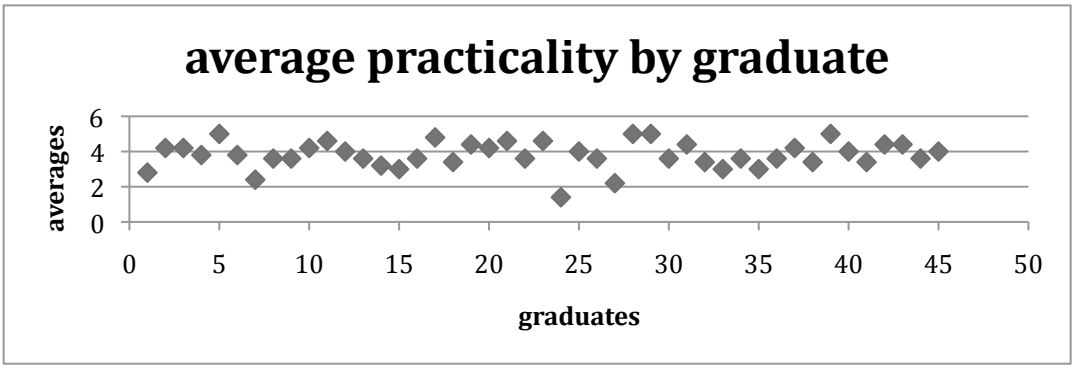
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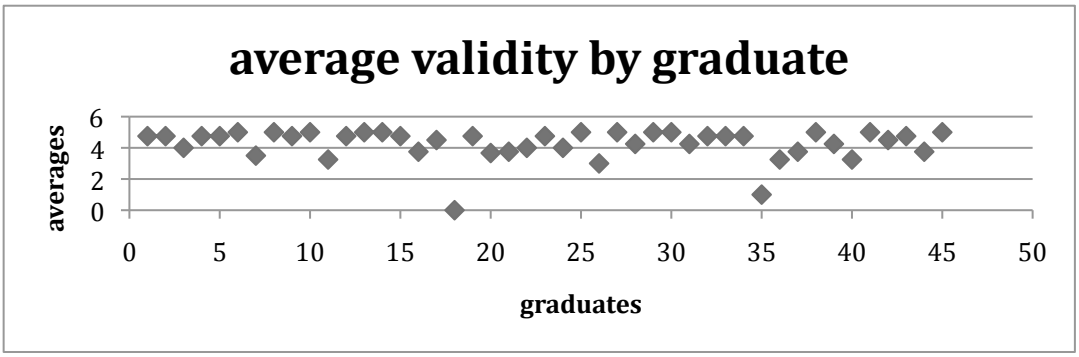
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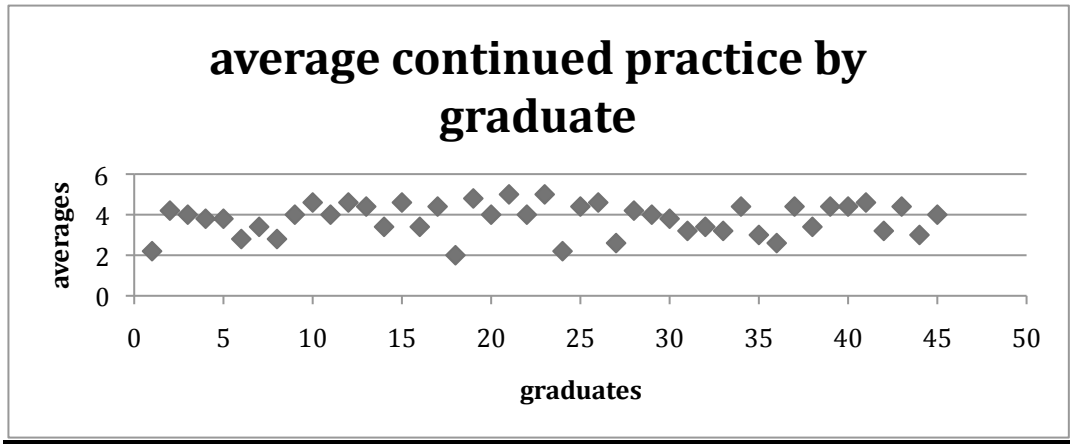
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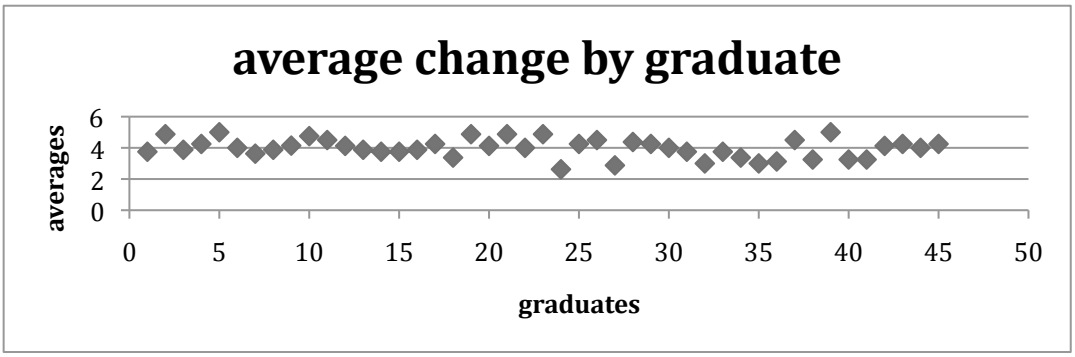

Figure 3. Average of Responses by Graduate in Each Survey Section

The graph in Figure 4 displays an overall survey average for each graduate. Again, these averages indicate strong agreement, with most averages clustered around the value of 4 (Agree). In their 2006 survey, which has many features similar to this survey, Zambo & Zambo chose to consider a midpoint rating as a positive response. Because they did not provide for the option of a neutral response (their response choices ranged from 1 to 4), a midpoint response of 2.5 fell on the positive side. Based on the five point Likert scale used in this survey, an average of 3 would be the equivalent midpoint rating, and an average of 4 would put the rating on the positive side. The results for this survey are clustered around 4, indicating a positive (Agree) response.

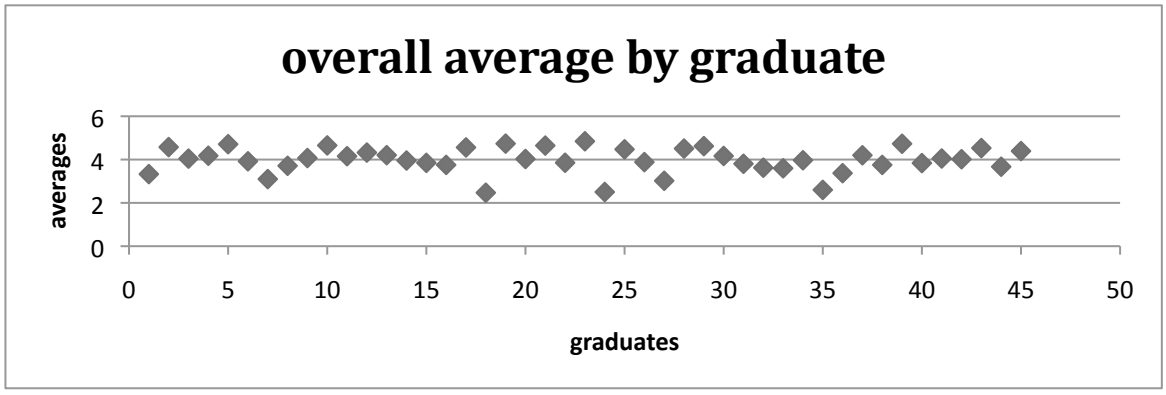

Figure 4. The Overall Survey Average for Each Graduate

Specific results from the quantitative portion of the survey are reported in Table 6. As they were in the survey, the statements and results are grouped by literature-based

theme (e.g., Benefit). Below is a chart showing the quantitative statements, the frequency of the responses to those statements, the average of all responses for each statement, and the standard deviations for each statement. These results are then discussed further following the table.

Table 6. Survey Results for Quantitative Questions – frequency of responses, averages, and standard deviation

All Responses N = 45	strongly disagree	disagree	neutral	agree	strongly agree	average	standard deviation
Benefit							
I have become a better problem solver from doing action research.	0	3	8	23	11	3.93	0.84
I feel more confident in my teaching practice from doing action research.	0	1	8	17	19	4.2	0.81
I have benefited from sharing my action research with others.	0	1	12	12	20	4.13	0.89
My desire to better understand more about my teaching practice is fulfilled when I do action research.	2	1	4	19	19	4.15	1
I feel that others have benefited from my action research.							

I feel that others have benefited from my action research. (Perhaps others in the field, administrators, parents, etc.)	1	3	6	24	11	3.91	0.92
I feel more connected to the work I do because I can affect change by doing action research.	1	2	7	22	13	3.97	0.92
One of the benefits of action research is that I have the opportunity to work with students, faculty, and even my school toward a common goal.	0	3	8	16	17	4.07	0.93
All Responses N = 45	strongly disagree	disagree	neutral	agree	strongly agree	average	standard deviation
Practicality							
The action research I have done has helped to improve the professional culture at my school.	1	8	16	16	4	3.31	0.95

Action research is worth the time because it brings new vitality to my work as a teacher.	0	1	6	23	15	4.2	0.74
I am more motivated in my teaching practice because of action research.	1	3	9	15	17	3.98	1.03
I am more reflective about my work from doing action research.	0	2	5	17	21	4.3	0.84
All Responses N = 45	strongly disagree	disagree	neutral	agree	strongly agree	average	standard deviation
Validity							
I report all the outcomes, expected and unexpected, in my action research.	1	1	2	11	29	4.5	0.88
I gather data from different perspectives if possible to give more insight regarding my research questions.	1	0	3	17	22	4.37	0.82

I consult with other people concerned and with other researchers to help ensure that my research is valid.	2	2	7	6	27	4.23	1.16
I try to design my action research so it can be repeated by other teachers.	1	4	2	10	27	4.32	1.07
All Responses N = 45	strongly disagree	disagree	neutral	agree	strongly agree	average	standard deviation
Continued Practice							
My immediate supervisor is supportive of me doing action research.	0	1	13	14	17	4.04	0.88
I share my action research with a wider community than just myself.	1	4	7	17	15	3.93	1.04
My research agenda comes from me so I have reason and motivation to do it.	0	1	7	14	22	4.3	0.82

Because of action research I find I continue to gather more information that helps me make professional decisions.	1	1	6	19	17	4.14	0.9
I have the time to do action research.	6	14	15	8	2	2.69	1.06
All Responses N = 45	strongly disagree	disagree	neutral	agree	strongly agree	average	standard deviation
Change							
I have an increased sense of community from doing action research.	3	4	15	16	7	3.4	1.08
I now share more ideas with my colleagues from doing action research.	3	2	12	20	8	3.62	1.05
I learn more about what works and what doesn't from doing action research.	0	0	3	26	15	4.27	0.59

Action research is a methodology that helps individuals to try new things.	0	0	4	22	19	4.33	0.64
My practice has improved because of action research.	1	0	9	20	15	4.07	0.86
Action research is a methodology that helps me to be more flexible.	0	1	16	17	11	3.84	0.82
I am more satisfied with my teaching practice now because I have done action research.	0	2	11	20	12	3.93	0.84
Action research provides a deeper understanding of my students' learning.	0	0	7	16	22	4.33	0.74

Several of the responses noted as predominantly negative or neutral are worth exploring further. In the Practicality section of the survey, the first two statements read "Our school or my classroom has made progress on school wide priorities from doing action research" and "The action research I have done has helped to improve the

professional culture at my school." Half or more than half of the respondents rated these statements as neutral or negative (Disagree/Strongly Disagree). The first statement produced two negative responses, 17 neutral, and 19 positive. The second statement resulted in nine negative responses, 16 neutral, and 20 positive. In contrast, similar statements emphasizing improvement of motivation, reflection, and new vitality received positive responses.

These results may not be surprising given the nature of the capstone project under the faculty-mediated model. The research topic must be narrow enough to follow the imposed structure and must also focus on student achievement. Because of these limitations, the typical choice of capstone project may not affect the professional culture at the teacher's school. It may also be that the faculty-mediated model relieves teachers from focusing on school wide priorities since their support comes from a university advisor rather than from within their schools.

The faculty-mediated model did not appear to affect teachers' sense of community. In the Change section of the survey, the statement "I have an increased sense of community from doing action research" was split with seven negative responses, 15 neutral, and 23 positive. The statement "I now share more ideas with my colleagues from doing action research" was similarly ambiguous with five negative responses, 12 neutral, and 28 positive. The capstone projects reveal that some teachers built this aspect into their project by involving other teachers in their grade level or department, but this was not typical. Certainly the project requires close interaction between a given teacher and his or her assigned advisor, but beyond that there is not a great expectation for collaboration with colleagues.

Finally, the Continued Practice statement "I have the time to do action research" was rated mostly neutral (17) and negative (7), with only 10 positive responses. Lack of time was a frequent theme among the open-ended survey questions and interview data and is discussed in more detail in an upcoming section.

Next, each of the five sections will be discussed below, with some statistics for each quantitative section and then some discussion of the qualitative section follows. For the qualitative statements, they are summarized as discussed in chapter 3, by theme or section that they appeared in the survey. In each section summaries were made and examples given.

Survey Section 1: Benefit

Benefit can be defined as an outcome that is favorable or advantageous; resulting in good. The survey questions related to the benefits of action research had an overall positive response rate of 77.2% (Agree and Strongly Agree). The overall mean response score was 4.0 (out of a possible 5). No statements stood out as having significantly more positive responses than others, though the fifth statement about benefits to others in the field had the lowest mean of 3.91. The others ranged up to 4.2.

Qualitative Data - Benefit

When asked the open ended question "Who has benefited from your action research?" participants offered a variety of responses, and some chose multiple responses. The majority referenced their students (22 responses) or their department and colleagues (22 responses). They also reported that schools and administrators (8 responses) and others in the field of mathematics (5 responses) benefited from their experiences; however, in most cases the effects of action research did not extend very

much beyond the classroom. Teachers reported that their colleagues received as much benefit as their students did. Perhaps because the focus of the project was on student achievement, the teachers felt their students benefited a lot and that that also led to departmental and collegial benefit as well. Interestingly, only 13 teacher researchers reported themselves as benefiting from their action research.

Open-response statements supporting the above outcomes included "I feel that each class of students I had after I created my capstone benefited from my action research. Additionally, I felt I did a better job presenting workshops to my colleagues." One graduate wrote that benefits were for "Mainly myself. I feel that I have a better understanding of how to go about finding solutions to problems that arise in my class." Another wrote an article that was published in a National Council of Teachers of Mathematics publication.

When prompted, "Action research has been beneficial for my students because..." an overwhelming response was that action research has helped the teachers to understand the needs of their students. They believe that they are better teachers now because they learned from their research and from their students. Responses to this question were widespread and not easy to categorize. Many teachers spoke specifically to the action research project they did. For example, a teacher wrote, "I can seek information and find what has worked for others. It made me try new things and get outside my comfort zone." Another teacher said "The research I did helped me to be a better teacher and have more knowledge in the area I was researching—this in turn benefited my students." For several teachers, change in their own practice was seen as ultimately benefiting students as well.

When asked the reverse question, “Action research has not been beneficial for my students because…” all of the teachers confirmed their positive statements by noting that this negative statement was not applicable. The result is that regardless of how the question was phrased, action research has been beneficial for their students. Examples of this include “I cannot think of a reason how it has not helped my students” and “I don't think there were any disadvantages for my students. It didn't interfere in their learning—it just made them more aware of what they were doing.”

From the question “Action research has been beneficial for me as a teacher because...” it was evident that action research has helped these teachers to learn more about their practice and improve as teachers. Examples are “It allowed me to learn about the different ways students learn,” and “It makes me a better teacher. I become more actively engaged in thinking about what things I do in the classroom that will improve how my students learn.” An increase in active professional development was discussed as well: “It has helped me to improve my teaching and allows me to participate actively at conferences where I share my work.” When considering the reverse statement, how “Action research has not been beneficial for me as a teacher,” the common response was again that this statement is not applicable.

Survey Section 2: Practicality

Practicality refers to an effort that is feasible, likely to succeed or be effective in real circumstances. This section had an overall 65.3% Agree and Strongly Agree response rate. It showed a lower response for the first two statements related to school-

wide priorities and professional culture at the school, with an average of 3.2 out of 5. The rest had means of 3.98 to 4.27. The overall mean for this section was 3.81.

Qualitative Data - Practicality

Nearly all teachers responded positively to the statement "Action research is a practical way to meet the needs of my diverse student body because...." For example: "It enables me to pick a topic that I NEED to work on and then address that problem, instead of being assigned some random topic that I have to get through. I can apply the research so it's not theoretical, but practical." Another teacher stated, "It forced me to teach to every student's learning style, not just the audience that learns best from my teaching style." This was seen as practical for all students.

For the statement "I find action research impractical to do because..." the overwhelming response referred to time constraints. Eighteen teachers mentioned time as a factor, with four references to other factors. Teachers appear to be very busy and carry heavy teaching loads. Ten teachers stated that the question of impracticality was "not applicable." However, even some of those cases later revealed that they "make time" because action research is important to them.

One teacher clearly identified the effects of time constraints: "There are challenges to meet the constraints of good research design, i.e. control group, without impacting the quality of instruction for some. It also takes time to design, gather data and do the analysis. Given such, I find action research challenging, but not impractical." Another offered suggestions for how to get around that challenge: "This is not a

surprise...time. Of course, it all depends on what your definition of 'action research' is. One can do action research daily (active and intentional reflection upon one's work)."

When prompted "I make action research practical to do by..." frequent suggestions included keeping the research simple and making small changes. One teacher noted that expanding her audience would make research more practical:

> I now teach at the high school level at a school that is considered a minority school. I plan to make action research practical by designing studies that will benefit not only my classroom but our school. I would like to conduct a study that somehow pertains to the expectations students have of their teachers. This type of research could be beneficial in helping teachers who wish adapt their methods to better meet the needs of a minority student population.

Another teacher emphasized the value of taking on small projects more frequently:

> I make action research practical to do by periodically (just before the start of a semester) focusing on a specific aspect of my teaching such as motivating students to do homework or experimenting with alternative assessments like group quizzes. I then decide what small change I will make to my teaching and how those results might be measured for success or failure. I implement the change during the semester and at the end of the term (or earlier) determine if the measured impact was significant enough to continue the practice.

Survey Section 3: Validity

In the survey, validity was characterized as a guarantee that the research actually supports the intended point or claim. In this section, teachers were asked about the frequency of behaviors related to validity. Two-thirds of the teachers (65.9%) replied that they always report all their outcomes, with 25% selecting the option "usually." In response to the statement, "I gather data from different perspectives if possible to give more insight regarding my research questions," 90.7% of the teachers reported that they always or usually do this. Seventy-five percent said that they always or usually "Consult with other people and with other researchers to help ensure that my research is valid." It was revealed that 84.1% of the participants felt they usually or always made their action research replicable for others.

Qualitative Data - Validity

When prompted, "I am careful to justify my results from action research by...." the responses referred to key ideas that appear in the literature on how to ensure validity in one's research (e.g., member checking, working with other professionals, gathering data from a different perspectives). For example: "I justify my results by asking other professionals to check my findings. I want my results to be as accurate as possible. The only way to do so is to have others review and verify." "Performing appropriate statistical analyses and…replicating the experiment" was noted as helping with valid analysis of data. Giving "thoughtful reflection both before and after the project" was also suggested, another key to validity that appears in the literature.

Teachers responded with examples to “I ensure that I don't simply confirm my own biases when I do action research by....” These included “working collaboratively with a diverse group of people, looking at all data from every conceivable angle” and “using statistical analysis to see if what I've done is valid.”

When prompted, “I ensure validity in my action research by...” teachers were able to give specific examples: “doing a thorough literature review, using carefully designed surveys (usually validated by other researchers), reporting all data.” Other examples included “Having other teachers give input on my tests and input on how they are graded. I also compare how my classes are performing compared to one another and look for explanations for any discrepancies.”

There were insightful responses to the statement “I find it difficult to ensure validity in my action research because....” For example: “education is a social science. Therefore, it is hard to account for all influencing factors when it comes to human beings.” Another teacher stated, “At times we gather so much data that it is difficult to sort through it all.”

Survey Section 4: Continued Practice

The items in this section of the survey have means ranging from 2.69 to 4.30. The responses of Agree and Strongly Agree amounted to 64.4% across this section. The third statement regarding teacher ownership of the action research agenda received the highest overall score in this section. The last statement, which asks about having enough time to do action research, scored 2.69. Only 10 respondents (22%) agreed or strongly

agreed that they had time to do action research. Again, the challenge of having time to do action research was clear.

Qualitative Data – Continued Practice

For the statement, "I am able/not able to continue to do action research because..." the most consistent response was that time is a deterrent. Several factors contribute to lack of time: "It's hard to continue to do action research because there are pressures added daily to teaching. Our workload keeps increasing and class sizes do also." One teacher summed it up simply, stating "Time!!! Time!!! Time!!!" Some teachers pointed out that they make the time because they feel that action research is worth the effort. "No matter my job or position, I will continue to pursue action research." In another mixed response, some teachers reported lack of support from administrators while others emphasized the support they have. "I am able to continue because it is one of our department goals and has support of our administration."

Most teachers chose the positive side of the statement, "I view/don't view action research as self-initiated professional development because...." In a rare example of outside support, one teacher described action research as being "self-initiated but these days administration is really pushing it." For most, "It is a self-initiated process. Informal or formal, action research takes a lot of work. Therefore, it has to be something that one is interested in and willing to put in the extra time." One teacher explained the drive behind the self-initiated process: "When I see an area of concern, I seek answers! Action research is a sound practice to find these answers." Another said, "I think the best

result comes from doing something a person really believes in, and it makes me continually look at research and try new techniques in my professional practices."

Survey Section 5: Change

The combined responses to individual statements in this section of the survey ranged from a mean of 3.62 to 4.33. Agree and Strongly Agree represented 74.2% of all the responses. The overall mean for this section was 3.98. The first and second statements regarding an increased sense of community and greater sharing of ideas received the lowest scores. The fourth and last statements regarding action research as a chance to try new things and better understand student learning received the highest scores. It was later suggested by an advisor that two of the statements that referenced increases in flexibility and sense of community, could mean different things to different people, so no conclusions were drawn. There were no open-ended statements in the Change survey section. Responses to other open-ended questions in this section are discussed below.

Responses to Other Questions

Three survey questions asked about the number of action research projects teachers had carried out. Over half the teachers (54.6%) reported having done no action research aside from the capstone project. Others reported some activity, with the most active teacher reporting 5 to 7 action research projects. Not surprisingly, 74.4% stated that they had completed no action research projects prior to carrying out the capstone project for their master's degree. Some of those teachers were motivated to do additional

action research following completion of their degree; however, 62.8% still responded that they had done no action research projects after the capstone project.

The survey asked participants to comment briefly on the other action research projects they have done. Some projects were explained as "a modification of the capstone project. It was the capstone that allowed me to establish the basic structure of the program." One teacher had a success story to share:

> I have rewritten my homework policy. In the past, I viewed homework as an opportunity for practice… In the past if a student ATTEMPTED every problem would receive a 10/10... Needless to say students fell into the habit of turning in junk and not paying attention when going over homework…I still go over major questions in class and give a few hints but we no longer do an entire homework problem in class. The students whine a little about the grading, but we are seeing higher test scores, better class discussions, and class dialogue with better student involvement.

Teachers were asked about the effects of action research on students: "I believe that doing action research has changed my students' achievement in the following ways (give specific examples if possible)...." One person wrote "Students achieve more when I am reflective on how they learn and what I, as their teacher, have done to allow them to construct their own learning." She put her reflection to good use: "When a learning task is successful, I continue to use it. When not, if I am reflective, I can modify it to bring about achievement next time." Another example described changes in student achievement as "I pay more attention to how and what the students are asking and thus have a better understanding of the student's depth of knowledge. I now evaluate

everything we do and ask how it will enhance my students' knowledge and determine if there is a better method." A final example highlights the effect of the teacher's professional activity on students:

> I definitely believe that action research can really change the whole classroom climate. The students are more motivated when they see their instructor is motivated to help them. I see students who rise to the occasions--even when previously they had no real motivation in excelling in a math class. I also see students feeling much more confident in their ability to learn math.

Teachers were asked to imagine future action research: "If you were to do an action research project now, what research question or problem would you work on and why?" A variety of ambitious action research projects were described in response to this question. One graduate discussed looking at the benefits of online homework for a new curriculum that the school was adopting, to see if it improves student learning. Another teacher wanted to look at how to teach students to be good problem solvers. Another wanted to "Further my initial capstone research and determine if there is a connection between understanding and retention." Other ideas included looking at classroom discourse (mentioned a few times) and how it influences the learning of mathematics in Native American students.

One teacher linked her idea to brain research suggesting that, "The typical class structure for math classes of warm-up, homework debrief/correction, direct instruction with or without guided practice, ending with time for independent practice is completely contrary to optimum learning. She wanted to experiment with "Putting the most

important new information first and then summarizing it during the last minutes of the period with multiple chunks of learning opportunities throughout."

Two teachers shared ideas for working with high-need students, which are best expressed in their own words. The first said:

> Since I am at a school that is of a minority population, I would want to do something related to the ethnic background of my students and stereotypes they believe have been placed upon them and/or their school. I would want to include surveys from surrounding schools to prove/disprove that stereotype exists. I would also be interested in finding out opinions from community on how teachers can help to change stereotypes if they do indeed exist. Note: Of approximately 70 students that I teach grades 8 - 12, 65 are African American. Another study I would be interested in would be is African American students more receptive to instruction from teachers of their own race or from another race.

This teacher's enthusiasm for action research and her students was evident as she concluded, "These are just two of the studies that I've thought about over the past 6 months that I have been at my current school. I LOVE the students at my school. They appreciate everything and are respectful. An action research project would help me to better meet their needs."

The question "What lessons have you learned from doing action research that you could share with others?" inspired a variety of thoughtful ideas. These are discussed in depth in Chapter 5 as part of the overall results. A common theme in this response was that action research "helped me to be more reflective about my practice." One teacher offered three suggestions: "1. Don't be afraid to take risks and try new things. 2. Even

when things don't always go right, learn from the mistakes. 3. Share your thoughts and ideas with others in order to get their opinions and learn from others." Another noted that the process of conducting action research was "actually more important for me as a learner than the actual results. Action research forced me to concentrate at a much deeper level about what I was actually trying to do as an educator. It also led me to learn individual topics at a greater depth providing increased confidence."

A final question in the survey allowed the teachers to say anything else they would like to say about action research, the capstone project, the survey, or their experience in the graduate program. Examples are given here and are synthesized with other findings in Chapter 5. Teachers commented that, "I know I still have a lot to learn. I think the capstone project/action research is essential to the growth of teachers." Also, "The capstone was a wonderful way to end my master's program at the university. It gave me tools to pursue my PhD."

Teachers were also complimentary regarding the overall program. One appreciated that "it was actually RELATED to what I was teaching, very hands on as opposed to theoretical. The teachers had actually taught in the classroom and were very active in staying current with new trends. The students I worked with had a lot to share and I learned a lot from them." Another typical reaction is represented by, "I had high expectations when I started the program. My coursework and capstone experiences exceeded my expectations." This teacher also noted that, "I would have liked to collaborate more with faculty during my capstone and not just at the end when presenting it."

Some teachers referenced both the challenge and the reward of participating in the capstone experience. For one teacher, "It was one of the most grueling yet exciting projects of my life, and I am very happy that I did it and am continuing the practices." Another said "The capstone project was one of the hardest things I have ever done, but the most rewarding." A third teacher was more eloquent:

> I am so grateful for my experience in this program, and the capstone/action research project specifically. It was a turning point for me professionally. It would be a great loss to eliminate the action research component from the program; it was the most significant aspect of my learning in all of my courses and experiences in the program. I strongly encourage you to continue to provide this powerful professional development and learning opportunity.

Capstone Data as Part of the Selection of Interviewees

The capstone projects were examined before the data from the surveys was analyzed. The examination of the capstone projects assisted in deciding whom to interview and what questions to ask in the interview as discussed in Chapter 3. After reading through all of the capstone presentations, I devised a list of graduates for further investigation based on their capstone presentations. This selection was based on the nature of the capstone topic (e.g., working with high need students), the presence of features that met some of the rubric criteria in a strong way (e.g., showing significant benefit), or discussion by the teacher researcher about how much the project changed his or her practice. Based on their capstone projects and presentations, ten teachers were selected for further consideration, identified by number as: 4, 7, 13, 15, 22, 23, 25, 29, 34,

and 37. This information was combined with data from teachers' survey responses, their experience with action research, and their work with high-needs students. The chart in Figure 7 shows how these features contributed to the final decision about whom to interview**.**

An analysis of the program graduates based on these four factors revealed that teachers 2, 13, and 23 possessed three or four of the factors (see Figure 7). This meant that their capstone projects rated high, their qualitative statements from the survey were thoughtful and exemplary, they had more experience with action research (two or more projects), and/or they worked with 40% or more high need students (defined in the survey as being eligible for free and reduced lunch). An "X" in any column represents the presence of that factor for a given teacher. If a teacher had more than one exemplary survey response (e.g., related to the literature, more thoughtful, unique) then it received a high (H) ranking.

Table 7 Interview Selection

Graduate	Capstone	Qual. Survey	Experience	Free/red lunch
2		H	X	X
4	X			
7	X			
12		H	X	
13	X	H		X
15	X			
17		H		
22	X			X
23	X	X	X	X
25	X			
27		X		
29	X			
31		H	X	
34	X	X		
37	X	X		

Not all of the study participants appear in this list. Those whose code numbers do appear here were selected based on the four criteria described earlier. Note that Graduate 27 possesses only one of the criteria, but was added to the set as an outlier representing a negative case. This subset of teachers is representative of the full group of graduates, not merely those who met the most criteria. For example, teachers 17 and 27 only possess criteria in one category, where others rate in two, three, or four categories.

The shaded rows represent the program graduates who were actually interviewed. Twelve teachers were originally selected for interviews; however, 22, 28, and 40 were not interviewed. A conscious decision had been made to interview candidates who were active teachers, and it was discovered that teachers 22 and 28 were no longer teaching. Graduate 40 did not respond to requests for an interview.

Further comparisons were made between the entire group of 45 teachers surveyed and the selected group of nine who were interviewed. It can be seen in Figure 8 that the groups were similar in terms of mean survey scores and standard deviations. This is further evidence that the nine teachers who were interviewed were representative of the entire group. There is one quantitative statement that received slightly higher responses in the interview group: "I have the time to do action research." The nine interviewees had an average of 3.22 as opposed to the whole group average of 2.69 (the last row under Continued Practice). Although this difference might have a cause (e.g., they have more support or make sure they make time for action research), it did not contribute to the selection of interviewees. I did not look at statistical significance between these themes but will do so in future research.

Table 8 Selected Nine Interviewees Compared with Whole Group

	nine interviewed average	standard deviation	whole group average	standard deviation
Benefit				
	4.00	1.00	3.93	0.84
	4.00	1.12	4.2	0.81
	4.22	0.83	4.13	0.89
	4.22	1.30	4.15	1
	3.89	0.93	3.91	0.92
	4.22	0.97	3.97	0.92
	4.00	0.87	4.07	0.93
Practicality				
	3.22	1.09	3.33	1.07
	3.33	0.71	3.31	0.95
	4.22	0.83	4.2	0.74
	4.44	1.01	3.98	1.03
	4.56	1.01	4.3	0.84
Validity				
	4.67	0.50	4.5	0.88
	4.56	0.53	4.37	0.82
	4.67	0.71	4.23	1.16
	4.56	0.73	4.32	1.07
Continued Practice				
	4.33	0.71	4.04	0.88
	4.33	1.00	3.93	1.04
	4.56	0.73	4.3	0.82
	4.22	0.97	4.14	0.9
	3.22	1.20	2.69	1.06
Change				
	3.67	1.00	3.4	1.08
	3.78	0.97	3.62	1.05
	4.22	0.44	4.27	0.59
	4.56	0.53	4.33	0.64
	4.22	0.83	4.07	0.86
	3.78	1.09	3.84	0.82
	3.78	1.09	3.93	0.84
	4.44	0.53	4.33	0.74

The Interviews – Schedule and Results

As discussed previously, the interview participants were selected based on four criteria: their qualitative responses to the open-ended survey questions, the amount of experience they had with action research, the percentage of their students who qualified for free and reduced lunch, and the strength of their capstone project. The interview questions were developed from the research questions and literature review as well as from an analysis of their individual survey results and capstone projects. There was an initial set of questions that all interviewees answered that probed for deeper understanding of areas important to this study. In addition, specific questions were asked addressing each individual's responses to the survey and work related to the capstone project.

I began conducting interviews in September 2008 and completed them in early October. I emailed each of the twelve selected graduates explaining that, based on their capstone presentations and survey information I would like to briefly interview them. All but three responded either immediately or after a second email request. All nine interviewees were willing and able to talk openly and extensively, bringing up important points about action research and their capstone experience. The interviews lasted from approximately 20 minutes to 1.5 hours depending on the teacher.

The interviews were conducted by telephone. I took written notes and, with permission, recorded the conversations. I transcribed the interviews, capturing what was said but leaving out identifying comments. For further validation that the transcripts captured what the interviewee intended and was willing to share, I did member checking

by emailing a copy of the transcribed interview to each interviewee for review and confirmation before using or quoting that data. Although each person had the option at that point to edit or add to the transcription, few changes were made. Some complaints about current work conditions were removed, and some minor word changes were done.

Interview Data

In the following sections, participant responses to the interview questions are presented and analyzed. The major purpose of the analysis is to organize responses in such a way that themes or categories are identified and overall patterns are clear (Patton, 2002). For this analysis I cut up the interviews by question and sorted them into piles by themes and subtopics within themes. I then read again through the interview data categorized under each theme, identifying notable quotations and remarks and quantifying responses where I could. I did not attempt to report every response here, but instead look for general conclusions. The full transcriptions of the interviews can be found in Appendix D.

The interview data is summarized and synthesized into several themes or categories. These are somewhat different than the five themes identified from the literature in Chapter 2 and used to develop much of the survey. Although the interview questions were indeed derived from the five literature themes and the seven research questions, the categories described here arose from the responses that teachers provided during the interviews, rather than from the instruments themselves.

There is, of course, overlap between the categories originally used as a conceptual framework and the themes that emerged from the teacher data. For example, since the

responses related to working with high need students were answered in terms of being beneficial, so I placed those responses with other data related to benefit. In a second step, I created a new theme titled "value" that encompasses many smaller themes, some from the literature and some new: benefit, practicality, continued practice, helpful, and usefulness. Other themes that emerged from the interview data are change, reliability and validity, community, and the action research model.

The Action Research Model

The first group of questions addressed the model graduates used to complete their capstone projects and other action research they have engaged in. A few of the comments described the usual steps in the action research process: "Think about an area to improve, identify the problem, think about what kind of design you want to have and how to measure the before and after, do the research, adjust along the way, and write a report about it." The difference was that the capstone project included a faculty member to serve as an advisor and reviewer. Teachers also noted that the action research process at the university involved building an outline for the project a year before doing it. The input of the advisors was valued, as was knowing about the project ahead of time so they could think about it (33%).

Three of the nine interviewees indicated that getting guidance from their faculty team and from their project classmates was really helpful. Seeing examples of other projects was helpful as well. Another teacher appreciated the handout that specifically outlined how they should do each part of their project: "That was probably one of the most helpful things that was given to me… I knew what I was supposed to do and when I

was supposed to do it." Two teachers did not take the now-required action research course, and they commented on how much more challenging it was to carry out the project without the course.

The idea that the project was "specialized to me" was highlighted. "It was something that I needed to see happen better, something I needed to improve. It was the best thing in the world," said one teacher. "I was really excited about it and I still am…I took a lot of valuable information out of that." Also discussed was how helpful it was working with an advisor along the way and having that support (33%). Another graduate spoke of the team collaboration that is now in her department and how she feels she can be a leader in that team. "I just can't say enough good things about that experience and it should happen to everybody." Another teacher mentioned that seeing other capstone presentations was very helpful, as was studying something in his/her interest area. Only one person stated that the program faculty members were not that helpful.

Suggestions were given for making the program's action research model stronger. One graduate talked about feeling isolated while doing her research because the action research class only meets in the summer. Having a second class in the fall with more input from peers along the way was suggested. One teacher recommended a course before the capstone project where a small action research project is done, to become familiar with the statistics and possible biases. "Having a class where we dissect what is happening, to get more input from peers along with my advisor team, I know that would have helped me."

Working with others who teach at the same level (e.g., high school, middle school, community college) was suggested. Another person advised, "Maybe have the

professors or advisors put together teams who are working together at the same time, so you would feel like you had someone going through the same things you are going through." The idea of having someone "to trouble shoot with, more of a support system is very helpful. I felt very alone." One graduate talked about the benefits of having a mentor (who is not a staff member) paired up with each candidate. Another teacher suggested working with another person along the way; getting different ideas for better brainstorming was also suggested. Lastly, one person highlighted "connecting with people in the field, not just in the program but all over the world, not just in the state."

A key theme raised in this discussion of the action research model was that there was a feeling of isolation. Teachers made recommendations to improve this by creating more interaction, collaboration, and support with others. Even graduates who took the capstone course felt that more could have been done to encourage communications throughout the school year between the graduates. Suggestions included allowing for more peer input, working with colleagues or in teams, having a mentor, and connecting with others in the field.

This feeling of isolation and the need to connect with others was an important outcome in the discussion on doing action research. It surfaced in the portion of the interview that addressed the action research model and in the section on continued practice. Teachers felt that by building community, by having others to talk to about action research, the experience is better and richer and the researcher doesn't feel so isolated.

Value

The majority of data provided in the interviews was related to value. This theme included subtopics such as practicality, benefit, continued practice, what was helpful, and what has been useful for high need students. The sum of all of these topics explains why a teacher should do action research—why it is of value.

1. Lasting effects. Because teachers learned a great deal, their project continues to be useful to them. Many different ways that action research continues to be useful were described in the interviews. Only one person said, "I don't use the result very much." The findings are difficult to categorize as several very different ideas emerged. Overall, action research continued to be useful in different ways that varied according to the teacher, but valuing reflection was a repeated theme. Teachers spoke of being more aware of their own teaching practice and having the ability to look at teaching more analytically and more accurately. One graduate spoke of the useful practice of ongoing and personal evaluation of how she is presenting material. She and others described "more of an informal evaluation, getting a feel for what works and what doesn't." One said, "My methods keep getting modified based on what I did in my capstone process and the testing that we have done. Oh man that's been helpful." One teacher said, "Almost every facet of what I present to my students in the classroom comes from one or the other action research projects. Hopefully I am improving every day because of the ongoing evaluations I do."

2. Value outside the classroom. Teachers have also found value in other areas of their professional lives. A teacher explained that because of her action research project her district is implementing an inquiry based mathematics class for high need students to

get the support they need. One graduate now writes grants that are "all about action research." The action research experience has been "extremely helpful" for addressing the goals of a grant and how results will be reported. Action research taught another graduate to research more, aiding in curriculum development and in evaluating and selecting programs for her district.

One comment from teachers was, "how valuable it is depends on choosing something that's interesting to you" (22% gave this answer) and that practitioners will grow in their teaching because of this factor. "You've got to do something in an area that you feel passionate about." One teacher explained that his action research experience "made me more careful in explaining things." Action research helped teachers to refine their teaching and their questioning skills, and to "[probe] a little bit deeper into what is really going on with students." Another teacher commented that doing follow-up research would be valuable. This is often recommended in action research with multiple cycles of testing and reflecting, but in a capstone project these repeating cycles are not possible.

3. Expanding action research efforts. If action research has long-term useful effects and there are ways to make it more practical to implement, would this encourage more teachers to do action research? Participants addressed the question of how action research can be introduced to teachers beside themselves. They felt that more teachers could be encouraged to do action research, but it would be better to make the approach less formal, more practical, and easy to implement. For example, one teacher suggested beginning by asking these questions: "What do I want to try to improve in my classroom? How can I go about making those changes? What have I been doing but haven't been

lately, or [what went] well and isn't now?" Program graduates discussed ways to simplify action research (mostly by not having to write up all the results) and using it to target issues in one's classroom.

Teamwork was frequently emphasized as an effective way to involve other teachers (44% referred to this). The suggestion was made to set up an action research project for a team of teachers to try and for them to measure it together. "Have the team design it, build it, analyze it—it's got to be real work, it's got to be in their buildings." One teacher stated, "If you do action research together as a team, people would be more excited about it and see how it works." Another interviewee thought, "It would encourage more schools to do a program like ours." One teacher said "Make it accessible to the everyday teacher"; two others said "I think all teachers can successfully be reflective on their practice…we can all do that." One graduate laughed because this seemed so obvious, "Yes!" Two teachers commented that more teachers might get involved if encouraged by other teachers. An interviewee thought of a colleague who with a basic framework could really "jump in and benefit." Having a framework was mentioned twice, and having a mentor once.

When asked if all teachers can successfully do action research, an affirmative yes was given 100% of the time. One person added, "As long as teachers want to learn and help people grow then they all can successfully do it." Teachers "need to know what makes their students tick and the only way you can find this out is through research. The only way to help people learn is to understand how they learn, and I think research will definitely benefit a teacher and help them grow."

4. High need students. "High need student populations can be defined as possessing at least two or more of the following characteristics: (a) a high proportion of low-income families; (b) a high proportion of minority students, including those with English as a second language; (c) a low mean student test performance or a large performance variation, with low-income and minority students over-represented at low performance levels; or (d) inadequate teacher access to professional development and educational resources due to location (rural and urban)" (National Science Foundation, 2008). Teachers provided numerous insights on the issue of action research addressing this population. "The practicality is that we are getting more high need students into higher-level math and we are seeing all of them in school. None of them have dropped out of school, all are still in the program and all are looking at pursuing college degrees." Teachers' considered action research to be a useful tool for understanding more about how students learn and in what context they learn. "There is a 98% Native population in our school so because of what I have done it helps me be a better teacher for my students."

Teachers found value in "finding out what strengths your students have [so] you can build on that in the classroom". One explained that "You can catch misconceptions that you may not have realized and you can help remedy those so students can continue learning, facing fewer obstacles." Action research has caused one teacher to "give the students greater attention and not just from me but from other students" by directing students into peer tutoring, which gets them more involved in class. Another teacher who works with a 99-100% American Indian population said that "To understand whom your population is and how they learn is a big discovery….My work has helped me develop

my lesson, to get to every student at their level without 'dumbing down.'" Another teacher explained that all her students were high need (defined by the definition given above). She cited three keys to reaching these students:

> The relationship I build with the students that made them more confident and then the rigor that I set—the rigor needs to be there even if they are considered high need. …The other thing is, they want to learn it if they see a need for learning it. Relationship, rigor, and relevance – for any student but especially for high need students.

5. Dissemination. Concerns were raised about how to disseminate the information learned through action research. One teacher who had many comments on the helpfulness of action research talked about the need to "get the word out" and to share what she has found so helpful with other teachers. "I think more of us who have gone through the experience need to go out there and talk about how enlightening it is—how valuable it is for building confidence and bringing more to your teaching" (22% mentioned confidence). Some suggested creating greater exposure for action research, such as having a panel at meetings of the Montana Educators Association and the National Council of Teachers of Mathematics to talk about how useful it is. "All teachers should be going through this kind of experience." Attending conferences was viewed as an important confidence builder. All participants said they were supported at least to some degree to attend conferences.

It was discussed that the more administrators and teachers are involved during the dissemination phase the more they are going to care about the outcome of the research. "I think it will also help the teachers to continue or start if it's in the environment it's an

atmosphere of a particular work place." Release time was also mentioned as a way to support teachers who continue to practice action research. One teacher said, "Schools need to allow time for teachers to get together to talk. They need to plan, get ideas, discuss and if they can do that then they can put action research in play with very little expense." Two teachers suggested that newcomers to action research would need some training and support. The need to be compensated for the time involved in doing action research was also mentioned.

Community

Developing a sense of community while doing action research was a theme that presented itself over and over in the interviews. The survey responses rated the community-building aspects of action research relatively low. This shows a lack of a learning community. Survey statements about making progress on school wide priorities averaged 3.33, action research helping to improve the professional culture at school averaged 3.31, having time to do action research averaged 2.69, having an increased sense of community from doing action research averaged 3.4, and sharing more ideas with colleagues averaged 3.62. Since a 2 represents neutral, a 3 agrees, and a 4 represents strongly agree, these ratings are on the lower side.

Community was described by one interviewee to be others who share a common interest and anyone you work with. Another teacher who now teaches at a very small school stated that "You have to have a student community and you need to have a teacher community to be able to implement a variety of ideas of action research." Responses showed that community encompasses many different types of people. Interviewees

referred to faculty, peers, other professionals in the field, administrators, spouses, the larger community one lives and works in, elders, parents, the school board, and friends outside the teaching environment who provide different kinds of feedback.

One person wanted the advising and feedback process to be expanded more. Having just the professor as an advisor was not seen as enough. "We did have a little peer input but not very much. I really would like to have had more peer input during the process and not just my advisory team." Professors aren't always available, are not immersed in the issues that school- teachers deal with on a daily basis, and can't provide peer support. Finally, it was mentioned that more peer input builds confidence and helps the teacher researcher not to feel isolated. One graduate described the frustration of being criticized by a competitive coworker and how that was hurtful. Talking to peers at conferences was seen as valuable, and was said to be helpful in addressing the issue that teachers are isolated much of the time.

Change

Four interview questions directly asked about change: personal or individual change, professional change, changes in curriculum or teaching practice, and changes in student learning. According to the literature on action research, one of the biggest effects of doing action research occurs in terms of personal transformation or change. This particular aspect of change did not appear to be the dominant effect of action research among these interviewees; instead, they emphasized change in the other areas, particularly with respect to teaching practice. It is possible that at the time of the

interviews the teachers had not fully contemplated or realized the changes that might have happened to them.

1. Personal change. When asked about personal or individual change one graduate explained, "For me the changes I've undergone are that data is very important for verifying my theories. If I believe this is the way students' learn best then I need to gather some data to confirm that, not rely on a gut feeling…. Decisions can cost districts thousands of dollars." This comment seemed to be more relevant to change in practice. Teachers feel their opinion is now valuable in their school. Another graduate stated that her "confidence level is so much different than when I started." She now has confidence to talk to her supervisor, and she has been placed on an advisory committee.

One teacher noticed that after working on her capstone project "the most dramatic change is how my students respond to me." Her students knew that she herself was a student working on a research assignment. They saw her learning too, and this made them feel more comfortable to speak up and even point out mistakes in her teaching now and then. Typically, these students do not look teachers in the eyes and they are very quiet and shy. Her students now look her in the eyes and talk more openly to her. The teacher felt this was a huge positive change.

A second teacher also talked about changes in the classroom rather than personal change. She said, "The way I've changed in my classroom, wow, I've gone from a more rigid classroom plan…to a greater flexibility, based on student results and based on my observations." Several teachers (22%) spoke of better addressing students' needs. Another said they connect more with their students, focusing on them. One graduate said

they are more research based now (not currently teaching) because they are in another graduate degree program.

2. Professional change. Many distinct professional changes were described by participants. These included looking at things more critically now and reading more research (33%) to gather information before making a decision. In the words of an interviewee:

> I think personally from action research it taught me how to see, how to evaluate my work. I think often time teachers just teach and you do and you go home and you don't think about evaluating your own work…. 'What am I doing?' and 'Am I doing a good job?' That [process] itself creates the next things that I want to do action research on.

One teacher explained she now has a hunger for doing mentoring work, advocating for professional development and getting other teachers involved in professional development. This is all because of her positive experience with action research. She feels she has grown so much professionally that she wants to get others involved. A second teacher said he has more recognition now from the College Board and Advanced Placement as well as the school district. He feels his work is respected—but he is disappointed that he hasn't been able to do more curriculum work for Native Americans. Another graduate said his action research was a springboard for continuing his degree. Doing an action research project initiated him into the field of research and gave him the idea and confidence to further his graduate education. For yet another graduate, professional change was tied with assessment, "how to find out what they are really

understanding through formal assessments and through questioning." Finally, a teacher commented that action research prepared her to do presentations at conferences.

3. Changes in practice. Many reported changes in practice are related to how teachers approach their curriculum and textbook. One person thinks more about the overall picture now, more about the "before and after when developing a curriculum." Another teacher is more focused on conceptual understanding and more careful about assessment, "making sure students are actually learning, not just following recipes for things." A third teacher doesn't use a textbook but instead develops a more personal curriculum: "My students don't learn best from adults' authority role, so it's more peer directed."

Change for one teacher meant a shift from being a traditional style teacher to an inquiry based approach. This was a direct result of a project that incorporated new teaching methodology; through action research the teacher researcher learned about and saw the results of alternate teaching methods. Another graduate emphasized a change in perspective about objectives:

> In the past I would pick up my book, teach out of my book—getting through Chapter 5 would be good. Now I look at what are the learner objectives, how do they match, how do I design my lesson so it will address the objectives, and how do I assess my students? Now, I am more focused on this—this is what I want them to know, this is how I am going to instruct them, and this is how I am going to test mastery of objectives, rather then materials.

Other areas of professional change include increased service on advisory committees (vital to building more continuity in a K-12 school); using computers more in teaching; and having greater expectations of students. Another teacher spoke of taking more time to get to know their students so they feel comfortable in class. Also mentioned were restructuring the organization of classes, focusing more on having students answer questions, and better understanding of students' interpretations of mathematics problems. It seems unlikely that these changes would have occurred had teachers not had the experience of trying new strategies, researching and gathering data for themselves, and reflecting on their practice.

4. Changes in student learning. developed into another major subtheme. One teacher spoke about her students being more motivated because they saw their teacher as a student trying to learn something to improve their own learning experience. Another graduate found that building a relationship with her students helped them to learn; she also cited "having high expectations, high rigor, high level for students to reach, and how relevant it is to them." Another interviewee noted that he is seeing more students comfortable in class and students trying to take more mathematics classes. Efforts by teachers to build relationships with students and change the way they conduct classes has also changed the way their students respond.

Teachers felt that there were more students going into college and trade schools than before. One graduate explained that increasing numbers of her students are taking the Advanced Placement calculus exam. At the other end of the spectrum, a teacher spoke of previously failing students now succeeding (after repeating her course); she felt that by being more aware of the students and their lives she is now a better teacher and

the students do better too. By teaching towards a more rigorous curriculum, another teacher found that her students valued being challenged. She said, "When you change what you are teaching towards then your students start valuing that." In many cases, the efforts of teachers to focus on student achievement in their capstone projects has paid off in terms of improved outcomes for students.

The students in one setting have a strong oral tradition, and the research on working with this group emphasizes story telling and making problems relevant to the students' lives. However, their teacher found that his students preferred a traditional approach: "A lot of kids said, 'Not so much of that cultural stuff, just more math'—they said, 'We like it when you just explain it to us. We like it when your discussion with us just shows us how to do the problems.'" The students are now talking more to each other, talking about mathematics, and they are awake (an improvement).

Validity and Reliability

In this portion of the interview, teachers explained how confident they felt about the research they did and the findings they discovered. One person claimed to be 80% confident and another said "very confident." Using a kind of reverse logic, others were confident of the validity of their research since they didn't get the results they were expecting (33%). Since their research did not confirm what they thought it would and they were surprised by the outcomes, they felt this meant their results were valid and reliable. Other replies given were "somewhat confident" since it was a first experience with action research, "pretty confident," and "fairly confident" (33%). One graduate had some reservations based on the data he was getting but in the end, after working with his

faculty advisor who pointed results out he did not see, he felt confident in the outcomes that he had.

Teachers also offered suggestions to enhance issues of credibility in action research by improving objectivity and validity. One graduate suggested that a research plan "be really well thought out and designed well. I definitely recommend having somebody go over that with you. Have somebody else look at it—do things make sense to them, do things seem biased to them?" It was also suggested that teacher researchers use rubrics and even recruit someone non-partial to use them (33%). One teacher mentioned that biases might be present when teachers are grading their own students' papers.

Other suggestions were related to gaining experience in research. It was suggested that teachers need training and coursework in statistics to assist with the data interpretation and presentation so that it is reliable and valid. Finding prior research and using outside resources was also mentioned. Another graduate recommended a "shadowing program" where teachers would "be paired with someone who has research experience."

Other Comments

The last question in the interview provided participants with the opportunity to share any last thoughts. Here graduates spoke again of action research as a positive experience for them (44%). One person said, "Action research was a piece of what I have been coming to as a professional teacher." Another stressed, "How very important it is that every teacher goes through this process." This person also felt that a panel at

state teachers' conventions where teachers can explain what they do with action research would help to inform others about its benefits. The value of the capstone project was summarized by one teacher:

> I think it's a great project. I think we should do more of it. All teachers' benefit from action research in their classes but sometimes it's hard to get through even one day. Sometimes in high school you are not just teaching kids, you are dealing with all the things going on their lives. I am amazed at what some of those high school teachers do when paired with a university professor…. Everybody is so busy in their lives it's hard to stretch. It's really valuable.

Conclusion

In summary, the graduates are very positive about the master's program and the useful learning experience of doing action research. Because of the capstone project, they feel that they are more reflective and have a deeper understanding of their students and their students' learning. The teachers emphasized the value of action research as well as the importance of support from a community of educators. Each interviewee had a slightly different style and I enjoyed getting a sense of each one. A few were very animated about action research, teaching, and the program. Another, who is now out of the classroom and in curriculum design, was thoughtful and more philosophical about her experience and its implications. One teacher voiced frustrations with his current teaching position and how difficult it was to conduct action research because of his circumstances. Each teacher had a slightly different voice and things to share, yet there were many

similarities, even though they are in different geographical locations and working with different types of students.

The purpose of this chapter has been to unify and synthesize the unique voices of the 45 study participants. This has been accomplished through analysis of both qualitative and quantitative data. The results of the survey, the analysis of capstone projects, and the interviews have been gathered and reported. In the next chapter, I discuss major themes and offer concluding remarks and recommendations.

CHAPTER 5

CONCLUSIONS

In this study I have examined action research as carried out by teacher practitioners in educational settings. A review of literature revealed five recurring themes that provide a framework for my investigation: benefit, practicality, validity, continued practice, and change. My quest was to examine faculty-mediated action research in light of the five themes that emerged from the literature. A review of graduate programs indicates that faculty-mediated action research is a common ingredient. However, I was able to find only one study that focused on faculty-mediated action research conducted by teachers as part of graduate programs.

This study of faculty-mediated action research at one university was designed to explore several areas of interest captured in seven research questions:

1. Under the faculty-mediated model, what types of action research projects do teachers typically see as important and engage in within their specific educational settings?
2. How does the teacher researcher ensure that all aspects of the research design are well aligned with the research questions? What standards of validity are appropriate for action research in educational settings for teacher practitioners?
3. How do teachers benefit from action research?
4. How practical are the requirements placed on teachers to do it well?
5. In what ways do teachers continue engaging in action research, in the absence of outside funding or faculty support?

6. How does teacher practice change as a result of doing action research?
7. How does action research affect teachers' ability to address the needs of diverse or high need student populations?

To summarize the method used: I first designed a pilot survey based on the themes identified in the literature and the research questions. The pilot survey was administered to twelve science teachers who had conducted faculty-mediated action research as part of a similar master's-level program. Their responses and suggestions contributed to the final design of the survey, which was then sent to the teachers in the mathematics program who had graduated in the years spanning 2003 – 2007.

Every graduate from those years (n = 45) completed the survey, which provided both quantitative and qualitative information. All forty-five of these graduates' capstone projects were then examined. Based on the survey data and an assessment of the capstones, a group of twelve graduates were identified for closer study through interviews. These participants were selected based on four criteria: the nature of their capstone projects, their qualitative responses to the survey, their overall experience in doing action research, and how many of their students qualified for free or reduced lunch. Nine interviews were ultimately completed. One of the original twelve subjects did not respond to requests for an interview after multiple attempts, and the other two were no longer teaching.

A second review of capstone projects and survey responses was conducted to assist in developing both general and specific questions for the interviewees. Revisiting the capstone projects helped to provide specific interview questions, as I asked interviewees to describe their work on the capstone project and to address statements

made in their capstone reports. Reviewing the projects also provided a sense of each teacher's overall experience with benefit, practicality, validity, continued practice, change, and effects on high need students, although not always and not consistently.

Answering the Research Questions

The following sections address the research questions posed in this study and how the three sources of data contributed to answering these questions. A limitation of the methodology used in this study that needs to be kept in mind as conclusions are presented is that the primary source of data is self-reported by the participants.

Question 1: Types of projects. The study explored what types of action research projects teachers typically engage in and view as important in the educational setting. The participants described their research as closely following the faculty-mediated model: deciding on a problem they wanted to work on, reviewing the literature on that problem, and devising a plan for intervention and data gathering. After having the plan approved and revised by a faculty advisor, they collected and analyzed the data, wrote up results, and reported on the project. This model was the only one the graduates were familiar with. If they went on to do more action research it usually followed similar steps but in a less formal way, and involved interacting with other colleagues rather than university faculty.

Most respondents stated that the faculty-mediated action research model is effective and works well, although it was only available during their master's program. Having a group of professors act as a validation group, guide the research, and provide checkpoints was unique to the capstone project experience. The faculty overview was

deemed valuable and in some cases was indispensable. However, there were a few complaints regarding the university faculty; they were sometimes too busy or not that helpful, and of course did not reside at the school where the teacher is teaching.

The capstone experience was useful—not one survey or interview remarked that the research they did was not useful. It was viewed as critical that the capstone project focus on something that the participants care about and are interested in researching. Overall, what is most productive in educational settings is to have time and encouragement for doing action research. Support for the process needs to be built into the culture of the school. One example of support that is built into the culture of the school comes from the administration, by making time for teachers to meet and time for teachers to incorporate action research into their schedule. Another example is for the school to have mentors or teams of teachers who are encouraged to work together and talk about the action research they are doing.

The projects teachers chose to work on cover the full spectrum of issues that teachers deal with daily. The assignment was to pick a topic that focused on student achievement, which allowed for many possibilities given the participants' unique classes and students. Their projects targeted instructional strategies, curriculum design/redesign, and assessment as well as school-wide programs. Figure 9 highlights each capstone project in terms of its general topic, specific focus, and grade level affected.

Table 9 The Types of Action Research Projects Conducted

Topic/Focus	Middle School	High School	Community College	Other Level
Program Evaluation		School program	School program	School program Professional development (2)
Curriculum Redesign (Content or Methods)	Multiple representation	Cultural relevance Problem solving (2) Technology (3) Communication (3) Ratio/proportion (2) Logical reasoning	Multiple representation Technology (2) Ratio/proportion Problem solving	
Curriculum Redesign (Assessment)	Conceptual understanding Student traits (2)	Conceptual understanding (2) Strategies (2) Student traits (2)	Conceptual understanding Strategies Student traits	
Curriculum Redesign (Course Redesign)		Struggling students (4) Course mechanics Course content		
Other	Mathematical alignment			Engaging students

Most participants who were currently teaching focused on their practice in one course and topic area. Many focused on some new method or strategy that changed some aspect of the mathematics that they taught. These included incorporating technology, emphasizing specific topics (e.g., rational numbers), using multiple representations, and focusing on communication, problem solving, or inquiry. Others targeted assessment practices, course mechanics, and types of interactions between students and with students. Some teachers focused on larger programmatic issues, looking for better ways to assess programs and assessing the impact of existing programs. These might be course level impacts, such as students' conceptual understanding of quadratics or functions, or broader impacts resulting from current practice in their school.

Many projects were focused on the needs of struggling students. The interventions included focusing on the cultural and historical relevance of the curriculum, addressing math anxiety, adopting strategies that took into account learning styles and multiple intelligences and remediation support.

In general, teachers studied something they could reasonably access in the situation they were in. Some were driven by needs shared by teachers in their schools and districts, others by intellectual curiosity. However, there was also something important to them about the topic. Almost universally, the topics chosen were personally relevant to the teachers in the context of their particular work. For most, the action research was not intended to totally transform their teaching practice or philosophy of learning, but rather provide incremental improvement in practice and understanding.

Question 2: Validity and reliability. The study also explored the standards of validity used by teacher researchers in educational settings to ensure quality and alignment. Teachers ensured accuracy in their action research by finding similar studies, talking with other teachers and researchers, talking with experts in the field (and sometimes someone outside the field), and by checking with their students. The predominant standard of validity for the teachers in this study was consultation with other teachers on the questions, design, and results of the action research. Especially valuable were the interactions with teachers from the same school or similar schools. To some extent, collaboration with teachers in the same school is dependent on the culture of the school.

Teachers felt very strongly that discussing their research with others in the field and gathering different kinds of data from different perspectives when possible was sufficient

and appropriate for teachers doing action research. They also tried to give careful consideration to what they were testing and asking in terms of alignment with their research questions. The fact that doing the capstone project made them more reflective about their work and more likely to read research literature in their field also contributed to accurate outcomes in future research.

Question 3: Benefits of action research. Both the survey and the follow-up interviews indicated that most if not all the teachers benefited from action research, and highly so. They saw benefit in their teaching, in becoming more reflective, and in having more insights and tools for working on problems in their classrooms. They stated that their students benefited, including high need students. The teachers' view was confirmed by the results reported in their capstone project presentations, where interventions were shown to have benefited their practice and their classrooms. The overriding benefit for teachers was that action research made them more reflective in their teaching practice, more aware of what is really going on in their classrooms and more aware of their students and student learning.

Question 4: Practicality of action research. Most of the teachers interviewed stated that action research would be more practical if they could use more informal approaches that still met the quality criteria for action research. While the capstone project was very valuable it was seen as rigorous and challenging, especially given how busy the teachers were already with their workload and other commitments. Not always having to write up results or document every step of the process is more appealing in some cases and more realistic in many. Teachers seemed willing and able to continue doing action research using less formal methods. However, as the formality of action

research increases, then so does the need for it to be embedded in the daily curriculum and schedule and supported by the school community. To do action research well, teachers need to meet on a regular basis, have administrative support, attend conferences periodically for professional development, and have permission for action research to be part of their professional development. This is not the case in most schools.

Question 5: Continued practice. The study investigated how (and if) teachers continue to engage in action research in the absence of outside funding or faculty support. Often, teachers in this study did not continue to engage in action research after the capstone project was completed. While all felt it was very worthwhile, few have continued to do action research, often stating that their current teaching position doesn't allow for it because they are too busy or it is not encouraged. A few teachers interviewed commented that they are overworked and can't find the time to fit it in.

It is very difficult to forge ahead alone in action research. One teacher even reported being ridiculed and negatively judged because other teachers did not understand the purpose or process of action research. The teachers who continue to do action research are either working or talking with another teacher in their building or department, and/or the administration has incorporated action research into the curricular goals so the culture is supportive and the environment is conducive for doing action research. There are very few teachers in this group. One teacher who is at a small school talked about feeling isolated, but wants to do more action research soon and plans to contact another rural schoolteacher to see if they can work together on an action research project.

When action research is not encouraged or supported in the school culture, it may

continue to occur but usually in a less formal manner. In most cases, this means results are not written up. Participants described the same steps of the action research process that were required under the faculty-mediated model, (choose a topic, learn about that topic, devise a plan and implement it, collect data, and reflect on the results). However, now the participants do not write up results, or rarely do, and they tend to be less rigorous in the steps described above. This is to be expected since they are no longer committed to a yearlong research project for a master's program.

Another key result of this study found that the school and the culture have a sizeable impact on whether and how teachers continue to do action research. Action research is continued in schools where the teachers have support and the administration requires it, encourages it, or at least appreciates it. One school district requires action research as part of the agenda, so teachers are involved in different action research projects in their classrooms, departments, or district-wide. In the case of encouraging action research, one school is supportive as long as it benefits the students. So, two teachers do action research and support each other in their classroom projects. In other cases, the use of action research was lost and the teachers stated that they did not have time to do formal action research. They may continue to be more reflective, but if teachers are not in a culture conducive to do such work, then time becomes the reason (or possible excuse) for not doing it.

In summary, it seems that the faculty-mediated model exposes teachers to action research but does not lead to sustained action research. Action research appears to work best and to be most sustainable when the culture of the school encourages and supports it. Even in the case where a university program supports action research, the teachers did

not continue to engage in action research unless they worked very hard on their own, their school culture already supported it, or the school culture changed and began being supportive of action research. What seems to help is having other teachers who are interested in action research, having time to talk and work with each other, and having at least some support from the administration if not actually having an action research agenda built into the curriculum. Funding did not arise as a significant obstacle to continuing action research. Factors that do hinder teachers from doing action research were seen when other teachers were threatened by it, when the administration only pats the teacher on the back but does not support the results financially, and when teachers are too busy and there is not time allowed or built into the schedule for action research.

Question 6. Change in practice. Many of the interviewees mentioned or talked extensively about becoming more reflective as a result of doing action research. They are now better observers in their classrooms. Doing action research has made the teachers more aware of their students and of the effects of their practices on their students. Their relationships with their students have improved, and the students have responded with improved grades and understanding.

In many of the survey statements and in all of the interviews, teachers described now feeling part of a larger group of researchers, teachers, conference goers, and presenters. They are aware of the bigger picture of their profession and of being a professional. In many of the interviews, teachers stated that they now read and look to the research literature more often. Reading professional literature, especially research literature, was not something they did previous to the capstone project. The teachers have now become researchers and see themselves this way.

Another major result relates to having more confidence in the classroom and in the workplace. This translated into more collaboration with other teachers, networking with others not local, speaking at conferences, and better communication with students and administration. Action research gave these teachers the confidence to try new things in their classrooms, to ask questions, to investigate, to not be afraid, to speak up, and to speak out. Sometimes this alienated them from other critical teachers who "just want a pay check" and did not care as much about "being the best teacher they can be for their students." Some noted that the administration just doesn't care much, even with convincing data from the action research results; their priorities are in other places. Regardless of negative consequences, all the participants interviewed felt that they are better teachers now because they have conducted an action research project.

Question 7. Working with high-need students. All of the interviewed teachers saw action research as beneficial to high-need students, whom they described as predominantly low income Native American and low income African American. Action research was viewed as a tool to use for solving problems in the school or in the classroom when high-need students were not excelling. In one case, because of an action research project the school's high need students now have a higher graduation rate than before and are going on to take more high level mathematics. The program started through action research is continuing at the school, but with little administrative support. At another school, two teachers discuss regularly the techniques they are trying in their classrooms with their high need students. They also have school support to go to conferences and try new things, as long as they can show benefit to the students.

Action research was found to assist teachers in finding ways to reach and help their

students, often providing new information that is valuable for the teacher and likely would not have otherwise been readily available. A program graduate now serves on committees that make curricular decisions that will affect the high need students. Another teacher looks online for studies and tries new techniques in the classroom that will relate to high need students and has had success in turning these students' academic performance around. The students now believe that they can do mathematics, and they are succeeding more than before.

Hence, it was found that action research is very effective in addressing the challenges teachers face with high need students. It is a way to target, learn about, and adjust curriculum to meet the needs of the specific students being taught. By targeting a problem, reading about it, gathering data, and then reflecting, teachers were able to have unbiased realizations about their students and their learning. This was especially valuable because the teachers were all ethnically different from their students. Action research helped them to let go of bias and find new ways to help their high-needs students.

Suggestions for Practice

The findings from this study are of immediate value to the department faculty that teaches and designs this master's program. However, they also inform other similar programs for practicing teachers that incorporate action research. The teachers who formed the population for this study are articulate and experienced educators. Their capstone experiences and continued action research efforts are an example of putting theory into practice, and they need to be heard.

Teachers in this program strongly value the freedom to identify a problem or intervention in their own classrooms that they want and need to address. For this reason, it is crucial that faculty and supervisors for such programs make sure that students are allowed to work on projects that they are passionate about. It was heard in almost every interview how beneficial it was that teachers were allowed to choose and develop a topic they wanted to work on in their unique classroom, relevant to their particular school setting.

It may be difficult, if not impossible, for the program faculty to provide expertise across the broad spectrum of topics that may be proposed as capstone projects. However, allowing the teachers to research and work on what is important to them appears to be more critical than having expert faculty available in the particular area the student is studying. The teacher researchers can inform the faculty as well as learning from them. Further, this goal can be met while still honoring program expectations to focus on improving student achievement.

The data suggest a variety of additional suggestions for program improvement. Teachers recommended the assignment of a "mini capstone" so they could become familiar with action research before conducting the larger project required for completion of the program. They confirmed the importance of attending and learning from other capstone presentations prior to beginning their own project. Finally, they supported having a full year to carry out the project (i.e., develop a proposal, implement an intervention, and work on the capstone report).

The development of a learning community should also be addressed. Teachers valued each other and their different experiences and knowledge as an important

resource. They would benefit from increased communication among themselves while carrying out their capstone projects. This can be accomplished by establishing critical friends during the action research project (peers or colleagues who ask probing questions and offer helpful critiques), clustering the teachers by their type of research study, and creating an online discussion forum to promote interaction. Fostering communication and creating opportunities for teachers to learn from each other is valuable and important.

Lastly, there may be ways to improve the likelihood of continued practice in action research among teachers at the end of the program. One approach is to provide guidelines and support for continuing action research with a less formal approach after the capstone project is concluded. Program faculty might also lead discussions on how teachers see themselves continuing to practice before they exit the program. Teachers may find that journaling, working on time management, building a community of critical friends, and sharing strategies might all encourage the continuation of action research when school climate does not.

Reflection and Limitations

When I began this project in 2007 I was not familiar with the key features and benefits of action research. Initially I had no reason to believe that action research was as much of a panacea as the review of literature said it was. However, as I began collecting and analyzing data it became clear that the survey data confirmed what I had read in the research. Reviewing finished capstone projects and completing interviews with teachers further established the full value of action research.

One limitation of this study is that I have not conducted an action research project myself, so I am inexperienced in this way. I have only read about action research and talked to others who have engaged in it. Perhaps the themes that I identified in the literature would be interpreted differently if I had carried out action research myself. On the other hand, inexperience with the phenomenon I am studying may be an advantage in that I am not biased from my own experiences with action research.

An important limitation of this study is that a significant amount of data (e.g., survey and interview responses) came from self-reports. Data was taken directly from the capstone projects, but this process was problematic as described earlier. Additional evidence such as classroom observations or student learning data to triangulate or provide a counterpoint to teacher statements about change in these areas did not occur.

Another limitation is that this study examines action research only as it is offered by one master's level program in one institution. However, the program is in many ways representative of other content-based master's programs for practicing teachers. This study also has several strengthening features, including a 100% return rate on surveys of all program participants over five years, and consistency between the findings from surveys and interviews. It happens that the results turned out to be quite positive, affirming the value of action research in general and as a component of the master's program at this university in particular.

Directions for Future Research

It would be interesting to extend this study by examining differences in schools where teachers continued to conduct action research and schools where this did not happen. It would be helpful to the future of action research to explore how much the school culture and support of colleagues influence the ongoing pursuit of action research. This idea can build upon and explore the findings in this research that the action research project did not notably contribute to community at the teacher's schools.

It would also be useful to examine the nature and effects of a less formal action research model. Many teachers in this study talked about continuing to conduct action research, but in a format much different from their faculty-mediated action research experience. Does this degree of formality and structure influence the success and validity of action research and the practical application of its findings?

Another idea that would be valuable is to look more intensively at the direct and indirect effects of action research on students. Students are ultimately the beneficiaries of any improvements to instruction that result from action research. Do positive findings from action research successfully translate into classroom practice? Possible ideas would be pre and post testing with students before and after an intervention project has occurred, observations, surveys, conducting interviews, and possibly comparing a class where action research is being conducted to a class where it is not.

To further investigate teacher practice, one might work closely with only a few teachers, for example, four teachers, in a three-phase study. A researcher could conduct pre classroom observations and interviews, then work closely with the teachers through

an action research project over the course of a semester or two semesters, followed by post classroom observations and interviews. Having the researcher and teachers build a portfolio showcasing evidence of the effects of conducting action research would supply interesting and useful data to supplement self-reported data.

Another research idea would be to investigate how to critically evaluate action research under a certain model. A rubric could be designed detailing how to analyze a capstone project thoroughly. This rubric could better assess the issues raised in this dissertation research and provide ways to rate capstone projects consistently and accurately.

A related question I plan to research in the future is to examine the apparent correlation between the five categories of: benefit, practicality, validity, continued practice, and change. By statistically analyzing the results that were shown in the charts in this dissertation and seeing how the responses to different categories correlate, I will be able to see if there is a relationship between these categories. For example, does high benefit correlate with high practicality or continued practice?

As a researcher and an educator, I would like to incorporate action research in the work I do in the future. Whether I am teaching, conducting formal research, or evaluating a program or intervention, I will incorporate action research into my professional life. It is not solely a teacher's tool; as discussed at the beginning of this dissertation, action research is used in many fields. I think, as one graduate put it, "I am already reflective, but action research gives me the tools to use." The tools of action research can help me and others research a topic or problem of interest, take informed

action, gather data from more than one perspective, reflect on the findings from that data, and make decisions to improve or enhance the circumstances of my situation.

Conclusion

This study revealed action research to be a useful and effective way to investigate problems or test new ideas in the classroom, to the benefit of both high need students and the general student population. Teachers view action research as an excellent approach to professional development, especially because it addresses issues that teachers care about and deal with on a daily basis. The surprisingly dominant and almost unanimous response of the 45 graduates from 2003–2007 demonstrates that action research is highly regarded as an effective, simple, and well-designed problem solving tool and a way to experiment with new possibilities in one's own practice.

A significant contrasting theme that emerged from this study is that the school culture is an essential factor affecting whether teachers continue to conduct action research. The attitudes and behavior of administrators and teacher colleagues set the stage for developing an ongoing action research program. Teachers have difficulty sustaining a program of action research on their own. Without a supportive professional environment, teachers will miss out on the important attributes and benefits of ongoing action research.

Overall, this study reveals that action research is a useful and empowering problem-solving tool that promotes improved confidence in one's teaching practice. By engaging in action research, teachers expand their methods of teaching and learning and become more actively reflective on the work that they do. By all accounts among the

teachers who participated in this study, action research is a valued addition to a teacher's portfolio of teaching and learning experiences.

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APPENDICES

APPENDIX A

THE SURVEY

Survey for graduates of MSU MSMME

Welcome! Please take a few minutes to answer this survey. Your answers are completely confidential and will be used in a dissertation research project. No individual survey responses will be given to any one and if there are any identifiable statements they will be edited to protect all parties involved. The MSMME faculty is interested in the overall responses in order to improve the program. We will examine the usual statistics on a population of 40 graduates total. Your completion indicates your agreement to participate in this valuable research. Thank you very much!

(start button)

Survey for graduates of MSU MSMME

The purpose of this survey is to better understand your views on action research based on your experience with the capstone project and other action research or similar research projects you have done.

There are five sections to this survey: benefit, practicality, validity, continued practice, and change.

Please note: This survey is written in the present tense assuming that you may have gone on to do other action research type projects. It applies to all students who have completed a capstone project in the past four years. Please answer with this in mind, reflecting back to the capstone project you did and combining your experiences from doing this kind of research. Thank you.

If you need to review the description of the MSSE action research or capstone project, here it is. From the website for MSMME: The capstone project is an action research project, based upon a classroom topic of interest to the student

and presented as a series of web pages. The underlying goals of the capstone project are to improve student achievement in the teacher's classroom or improve the teacher's understanding of the teaching and learning process.

Your name and the title of your capstone action research project

Section 1: Benefit
(Benefit = favorable or advantageous; resulting in good.)

		strongly disagree	disagree	neutral	agree	strongly agree
(1)	I have become a better problem solver from doing action research.					
(2)	I feel more confident in my teaching practice from doing action research.					
(3)	I have benefited from sharing my action research with others.					
(4)	My desire to better understand more about my teaching practice is fulfilled when I do action research.					

		strongly disagree	disagree	neutral	agree	strongly agree
(5)	I feel that others have benefited from my action research. (Perhaps others in the field, administrators, parents, etc.)					
(6)	I feel more connected to the work I do because I can affect change by doing action research.					
(7)	One of the benefits of action research is that I have the opportunity to work with students, faculty, and even my school toward a common goal.					

(8) Who has benefited from your action research? (From question 5, who has benefited from your action research)

(9) Action research has been beneficial for my students because.....

(10) Action research has **not** been beneficial for my students because.....

(11) Action research has been beneficial for me as a teacher because.....

(12) Action research has **not** been beneficial for me as a teacher because.....

Section 2: Practicality

(Practicality = likely to succeed or be effective in real circumstances; feasible)

		strongly disagree	disagree	neutral	agree	strongly agree
(13)	Our school or my classroom has made progress on school wide priorities from doing action research.					
(14)	The action research I have done has helped to improve the professional culture at my school.					
(15)	Action research is worth the time because it brings new vitality to my work as a teacher.					
(16)	I am more motivated in my teaching practice because of action research.					
(17)	I am more reflective about my work from doing action research.					

(18) Action research is a practical way to meet the needs of my diverse student body because.....

(19) I find action research impractical to do because.....

(20) I make action research practical to do by.....

Section 3: Validity

(Validity = guaranteeing that the research actually supports the intended point or claim)

		never	seldom	about 1/2 the time	usually	always
(21)	I report all the outcomes, expected and unexpected, in my action research.					
(22)	I gather data from different perspectives if possible to give more insight regarding my research questions.					
(23)	I consult with other people concerned and with other researchers to help ensure that my research is valid.					
(24)	I try to design my action research so it can be repeated by other teachers.					

(25) I am careful to justify my results from action research by.....

(26) I ensure that I don't simply confirm my own biases when I do action research by.....

(27) I ensure validity in my action research by.....

(28) I find it difficult to ensure validity in my action research because.....

Section 4: Continued Practice

	strongly disagree	disagree	neutral	agree	strongly

		disagree				agree
(29)	My immediate supervisor is supportive of me doing action research.					
(30)	I share my action research with a wider community than just myself.					
(31)	My research agenda comes from me so I have reason and motivation to do it.					
(32)	Because of action research I find I continue to gather more information that helps me make professional decisions.					
(33)	I have the time to do action research					

(34) I am able/not able to continue to do action research because.....

(35) I view/don't view action research as self-initiated professional development because.....

Section 5: Change

		strongly disagree	disagree	neutral	agree	strongly agree
(36)	I have an increased sense of community from doing action research.					
(37)	I now share more ideas with my colleagues from doing action research.					
(38)	I learn more about what works and what doesn't from doing action research.					
(39)	Action research is a methodology that helps individuals to try new things.					
(40)	My practice has improved because of action research.					
(41)	Action research is a methodology that helps me to be					

	methodology that helps me to be more flexible.					
(42)	I am more satisfied with my teaching practice now because I have done action research.					
(43)	Action research provides a deeper understanding of my students learning.					

(44)	Aside from the capstone project, how many action research projects have you done?	
(45)	How many action research projects before the MSMME capstone?	
(46)	How many action research projects after the MSMME capstone?	

(47) Can you comment briefly on the other projects you have done?

(48) I believe that doing action research has changed my students' achievement in the following ways (give specific examples if possible).....

Last few questions...

(49) If you were to do an action research project now, what research question or problem would you work on and why?

(50) What lessons have you learned from doing action research that you could share with others?

Other Information

		2003	2004	2005	2006	2007
(51)	MSU graduation date					

(52) Number of years of teaching experience

(53) Your age

(54) Gender: Female Male

(55) Average number of students you teach per term

(56) Subjects/Courses you teach

(57) Describe the demographics or other characteristics of the community where you teach.

(58) Would you describe the place where you teach as:

- ...a metro center (population over 1,000,000)
- a big city (population 100,001 - 1,000,000)
- a city with population 20,001 - 100,000 adjacent to a metro area or big city
- a city with population 20,001 - 100,000 NOT adjacent to a metro area
- a small city (population 2,500 - 20,000)
- a rural community with less than 2,500 people

(59) What grade levels of students have you taught while examining your teaching practice with action research? *Select as many as apply:*

- grades 3 - 5
- grades 6 - 8
- grades 9 - 12
- University or college
- adult learners

☐ Other: _____

(60) Please characterize the students in your classrooms (*select as many as apply*)

☐ Regular (mixed) classroom students
☐ Home school program
☐ Gifted program students
☐ Extracurricular program
☐ Special needs students
☐ Other: _____

(61) Which of the following best describes your ethnicity?

○ Hispanic or Latino ○ Not Hispanic or Latino

(62) Which of the following categories best describes your racial identity? *(Select all that apply)*

☐ American Indian or Alaska Native
☐ Native Hawaiian or Other Pacific Islander
☐ Asian or Asian American
☐ White
☐ Black or African American
☐ Other: _____

(63) Please give an estimation of the percent of free or reduced lunches students are eligible for.

_____

Estimate the proportions of the students you teach within each of the ethnic categories below.

		None	less than 25%	25% - 50%	51% - 75%	76% - 100%
(64)	American Indian or Alaska Native	○	○	○	○	○
(65)	Asian or Asian American	○	○	○	○	○

(66)	Black or African American					
(67)	Native Hawaiian or Other Pacific Islander					
(68)	White					

(69) Is there anything else you would like to say about action research, the capstone project, this survey, or your experience in the MSMME program?

Send Answers Clear All

APPENDIX B

ACTION RESEARCH GUIDELINES

Capstone Presentation & Comprehensive Examination

Overview

All students must present (A) a capstone project and (B) pass a follow-up oral examination in order to complete the MSMME program. These requirements are intended to give the student the opportunity to synthesize a significant body of knowledge based on their work in the MS program.

Part A: The capstone project is an action research project, based upon a classroom topic of interest to the student and presented as a series of web pages. ***The underlying goals of the capstone project are to improve student achievement in the teacher's classroom or improve the teacher's understanding of the teaching and learning process.*** The first step of a capstone project is a capstone proposal, which must be approved by the student's graduate committee. The results of the work are presented in a seminar, symposium, or other suitable forum approved by the student's committee. Here are some samples of Capstone Project pages:

Sample 1 Sample 2 Sample 3

Sample 4 Sample 5

Part B: The oral exam allows the student and his/her graduate committee to reflect on the theoretical foundations, methodology, and results of the capstone project. This exam is normally taken immediately following the capstone presentation. A notification of intent to take the examination must be filed with the Department of Mathematical Sciences and the Office of Graduate Studies in accordance with the "Dates and Deadlines" posted in the MSU Graduate Catalog.

Course & Credit Hour Requirements

The capstone project represents a significant component of the MSMME program. As a result, the capstone project now comprises seven (7) credit hours of the students' entire 30-credit program of study. Specifically, as of summer 2006, each student intending to complete a capstone project **must** include the following three courses on their program of study:

Math 571-01 In-Service Mathematics Education: Introduction to Action Research **2 credits, on-campus, offered each summer**

Math 571-02 In-Service Mathematics Education: Proposal Development **2 credits,**

distance, offered each fall through the Burns Telecommunications Center.

Math 577 Improving Student Achievement in Mathematics **3 credits, on-campus/distance. Offered each summer though the Burns Telecommunications Center.**
Most students will complete 571-01 during a summer session, 571-02 during the subsequent fall semester, and 577 during the subsequent summer session. Please note that the College of Graduate Studies mandates that each student must be enrolled in at least three credits of coursework (of which 577 qualifies) during the semester they complete their capstone project and during the semester they intend to graduate.

APPENDIX C

INTERVIEW QUESTIONS

(I use AR synonymous with action research and capstone project.)

1. Describe the action research process you experienced at MSU. What suggestions might you have to make the **MSU AR model** stronger? What is one thing you remember about the MSU AR model that was very helpful? Describe **other** action research **models** you have worked with and how effective you found them to be?
2. How **confident** did you feel about the measures you took to ensure **validity** in your action research (i.e. that you weren't just confirming your own biases, finding what you wanted to find, or thought you would find)? What guidelines for improving objectivity and validity would you recommend to your peers who would like to do action research in their classrooms?
3. Can you give an example from your school action research experiences that **demonstrates the practicality** of your project? What **ideas** might you have as to how to make the action research process even **more practical**? Do you think this would **encourage more teachers** to do action research?
4. While funding is always helpful, it's not always available. Are you supported to attend conferences? What other factors (not financial) do you think could help teachers **continue to practice** action research?
5. These next 4 questions are about change but each focuses on a slightly different aspect.

- What **personal or individual changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?
- What **professional changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?
- What **curriculum and teaching practice changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?
- What **changes in student learning** have you seen from doing action research? Can you give an example? How valuable would you describe these changes to be?

6. Do you think **all teachers** can successfully conduct AR? Can you explain why or why not?
7. High need students can be defined as traditionally less engaged, less successful, or having a history of being underrepresented, etc. In what ways has AR affected your **high need students**?
8. Writers on AR often talk about the importance of **interacting** with other **professionals** while doing action research. During your AR experience at MSU, whom (if anyone) did you interact with about your research while you conducted it? And, in your research after MSU, whom did you interact with? Do you think **community** is an essential component in AR (and who do you define community to be)?
9. In what ways, if any, are you able to **use the results** of your AR in your teaching practice today?
10. What about AR is still **useful** to you?
11. Is there anything else you would like to say that I have not covered in this interview?

Specific Interview Questions

Graduate A

Did you continue to research methods to help all students overcome math anxiety? If so, what did you do? What did you find? If not so, can you explain why?
Did you get input from students on how you can better meet their needs?
What have you found that works?
What are you doing with action research these days?
Have you found methods to better meet the needs of a minority student population, as you mentioned in the survey, that this research would be beneficial in helping teachers who want to meet such needs?
Why do you think the school you are at has requirements that make it difficult to do action research for non-tenure teachers?
Do you think this changes once you receive tenure?
Have you been able to do any action research in your current teaching position?

Graduate B

You gave a 3 on the survey one a scale of 1 – 5 for "Feel more confident in teaching from doing AR". Can you explain why?
You stated that, "No matter what my job or position, I will continue to pursue action research." What have you continued to do? Why such a strong positive statement?
You stated that, "I DO view action research as self initiated professional development. Every teachers should strive to improve themselves as an educator, and the pathway to this type of improvement is action research." Again, a strong statement, why and what have you seen because of this view?
Can you briefly comment on the 4-5 projects you did before MSMME. What kind of AR were they? (Probe what action research means.)

Graduate C

You gave a 3 for AR bringing new vitality to your work as a teacher. Your project seemed to indicate a higher score. Can you comment?
How do you deal with the time issue now in order to do AR?
On "it being hard to account for all influencing factors with it comes to human beings." Can you comment on what you do to address this issue?
What do you do about having the time to do AR? You gave it a 3 on the survey.
If your definition of AR is not formal, can you share what your definition is?
You gave AR a 3 in helping you to be more flexible. Can you comment on that?
(They have comments on the importance of being reflective. Ask to explain how that works for them.)

Graduate D

You mention that you continually evaluate your effectiveness by reflecting on your lessons. Can you comment on how you do this and what it does for you?
Who else do you have review your data? You stated you have others review it.
Do you still feel that, "To stop action research after a formal degree program is cutting

off my reaching future students?"
How do you "facilitate explorations and ideas in cooperative learning?"

Graduate E
For "others have benefited from my AR" you gave a 2, why? But you stated self and students have benefited.
You indicated that time and addressing individual needs is a challenge (in the section on impractical). What are you doing to address this?
If you design your AR so, "it can be repeated by other teachers," has it been?
For the statement on sharing your AR with others, you gave a 2. Is this still the case?
For having the time to do AR you gave a 2. Is it still hard to find time to do?
You did 5-7 projects, 2 before, 3-5 after. Can you tell me about them?

Graduate F
For making progress on school wide priorities via AR you gave a 2, yet project seems to target some school wide priorities, why the low score?
How is your time for doing AR now? You gave a 3 for that statement on a scale of 1 – 5.
Why was your "data gathering, method, and results criticized" if you did get many points of view?
Do you still think 2 out of 10 teachers would be interested in the results or attempt to do AR because of the time it takes?
You gave a 2 for being more satisfied with your teaching practice because you did AR, do you still feel the same? Why or why not?
You did 1 AR before, none after, is it still the same?
What lessons have you learned from doing AR that you would like to share with others?
You didn't answer that before so I wondered if you would like to comment on it now?

Graduate G
You stated that, "collecting data helps us learn what works and what doesn't." Can you comment on this now? What have you found works and doesn't?
Can you comment on the grants that you have worked on that "utilize action research" as you stated in the survey? Who funded this project? How is it going?
You did 2 projects after the capstone. Can you comment on them?

Graduate H
You gave a 2 for AR improving the professional culture at your school. Can you comment on this?
You gave a 2 for designing research to be replicated by others. Can you comment on why you gave a 2?
There was a lack of answers on some qualitative statements. Can you comment on why?
You did 3 other AR projects but for yourself. Can you comment on them?

APPENDIX D

INTERVIEWS

Interview Graduate A (new reference for confidentiality)

Describe the action research process you experienced at MSU.

I think if there was a class that would frame what action research is and how to collect data, how to write it up. I didn't take that class in the action research so it was very challenging to me because I didn't have that frame of reference. I thought up a problem and how to collect data on it and how to report that out. It was difficult because I don't feel confident in writing. It would have been more beneficial if I had taken the course and had that background information. I didn't really feel like I had anyone other than my advisor. I had a working relationship with the professors at MSU but if I hadn't had that I wouldn't have felt comfortable doing that (talking to them).

What suggestions might you have to make the **MSU AR model** stronger?

Make that course a requirement. It's difficult to do it without taking that course. If people aren't strong writers, give sample models to look at I had no website designing experience. Make sure people have training in how to do a web site and where to house it. Maybe have the professors or advisors put together teams who are working together at the same time so you would feel like you had someone going through the same thing you are going through, to trouble shoot with more of a support system is very helpful. I felt very alone.

What is one thing you remember about the MSU AR model that was very helpful?

The most helpful thing was assigning a professor assigned to me. The professor held my hand through the writing process. I would write a draft, send it to her and she would mark it all up. I was having a difficult time getting my experience on paper and I had a lack of writing abilities. Without her I would have not finished it, I would have thrown up my hands.

Describe **other** action research **models** you have worked with and how effective you found them to be?

I haven't worked with any that are as detailed as what I went thorough.

How **confident** did you feel about the measures you took to ensure **validity** in your action research (i.e. that you weren't just confirming your own biases, finding what you wanted to find, or thought you would find)?

I was somewhat confident not having any experience in action research it was difficult for me to decide what I was going to use and how I was going to use it. A lot of information I gathered was subjective, it was my opinion, so I'd be somewhat confident.

What guidelines for improving objectivity and validity would you recommend to your peers who would like to do action research in their classrooms?

What I would do is try to use valid and reliable assessments. I would also try to develop some sort of observation protocol where someone came in to observe lessons, maybe even more than one person and that protocol is pretty specific in what you are looking for. I think that would make it more valid. The other thing is to have some training, coursework in statistics, in how to give the results in a valid and reliable manner, which is also difficult.

Can you give an example from your school action research experiences that **demonstrates the practicality** of your project?

With my project… with student who had failed in math…now in my district other programs have stemmed from that (action research project). We're making progress but it is still not where I want it.

What **ideas** might you have as to how to make the action research process even **more practical**?

That the people who are instructing the classrooms are involved in developing the research come together as a group to say, "This is what I think we should try" and then get a consensus on what needs to be tried how to measure it. Essentially, they set up the action research process they need. That team: to design it, build it, analyze it, it's got to be real work, it's got to be in their buildings. A team of teachers versus just a teacher, then you need a way to disseminate the information after you design your project have a team of teachers and administrators involved. They are going to care about the outcome and they are going to want to know what the outcome is.

Do you think this would **encourage more teachers** to do action research?

I think all teachers have a theory of how to teacher best and they need to try that theory and to collect data and to see if it actually works. If you do action research together as a team, people would be more excited about it and see how it works. I do think they can. I think they need training what it looks like, how to go about it, what kind of assessment should you use, how to compile that data. It all needs to be in place before you feel confident to do it.

While funding is always helpful, it's not always available. Are you supported to attend conferences?

Yes I am. As a classroom teacher probably not as many because it would take me out of the classroom however, I have been supported by the math organization to attend conferences now. I primarily work with principals. I do work with teachers when they bring them in with groups to work on curriculum.

What other factors (not financial) do you think could help teachers **continue to practice** action research?

I think the key is somehow schools need to allow time for teacher's to get together to talk and they need to plan, get ideas, discuss and if they can do that then they can put action research in play with very little expense.

These next 4 questions are about change but each focuses on a slightly different aspect.

What **personal or individual changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

For me the changes I've undergone is that data is very important for verifying my theories. If I believe this is the way students' learn best then I need to gather some data to confirm that not rely on a gut feeling. It is extremely valuable. We make curriculum and instruction decisions based on gut feelings. Gut feelings, decisions can cost districts thousands of dollars.

What **professional changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

I guess I am still extremely active that way. I am always looking at research trying to see what way student's learn best, what research out there is saying that's true, what programs are out there that work well, what doesn't work well. So professionally it's made me look at things more critically and want more information before making a decision.

What **curriculum and teaching practice changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

Curriculum has changed because in the past I would pick up my book teach out of my book, getting through chapter 5 would be good. Now I look at what are the learner objectives, how do they match, how do I design my lesson so it will address the objectives, and how to I assess my student? Now, I am more focused on this: this is what I want them to know, this is how I am going to instruct them, and this is how I am going to test mastery of objectives, rather than materials. I have switched more to an inquiry based style of teaching over stand and deliver. It makes me really reflect on how I grade students and how I should reexamine that process more of an assessment system rather than so summative. Homework is for practicing and learning, it should be master based, get the grade when obtain mastery. This helped me become more reflective in my teaching as well.

What **changes in student learning** have you seen from doing action research? Can you give an example? How valuable would you describe these changes to be?

Build the relationships with student in order for them to learn. Now, I come to realize building a relation with them will help them learn. Having high expectations, high rigor, high level for students to reach, and how relevant it is to them. I saw that in an inquiry based format you can make it more relevant to them and they are more willing to learn. I had 3 classes, all had failed in the past, but because of relationship, relevance, and rigor they came in willing to learn didn't have the discipline problems.

Do you think **all teachers** can successfully conduct AR? Can you explain why or why not?

Yes. Teachers would need training and support, but all could do it.

High need students can be defined as traditionally less engaged, less successful, or having a history of being underrepresented, etc. In what ways has AR affected your **high need students**?

When I taught courses, all were high need. Three things were key - the relationship I build with the students that made them more confident and then the rigor that I set, I had students say, "Don't treat me like a kindergartener" they still wanted to be challenged. Their rigor needs to be there even if they are considered high need and then the other thing is, they want to learn it, if they see a need for learning it. Relationship, rigor, and relevance - for any student but especially for high need students.

Writers on AR often talk about the importance of **interacting** with other **professionals** while doing action research. During your AR experience at MSU, whom (if anyone) did you interact with as you conducted your research?

I worked with the person assigned to me for my capstone and then the rest I felt comfortable going to for assistance. Other than my husband who saw me in tears many a night over this.

And, in research after MSU, whom did you interact with? Do you think **community** is an essential component in AR (and who do you define community to be)?

I would say that community is essential and that would be the colleagues you teach with and your administrator in the building. I also think that people from the university can be extremely helpful because they can help you with the model, what kinds of assessments you want to look at, also professors with statistical experience, how to analyze data, how to report it out, also someone who is really going to help you write it up. It's understandable if somehow that team can be infused into the action research so the person really feels they are accessible, they should be part of the community as well.

In what ways, if any, are you able to **use the results** of your AR in your teaching practice today?

Because of the action research project I did, we are currently working on a program in our district those we know are going to be high need students are going to be supported

with another math class that is inquiry based. Much of that came from my experiences with my action research process.

What about AR is still **useful** to you?

I have currently moved from working in the classroom to working in the district and I am currently working with curriculum and assessment now so to me, I write grants and then I facilitate those grants the grants are all about action research. What do you want, how are you going to report it out so that has been extremely helpful. Also, with curriculum work there are so many programs out there now, the action research experience has helped me to research more. Action research helps me with all of that as well, maybe we put two programs in place and then we monitor the two programs to see which is more beneficial. So, in that way it's been helpful as well. It helps me evaluate and select programs for the district now.

Is there anything else you would like to say that I maybe I haven't covered in this interview?

I don't think so. (She wants to hear what comes out of this project)

Specific Interview Questions Graduate A

Explain that the following comes from their survey and capstone information.

You stated that, "collecting data helps us learn what works and what doesn't." Can you expand on this? What have you found that works and what doesn't work?

What I meant by, see if it works or doesn't, I was a firm believer that inquiry based learning works for kids. I had no way of knowing. With action research, here is one year's worth of data to see that it was working. I kept a journal of the kids and a journal all through it and I saw many of those changes over the course of the semester that I had them. I was really paying attention to verify whether or not it works.

Can you comment on the grants that you have worked on that "utilize action research" as you stated in the survey? Who funded this project and how is it going?

Funded by the math science partnership grant department of education grant, focused on increasing teacher content knowledge and research base with the assistance of math coaches. We are beginning our 5th year with that grant and seeing student increase in achievement and an increase in content.

You have done 2 AR projects after the capstone. Can you discuss them a bit?

That one targeted at middle school teachers and the second one targets intermediate 4th-

6th grade teachers.

Interview Graduate B

Describe the action research process you experienced at MSU.

What they did very nicely, they told us for our capstone we would have to do a research project, where we would do this activity with our classroom and then collect data to see what was happening. The nice thing about that is that they told us about it early so we knew it was coming down the line. They also told us about other peoples' projects so we had an idea of what kinds of things we might do.

What suggestions might you have to make the **MSU AR model** stronger?

I think it was a pretty good model. It did give us plenty of examples and it gave us plenty of lead-time. It did give us a lot of good suggestions from university professors who had done a lot of research themselves. It was nice because they had experience teaching but they also had experience with the research process so if you were going to do a project they could say, "I don't think that is going to float," they had a lot of support for those types of questions that would come up… They guided you. They didn't tell you where you were going to go but they had a lot of guidance for you. To make it stronger, I don't know, the only thing I can think is to have a course before the capstone to do a small action research. A very short thing, a set project, so you had some experience with it some experience with the statistics and what kind of biases might come into play.

What is one thing you remember about the MSU AR model that was very helpful?

I think I said that… they did a really good job of guiding me. Really, their guidance is really the best thing about it, when you get down to that. And, then the fact you had the flexibility to do a short project or a long project.

Describe **other** action research **models** you have worked with and how effective you found them to be?

I have done other in class action research. I don't know if it was a different model. Most of the in class work I have done was informal and this project was nice because it was more formal.

How **confident** did you feel about the measures you took to ensure **validity** in your action research (i.e. that you weren't just confirming your own biases, finding what you wanted to find, or thought you would find)?

I'm not very confident and that is one of the things that came up. Even when I did with my project we had … my data collection was over something that I really believed in, something that I thought was going to be really helpful. It wasn't just so I could write a

paper. We were looking at a number of things. We were looking at really key things. Some of our p values weren't really low enough to say it really was effective but talking to some professors they would help me to look at what was really going on. If you can step away from the data… maybe our data doesn't look perfect but there are these other things happening… maybe we were confirming some of our biases when I was rejecting stuff my professors were helping me see that something was happening there. So, my confidence, I felt pretty good about it…

What guidelines for improving objectivity and validity would you recommend to your peers who would like to do action research in their classrooms?

Quite honestly if you can have a bigger population then you can have better control… when you can expand your study to a larger population of students that helps balance your work and efforts. I had to find a control group. When you can expand your study to a larger population that's better.

Can you give an example from your school action research experiences that **demonstrates the practicality** of your project?

Of the 22-23 kids that we had in that cohort, we had 6-7 who excelled in our program. The practicality is that we are getting more "high need" students into higher-level math and we are seeing all of them in school. None of them have dropped out of school, all are still in the program and all are looking at pursuing college degrees.

What **ideas** might you have as to how to make the action research process even **more practical**?

Do you think this would **encourage more teachers** to do action research?

I don't know if it would encourage more teachers to do action research, but I think my study, it would encourage more schools to do a program like ours. I am not sure it would encourage anybody to do more action research. High school teachers are so overwhelmed by the day to day work that stepping back to do action research is really hard for most of them unless they are 20 year teachers and don't have children, etc. We do this 6:30 – 4:30 deal every day and then you go home and try to have a life and prepare and collect data and present the data ... we talked abut publishing my data but no one is really excited about it. It's beneficial because I know it works but it's my principal. The district and school board will pat me on the back but they don't give me one penny. If action research proves something is working it should make valid that those programs should be funded. It's quite sad, I'm not begging for money, but I am begging for money.

While funding is always helpful, it's not always available. Are you supported to attend conferences?

You know, I think going to MSU might have been one of the best things that ever happened to me (in the professional academic realm) because it gave me the confidence to say, "Hey, you should send us to conferences. " I got some funding to go to a math conference 9 years ago and 2 years ago I wanted to go again. There is this thing of money, money, money but you have to get someone to cover for your kids… this dissension, why do you get to go…well, if you ask for it and they approve it then other people are jealous, but they haven't been organized enough to get it. I went to one conference but the district didn't come forth and pay for it. If you want to do those things you are lucky, but a lot of teachers believe that teaching is a static thing and there is no benefit to professional development.

What other factors (not financial) do you think could help teachers **continue to practice** action research?

I think one thing is that if districts encouraged it and districts gathered it and published it right now they say we'd like you to do this. This is the data we want you to gather. Instead they say we are going to give a test and we'll have someone crank the data. Instead of saying why doesn't each teacher find a project they each want to do and let's compare the data, lets see what works best. Instead they go to the most trendy types of edu-speak that might not have anything to do with the kids from our classrooms. They say, "I need this to improve and I need to see this kind of data" and lets get some real data. We have seen an increase from 64%-74% for graduation rates. We need to have support of our programs. We are doing better.

These next 4 questions are about change but each focuses on a slightly different aspect.

What **personal or individual changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

When you do it with a specific group of kids it makes you connect with them even more so it makes you really focus on them. How they're doing year to year, it makes you much more cognisant to what you are doing in your class. The whole point of action research is you do it, review it, adapt. Do it, review it, adapt. Trying to get better at each cycle.

What **professional changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

(asked for explanation different from below) I guess professional change from doing the action research even though I said the district doesn't fund us they have applauded us and are all over our program. Advanced Placement is in love with us. Its been very nice having people from the college-board recognize the work we do. My status is the same in the school. I know people respect the work I am doing. I am nonnative. Honestly, I am disappointed I haven't been able to do more native curriculum work.

What **curriculum and teaching practice changes** have you undergone from doing

action research? Can you give an example? How valuable would you describe these changes to be?

I think the one thing I saw with the kids I worked with I really thought that they do cultural relevant math and develop math problems or data based on a story they brought in. A lot of kids said, "Not so much of that cultural stuff, just more math" and another thing they said, "We like it when you just explain it to us. We like it when your discussions with us just show us how to do the problems. " This culture has an oral tradition and that is an effective method of reaching them. You can't just throw it out and do total discovery learning. I was pretty amazed. The perception I need to explain it well and not just turn them loose too early and other thing about the program I did is that it made them feel comfortable. They know each other and they talk now, talk business and are awake. They are in the class with their peers.

What **changes in student learning** have you seen from doing action research? Can you give an example? How valuable would you describe these changes to be?

Do you think **all teachers** can successfully conduct AR? (Probe - Can you explain why or why not?)

Yeah I think you can it takes a support… it has to be encouraged

High need students can be defined as traditionally less engaged, less successful, or having a history of being underrepresented, etc. In what ways has AR affected your **high need students**?

Huge effect because all the students in that group were high need. I think it helped all of them, all of them for the most part. They made it through their math classes, they're still in school, they still have people who care about them, they still have this program that is really on board and trying to monitor their every bad decision.

Writers on AR often talk about the importance of **interacting** with other **professionals** while doing action research. During your AR experience at MSU, whom (if anyone) did you interact with as you conducted your research?

Primarily my advisor, a little with a professor at the university in my area … professors seem busy and were not working on student level that I was in the high school.

And, in research after MSU, whom did you interact with? Do you think **community** is an essential component in AR (and who do you define community to be)?

Yeah, I think it's huge but even I found that when I was doing the work and talked to people about my results, one teacher was appalled that these students were getting extra privileges, another teacher wanted to be more successful with this group of students. It was wonderful when teachers were supportive but when one's digging your grave it's

hurtful.

In what ways, if any, are you able to **use the results** of your AR in your teaching practice today?

It affects my teaching practice. We are continuing the program and now the district is funding our program. I can say, "look how well this is working" and they will say, "well we'll fund you again" and they give us a room and they don't have a janitor and, "we don't really have books for you and the computers aren't going to work" it's one of those things I guess. "We should help you" but these kids go out of their way and we should treat them like kings and queens but its not and it's destructive.

What about AR is still **useful** to you?

Is there anything else you would like to say that I maybe I haven't covered in this interview?

I think it's a great project. I think we should do more of it. All teachers' benefit from action research in their classes but sometimes it's hard to get through even one day. Sometimes in high school you are not just teaching kids you are dealing with all the things going on their lives. I am amazed at what some of those high school teachers do when paired with a university professor. I guess it's that thing of everybody is so busy in their lives its hard to stretch. It's really valuable. I think Bozeman is really lucky in that way.

Specific Interview Questions Graduate B

Explain that the following comes from their survey and capstone information.

You gave a 2 for the statement on making progress on school wide priorities using AR, yet your project seemed to target some school wide priorities. Why did you give this low score?

I think that must have been what it is (lack of support).

Do you still think only "2 out of 10 teachers would be interested in the results or attempt to do AR because of the time it takes"? Can you explain?

Maybe 1 out of 10, I think a real small percentage. I can think of 20 teachers who would say, "Why would I want to do that?"

You gave a 2 for that statement on being more satisfied with your teaching practice because you did AR, do you still feel this way? Why or why not?

Well yeah. You don't know me Sarah but I think I am never going to be happy with my

teaching. I just, until I find the golden pill that makes me reach every student and every student is comfortable, safe, and challenged, I feel like I have a lot of work to do as far as organizational skills and developing great engaging curriculum and have the time to do it. I feel my days are, they're so overfilled, I often don't do a good enough job with the kids I have. Part of it's personality, part of its really the truth. I teach in a big school with lots of kids. I have 3 preps, teaching 5 classes. I wish I had more time to do good things with the kids.

Are you currently engaged in doing AR?

No I am not.

What lessons have you learned from doing AR that you would like to share with others? You didn't answer that question in the survey so I wonder if you can comment on it now?

I think it's valuable. I guess and this is not something that I've thought of very long. That action research can be and should be such a valuable part of high school education and it needs to be encouraged if not mandated by the administration. I think instead of, "you are going to be observed each year" it should be "Are you doing the right thing?" Instead of that, have teachers do real action research projects. "You will not be judged on two days that I see you teaching" but, "Here is your project for this year, come up with some great ways to do this." I think teachers become lackadaisical and where you are held accountable for their success I think it makes you a better teachers. I think it's powerful. I just know some people don't want to do it some action research. It's a way to get teachers to be reflective on their practice.

Interview Graduate C

Describe the action research process you experienced at MSU.

I am recalling from memory because I feel like it's been a long time. I recall that the steps I took was to first think about what area to improve. Then I identify the problem. And then we have to think about what kind of design we wanted to have and how to measure the before and after to see if the hypothesis actually works and then I did the research in my classroom and I had to adjust along the way and I wrote a report about that.

What suggestions might you have to make the **MSU AR model** stronger?

There are a couple of things but I am not sure if they are not doing this already but for me I think well first of all, to have a lot of past examples for students to see, that's helpful and then the other thing is helping the student who are about to do action research to

connect with people in the field, not just in the program but all over the world not just in the state. I have done something similar I don't remember seeing someone else's work like that it would have been very helpful to me to connect with people who had done similar things and maybe to have a stronger model to follow.

What is one thing you remember about the MSU AR model that was very helpful?

One thing I remember was to look at something in my interest area. Whatever I wanted to do was to look at something that could be measured. (My memory is that the professors were not that helpful). The presenting part was really great, I thought.

Describe **other** action research **models** you have worked with and how effective you found them to be?

I have not.

How **confident** did you feel about the measures you took to ensure **validity** in your action research (i.e. that you weren't just confirming your own biases, finding what you wanted to find, or thought you would find)?

I would say how about 80% confident.

What guidelines for improving objectivity and validity would you recommend to your peers who would like to do action research in their classrooms?

That's a hard one. I was thinking of a lot of time you have to measure before and after. I think having a really good rubric really helps so you really have to sit down and ask a question and doing a survey the range that you want, it needs to be really well thought out and designed well. I definitely will recommend having somebody else go over that with you. Have somebody else look at it so whatever it is you want to measure, have somebody look over that – do things makes sense to them, do things seem biased to them?

Can you give an example from your school action research experiences that **demonstrates the practicality** of your project?

I get immediate, get really good feedback, on how to improve either my teaching or student learning, and what works, and what doesn't work.

What **ideas** might you have as to how to make the action research process even **more practical**?

I think just on the personal level, you need to do something that is fairly simple and straightforward. Maybe it takes a long time to measure or it needs other departments' collaboration, that's really hard to do I think, so just keep idea and your inquiry simple, and something you can implement right away that's really nice…. (discussion "these are

no brainers")

Do you think this would **encourage more teachers** to do action research?

Yeah… (laughter) Yes.

While funding is always helpful, it's not always available. Are you supported to attend conferences?

Yes

What other factors (not financial) do you think could help teachers **continue to practice** action research?

More time. Release time, more, absolutely, it's another like dah, time. I think it will also help the teachers to continue or start if it's in the environment it's an atmosphere of a particular work place.

These next 4 questions are about change but each focuses on a slightly different aspect. What **personal or individual changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

I think personally from action research it taught me how to see, how to evaluate my work. I think often time teachers just teach and you do and you go home and you don't think about evaluating your own work and do assessment and think, "what am I doing," and, "am I doing a good job?" That, itself creates the next things that I want to do action research on. For example, if I evaluate my effectiveness to teach a particular class I thought, "gosh I did not do this particular topic or particular area very well" and then that pumps me to think I can test out and see if this is something I can change.

What **professional changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

I feel like I just talked about my professional. Well, I guess it put me into action research awareness and so at work I feel like I can talk with other people about it and raise the awareness as well.

What **curriculum and teaching practice changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

(came back to) I think action research just makes me think more about when I am developing a curriculum I think about before and after. I will look at that more so I look at the curriculum more. What is it before I teach this class and after I teach this class? It's the overall picture.

What **changes in student learning** have you seen from doing action research? Can you give an example? How valuable would you describe these changes to be?

I think when I do an action research I feel that they are more motivated in learning themselves because they see me as a student trying to learn something and that I'm really learning about something that affects them.

Do you think **all teachers** can successfully conduct AR? Can you explain why or why not?

I think so but I think they need to have, I would hope they have some training. All teachers can, yeah everybody can I think.

High need students can be defined as traditionally less engaged, less successful, or having a history of being underrepresented, etc. In what ways has AR affected your **high need students**?

I don't think I can answer that because I don't think I have looked at that area before. I think overall, I don't think I can think about that specifically, it's more like all the students.

Writers on AR often talk about the importance of **interacting** with other **professionals** while doing action research. During your AR experience at MSU, whom (if anyone) did you interact with about your research while you conducted it?

I don't believe there was any. My colleagues were aware but I don't think there was interaction … (clarification discussion) oh yeah, the professors and I worked with fellow students.

And, in your research after MSU, whom did you interact with? Do you think **community** is an essential component in AR (and who do you define community to be)?

My colleagues. (2nd question) Yeah, I do. The community will be would colleagues be okay?

In what ways, if any, are you able to **use the results** of your AR in your teaching practice today?

I don't use the result very much I have to say.

What about AR is still **useful** to you?

I feel like I'm just more aware of my own teaching practices and I am able to look at it more analytically, more accurately, it just helped me measure.

Is there anything else you would like to say that I have not covered in this interview?

Yes I do, I think teachers need to get release time to do things like this. It's really hard on a regular teachers' load.

Specific Interview Questions Graduate C

For "others have benefited from my AR" you gave a 2 - why?

I was thinking more about other people like other professionals, like have others been able to use what I did?

In the survey in the section on it being impractical you wrote that time and addressing individual needs is a challenge what are you doing to address this?

I want to clarify that so, at the time I was doing action research…. I wanted …what I meant was to do the research a lot, it was hard to find things that I addressed in the work I was doing.

You stated that you design your AR so can be repeated by other teachers.... has it been repeated?

I don't think so. I don't remember that. I might have written that to say that would be a suggestion when they are thinking about doing action research so that it's something other people can repeat.

For sharing AR with others – you gave a 2 - is this still the case? Is there a reason for that?

Yeah. Probably just because I am not practicing myself these days so it is hard to share something you are not doing.

For having the time to do AR – you gave a 2 - is it still hard to find time to do?

Oh yeah, it will be like 0 right now.

You did 5-7 projects, 2 before, 3-5 after – can you tell me about them?

Yeah but it was very informal –(probed about model used)… something in my teaching let's say I identify in my eyes as a problem, I see a problem let's say the amount of

student's that understand factoring after I've done factoring, so I identify a problem, okay so I will think about something I can do, I need to try or want to try talk to colleagues. What I have been doing has not been working well I will try, I want to try something so I research a little bit, an idea comes up, I talk to colleagues, I implement in my class and see the results after that – (more probing second cycle) I will have to say that in my mind I want to do more but it's impractical it usually stops after one cycle. I might take the idea further the next term with a different group of students.

Interview Graduate D

Describe the action research process you experienced at MSU.

I went through the class, eliminated ideas for my project, then went and worked on following the outline for the proposal, finally, presenting my proposal and turning it in.

What suggestions might you have to make the **MSU AR model** stronger?

It might be easier if a student is open to different ideas to have better ideas to brainstorming and finding a new twist that makes it a little easier to do something.

What is one thing you remember about the MSU AR model that was very helpful?

Having a classroom in which to check ideas with what you are trying to do. Some of my friends didn't have a classroom and that was tougher. Having a classroom setting seemed much easier.

Describe **other** action research **models** you have worked with and how effective you found them to be?

I haven't worked with anything specific in a formal way I have just done different trial and error things in my own classroom kind of like a control group… more of an informal instead of formal observation.

How **confident** did you feel about the measures you took to ensure **validity** in your action research (i.e. that you weren't just confirming your own biases, finding what you wanted to find, or thought you would find)?

I was fairly confident in the results of what I had found, pretty much what I was expecting, I tried to eliminate biases but you can never remove them 100%.

What guidelines for improving objectivity and validity would you recommend to your peers who would like to do action research in their classrooms?

Probably to view with more objectivity have more outside resources if you are doing something and you want observation it might be helpful to get someone totally differently someone with a totally different twist.

Can you give an example from your school action research experiences that **demonstrates the practicality** of your project?

It's allowed me to approach a situation and realize that different students express their idea in different ways. Some might be better at artistic others verbal and others by using examples. Students don't all shine answering questions the same way.
What **ideas** might you have as to how to make the action research process even **more practical**?

Probably have a person start out trying to answer the question, "What do I want to try to improve in my classroom?" and then, "How can I go about making those changes?" "What have I been doing but haven't been lately or did go well and isn't now?" "What is the difference, are student less attentive now than before?" Try to see different things around that way.

Do you think this would **encourage more teachers** to do action research?

I think it can encourage more teachers to do more action research. I think the biggest is the writing up, some way to make it less formal. A way to approach something first and then the big formal process you have to go through with double checking the data… get more of an informal method in doing the assessment and then if someone was interested in a more formal then come up with that.

While funding is always helpful, it's not always available. Are you supported to attend conferences?

I believe we can. I have not lately.

What other factors (not financial) do you think could help teachers **continue to practice** action research?

I think encouragement from other teachers, sometimes you have to get out there every body just gets in a rut. Teachers doing the same thing over and over again, kind of working motivation to approach something in a new way, to introduce something different. Get out of the routine of what you've constantly been doing in the past.

These next 4 questions are about change but each focuses on a slightly different aspect.

What **personal or individual changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

It's with mine in particular. It made me aware of how writing can be a little more conscious to deal with, writing in mathematical language. I realized the communicating of math terminology, not just explaining words but using them more frequently.

What **professional changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

It allowed me to get ready to do presentations at conferences, it allowed my to come up with other ideas on this, ideas to get started and guideline of procedures. You have to have good sound valid data this was a way to help emphasize the backing of that.

What **curriculum and teaching practice changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

Probably helping me to restructure the organization of the class, maybe focusing on students' answering questions, having a bigger interpretation of the question. Such as for word problems, sometimes there is more than one way to interpret the problem the students make different assumptions, create different twists of a problem.

What **changes in student learning** have you seen from doing action research? Can you give an example? How valuable would you describe these changes to be?

With some of the kids, I think they were glad to have another alternative to expressing their ideas, with some of the other kids they were glad when it was over. They didn't like it. "It stretched my brain a little bit" they'll work on thinking about a problem and hopefully not be so quick to think that their method or answer is the only way. Kids have gained more confidence we don't always have to follow a certain procedure but we can follow them.

Do you think **all teachers** can successfully conduct AR? (Probe - Can you explain why or why not?)

I think all teachers can successfully conduct action research because it's really just the document part of what is going on in your classroom, given the time, given the right situation. I think all can do action research. Teachers are already doing this in their heads so this is a process where they just kind of have to slow down and write the information out I don't think all do but all can.

High need students can be defined as traditionally less engaged, less successful, or having a history of being underrepresented, etc. In what ways has AR affected your **high need students**?

I didn't specifically have any high need students but I can see where action research comes up with several different levels and how to approach the problem.

Writers on AR often talk about the importance of **interacting** with other **professionals** while doing action research. During your AR experience at MSU, whom (if anyone) did you interact with as you conducted your research?

It was other fellow classmates, people on my committee, and sometimes I would talk to friends that were outside the teaching environment all whom provided different feedback… pretty much the different people you feel comfortable with while its going on.

And, in research after MSU, whom did you interact with? Do you think **community** is an essential component in AR (and who do you define community to be)?

I really haven't done any formal action research since then. I mostly haven't taken the time to do any formal research. The community involves the students, the students, the teachers, and the administration. It involves parents, the school board, it could be beneficial to get some other information, say you want to add more technology in the classroom. If you have data, that will speak volumes to parents and community and make it easier to get resources. Yes, it's an essential component but it doesn't have to include all those groups, without one of the two you just don't have it.

In what ways, if any, are you able to **use the results** of your AR in your teaching practice today?

Just in the way to do reflections on how people think how they approach problems and to look at different subject matter. What I used in English I can use in math too. It helps with cross curriculum.

What about AR is still **useful** to you?

Probably it's something we have discussed to help formulate getting good strong data for doing a proposal or a presentation or for writing a paper and it's a way of testing out ideas probably with that it's more of an informal evaluation getting a feel for what works and what doesn't work.

Is there anything else you would like to say that I maybe I haven't covered in this interview?

I don't think so.

Specific Interview Questions Graduate D

Explain that the following comes from their survey and capstone information.
You said in the survey that you "haven't seen much benefit and you have not seen much disadvantages" can you expand on that?
The reason I haven't seen very many benefits from the people I saw going through I didn't see it made regular changes. I didn't see any major positive aspects of it and that

could mean that I did stay in contact with them afterwards and for the disadvantages I didn't hear or see anything that would totally shock people or gave them trouble about it as far as I know they are still teachers.
There was a statement about becoming a better problem solver. You gave a 2. Can you comment on that?
Probably because in my case I was already doing a lot of problem solving, looking at stuff. I feel like action research didn't make that much difference as I was doing it and it was discouraging because I had to write it out, I was thinking this is taking too long (to write it all out).
For the statement on having a desire to "better understand more about my teaching practice" you gave a 1, can you comment on this?
Because the way I looked at it. I was looking at the problem, if I didn't have action research, I would still be doing the same thing. The action research made not a difference because of the paper work and all that was discouraging. What am I doing? What can I do better? Sometimes for me to write in a formal way is more discouraging.
The statement on being more reflective now, more motivated, and helping the professional culture at your school, you gave a 2, can you comment on that?
Part of it, with some of that I had moved to a different school so I am not seeing the impact from when I was doing it at the previous school. The other part was the feeling that the school just didn't really care (the old school) just a mixture of that so I really feel it didn't make much of a difference at all.
You stated that the time to do action research was a 1, can you comment on that?
Yeah, it is and I'm thinking in terms of writing up all the formal, gathering all that data, trying to write one formal observation. I will be concentrating on one instead of multitasking and trying to do 4-5 things at once.

Interview Graduate E

Describe the action research process you experienced at MSU.

What suggestions might you have to make the **MSU AR model** stronger?

I don't know of anything that could be done better than how he (my advisor) did. I think he did a great job of explaining.

What is one thing you remember about the MSU AR model that was very helpful?

I remember a handout that he gave us, several pages, and it outlined specifically how we should be doing at each part of our project. That was probably one of the most helpful things that he had given to me. I had never conducted research on my own and that hand out that he gave us at that time, that guideline helped. I knew what I was supposed to do and when I was supposed to do it.

Describe **other** action research **models** you have worked with and how effective you found them to be?

That was my first experience of conducting research myself and that was the first model that I had and I was very happy with it. I have not had an opportunity to do other action research. I would like to do some research soon.

How **confident** did you feel about the measures you took to ensure **validity** in your action research (i.e. that you weren't just confirming your own biases, finding what you wanted to find, or thought you would find)?

I felt very confident. At first, I was worried about it that, so I would get my data and I would email it to some body else and others with more experience in research and they would look at it. I'd ask, "Would you verify my data."

What guidelines for improving objectivity and validity would you recommend to your peers who would like to do action research in their classrooms?

I think pairing with someone who has research experiences and just kind of shadow someone who is familiar with research. A shadowing program would be very beneficial.

Can you give an example from your school action research experiences that **demonstrates the practicality** of your project?

I feel like I've learned a great deal. I had been a student in a similar situation to my students. It verified how I felt when I was a student. I think it helped me to readjust how I talk in a way that would have met my needs as well as other students' needs.

What **ideas** might you have as to how to make the action research process even **more practical**?

I think as long as people research a subject that is of particular interest to them, for some reason, and they can somehow relate it to their lives', that is more practical. They are going to know there is a benefit from working in an area of interest to them and they will grow in their teaching. You've got to do something in an area that you feel passionate about.

Do you think this would **encourage more teachers** to do action research?

I think so. I think if teachers are truly interested in teaching and not just a paycheck, if they want to help people then they should be interested in research. They need to know what makes their students tick and the only way you can find this out is through research. The only way you can help people learn is to understand how they learn and I think research will definitely benefit a teacher and help them grow.

While funding is always helpful, it's not always available. Are you supported to attend conferences?

The previous school yes, we were. At my current school we are encouraged but it's harder to attend because of the size of the school (it's small).

What other factors (not financial) do you think could help teachers **continue to practice** action research?

If teachers have an opportunity to sit down with other teachers, if I can sit down with other math teachers and we start discussing our classes and we see our similarities and our differences, I think if we can get others to see what we are interested in. We've got to step up and we've got to speak out if we want students to have a better understanding. We have to have a better understanding of how they learn and I think research is the way to go. If we can share our ideas with others then maybe we can draw them into our passion for wanting to do better.

These next 4 questions are about change but each focuses on a slightly different aspect.

What **personal or individual changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

With the research project that I did my personal or individual changes, it helped me understand more about the needs of my students. It snapped me back into the realization of when I was a student. It kept me reminded of that it kind of, it brought me down to earth. After my action research project, I would get to class a few minutes early and try to be more student focused, talking to my students and asking them how their day was.

What **professional changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

That kind of goes along with what I just answered, the personal and the professional go hand in hand the way I answered that question.

What **curriculum and teaching practice changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

Of the changes that I went through in my classroom, after that, I was realizing that students have, I think I took more time to get to know each student as a person. I wanted to make them feel more comfortable in class and I made a conscious effort to do that. (cites example of students' interaction and what this interviewee did)

What **changes in student learning** have you seen from doing action research? Can you give an example? How valuable would you describe these changes to be?

I have a student who I had for 2 semesters. I saw her grade was going to be a failing grade and at the end of the second semester I asked her specifically what was different. She had a low average too the first semester and the second semester she almost got an A, "something was just different it's not that you taught different there was just something different with how you interacted with the class." I think that I was more aware that students had things to do other than math, that students have a life outside of math class.

Do you think **all teachers** can successfully conduct AR? Can you explain why or why not?

Yes, I think that teachers can successfully conduct action research because, I say, "yes" and I want to say, "no" too, if they are teaching for the right reasons. Because they want to learn, then yes it will help them learn, and I could say no because if someone is just reaching because it's a job, it wouldn't matter how much research they did, that is if they decide to help people grow then action research will benefit them. It would depend on the individual.

High need students can be defined as traditionally less engaged, less successful, or having a history of being underrepresented, etc. In what ways has AR affected your **high need students**?

(Came back to later) I have been going to several websites in which studies have been done to find out what can I do to help African American students' feel better about learning math. Something I can relate from the African American culture and heritage that will help them understand the content. They are underrepresented in math and science and I want to do something in my classroom that sparks their interest and makes them think, "I can do this." They are low-income students too. The average annual income is 18k per year so trying to get them motivated to think, "yes, I can do this I can go to college if I apply myself I can get a scholarship." It's about everything at my school.

Writers on AR often talk about the importance of **interacting** with other **professionals** while doing action research. During your AR experience at MSU, whom (if anyone) did you interact with as you conducted your research?

With my professors, advisors (3 of them), my interaction with them, I feel like I worried them to death and my department head where I was teaching, she helped me gather information and administer a survey. After it was over, I let her see the results and she was very surprised.

And, in research after MSU, whom did you interact with? Do you think **community** is an essential component in AR (and who do you define community to be)?

Yes, I think community is important and I would define community as a group of

individuals who have a common interest. My community for my research project was my math students. Community is a better word to use than subjects.

In what ways, if any, are you able to **use the results** of your AR in your teaching practice today?

I teach high school now so the thing I try to remember from my research is that not everybody is going to be a math teacher, no matter how much I want them to. At my school, over 90% are African American and I'm not African American. The research I did with my other students applies to these students too. I have students who say, "I am Black, I can't do math." I try to turn that around. I have one class that is coming around and saying, "I can do that." You've got to remember the background information and how you can turn it around.

What about AR is still **useful** to you?

Again it's just the fact of remembering that people have things to do other than the homework I give them.

Is there anything else you would like to say that I maybe I haven't covered in this interview?

I think I've said a lot I can't think of anything I would want to add.

Specific Interview Questions Graduate E

Explain that the following comes from their survey and capstone information.

Did you "continue to research methods to help all students overcome math anxiety" as you stated in your survey? If so, what did you do and what did you find, if not, why not?

I have not been able to continue at this time. A lot of it is because I am the only math teacher at my school. I have one class of 8th, 9th, and 10th grade. If I am going to do math research with my class size I think if I am going to do a valid study I need more student's involved. I haven't partnered with a teacher from another school yet.

What have you found that works in meeting your students' needs, as this was a theme in your work?

I may have already touched on this. The main thing I am doing is trying to relate math to something they are familiar with. For example in learning about dependent and independent variables, I said, "okay, the independent variable - there is going to be a game next Friday night. Who wins the game depends on who play the best." I am trying to find examples to relate it to their everyday life and that may not be exactly how I did

the example either.

Are you doing action research presently?

No I am not doing any action research at this time.

Have you found methods to better meet the needs of a "minority student population", as you stated in your survey? What have you found and would this research be beneficial in helping teachers who want to meet such needs?

I have gone on line to reliable websites. ERIC I read a lot and in the journals, I try to read what works in other places and try to adapt it to meet the needs of my kids.

Why do you think the school you are at "has requirements that make it difficult to do action research for non tenure teachers"?

It has a lot to do with the fact that I am the only math teacher at my current school. There is only one of everything at this K – 12 school, I have 8th grade – 12th grade. By the time they get to me in the 8th grade, they had a person who is not a math teacher so there are a lot of things my 8th graders don't have, the back ground knowledge for, it's tough it's tough, I love my kids and I do everything I can.

Have you been able to do action research in your current teaching position?

No.

If not, do you have any plans in the future of doing any?

Yes, I want to. Looking at minorities in math, I have all kinds of ideas brewing. There are all kinds of things I am curious about. I was always want to know "why" my principal says, "Why do you always want to know why"… I hope that maybe something I've said will be helpful in someway… I guess too, I think having the Alabama perspective is maybe a little different than some others… I think action research can help with high need students. I have one student with special needs and for some reason she is my top math student, she is among, I don't know how and I don't know why but it's working.

Interview Graduate F

Describe the action research process you experienced at MSU.

The premise was, we found a problem, looked at what are the possible ways were to alleviate the problem, did a lot of looking at difference sources of material, that type of

information, and we tried to implement one method.

What suggestions might you have to make the **MSU AR model** stronger?

Seems like it would be nice to have a mentor paired up with each candidate. Maybe that's not an MSU staff member. That would be a practical way to go. I think having a mentor is beneficial.

What is one thing you remember about the MSU AR model that was very helpful?

You know one thing that came out of it, sort of looked like a negative, it wasn't something I expected to come out… understanding that the work I was doing might result in a positive return just because of the way I did things differently, that might have showed a gain in the result whether I applied my treatment or not – this point was made in the capstone presentation - I wish someone had pointed that out to me at an earlier time.

Describe **other** action research **models** you have worked with and how effective you found them to be?

I don't know that really I can recall that I've worked with any.

How **confident** did you feel about the measures you took to ensure **validity** in your action research (i.e. that you weren't just confirming your own biases, finding what you wanted to find, or thought you would find)?

Well, I felt confident going in so I'd see some positive results. I did see positive results. There were some things I found that I was not expecting such as my work might have shown improvement and have nothing to do with my treatment.

What guidelines for improving objectivity and validity would you recommend to your peers who would like to do action research in their classrooms?

(oops skipped this one if you want to add anything here)

Can you give an example from your school action research experiences that **demonstrates the practicality** of your project?

Just the fact that I have used it since, doing the capstone shows me that it's practical in the classroom to know that I can integrate that as part of a regular classroom lesson not out side of the classroom.

What **ideas** might you have as to how to make the action research process even **more practical**?

Well, I think each year that I have used it I have streamlined it by taking out things that

have been less effective and adding things that have been more effective – specific examples: going from a physical manipulate to a computer based manipulative that's one of the things I have changed that has allowed it to be practical for every kid in the classroom.

Do you think this would **encourage more teachers** to do action research?

Um, maybe. Yeah, you know there are some teachers that are going to look at a result more seriously if they have a plan going into it. I can think of one teacher that if she had a basic framework I could see her really jumping in and benefiting.

While funding is always helpful, it's not always available. Are you supported to attend conferences?

As far as funding goes, in a limited amount. As far as willingness from administration, sure.

What other factors (not financial) do you think could help teachers **continue to practice** action research?

Seeing their greater positive results in their students.

These next 4 questions are about change but each focuses on a slightly different aspect.

What **personal or individual changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

I would say, the way I've changed in my classroom, wow, I've gone from a more rigid classroom plan, as far as daily lesson plan goes, to a greater flexibility, based on student results and based on my observations. I think I became a better observer and in that have a greater ability of observing. I think I've been able to address students' needs better.

What **professional changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

I would say it's very similar.

What **curriculum and teaching practice changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

I've integrated more computer use and greater expectation of my students to be willing to use the computer to find manipulatives to learn a process.

What **changes in student learning** have you seen from doing action research? Can you give an example? How valuable would you describe these changes to be?

That kind of refers back to that pervious set.

Do you think **all teachers** can successfully conduct AR, why or why not?

I think so, but I think that really depends on the guidance that they have in understanding what action research is all about and having someone to mentor through that process… give a framework throughout the process.

High need students can be defined as traditionally less engaged, less successful, or having a history of being underrepresented, etc. In what ways has AR affected your **high need students**?

Its given them greater attention and not from just me but from other students ive been able to direct other students on how to guide other students how to guide them. Just getting them more involved in the class, that's one way the capstone really influenced the future of my classes

Writers on AR often talk about the importance of **interacting** with other **professionals** while doing action research. During your AR experience at MSU, whom (if anyone) did you interact with as you conducted your research?

Well, I interacted with other students going through the process and other faculty at MSU. One article in particular spurred me to contact the author of that article so I emailed back and forth with that person.

And, in research after MSU, whom did you interact with?

I continue to interact with a teacher in the building who was in the program. We continue to utilize that. (Discussion of study)… we put in the school improvement program and now give 5 quizzes a year. We check the status over the past 4-5 years, the results on those scores keep getting slightly better and slightly better and slightly better.

Do you think **community** is an essential component in AR (and who do you define community to be)?

I think you have to have a student community and you need to have a teacher community to be able to implement a variety of ideas of action research.

In what ways, if any, are you able to **use the results** of your AR in your teaching practice today?

Well, just in comparing over the years how we've done with the testing that we did 4

years ago compared to how it is going now.

What about AR is still **useful** to you?

That things keep getting modified. My methods keep getting modified based on what I did in my capstone process and the testing that we have done. Oh man that's been helpful.

Is there anything else you would like to say that I maybe I haven't covered in this interview?

(Laughter) If my answers seem whacky its cause I'm mentally so far away from having done the capstone. What I do now may not appear related but I think it still is day to day.

(no specific interview questions)

Interview Graduate G

(I use AR synonymous with action research and capstone project.)

Describe the action research process you experienced at MSU.

Independently I came up with a topic I wanted to research based on my experience in the classroom…. I picked a problem I was wondering about, refined it with the help of my advisor, set up a methodology, collected my data, and wrote up a final report.

What suggestions might you have to make the **MSU AR model** stronger?

I felt like a little more guidance at the beginning while I was first formulating my project would have been helpful.. I feel like I had a strong project but I know some of the other people were floundering around trying to figure out what to do. Although, I realize the advisors are trying to keep theprojects to something you are really interested in. So, I can see both sides of it…. Working with an advisor was really valuable, in fact, it might be nice to have another person to work with along the way.

What is one thing you remember about the MSU AR model that was very helpful?

The main thing was working with an advisor. I worked with Dr. X and we really went back and forth on a lot of ideas…. Having that support along the way was great, sometimes it was like, I just gave this quiz and it didn't work out the way I wanted, what should I do? Just having that person to go to when there are

problems, to check in with how to handle things without it disrupting your research, was extremely valuable.

Describe **other** action research **models** you have worked with and how effective you found them to be?

I really haven't worked with any other formal ones like that. Not really action research, no.

How **confident** did you feel about the measures you took to ensure **validity** in your action research (i.e. that you weren't just confirming your own biases, finding what you wanted to find, or thought you would find)?

Um, pretty confident because I was one of the ones that didn't exactly find what I was looking for. I found the opposite to some extent. I did see some correlation but not nearly as strong as I was thinking. So, as I said before, the communication back and forth was really useful. I had lots of checks as I was going along to ensure validity. I am pretty confident with my results.

What guidelines for improving objectivity and validity would you recommend to your peers who would like to do action research in their classrooms?

I think the main thing that would help is to do a preliminary study. I know when I finished my project I went back and I rewrote some of my quiz questions in hind site that were not as clear as I had wished. Every now and then students misinterpreted questions that seem clear to you as you write them.. So, I think it's nice to do a small pilot study to work out the kinks if you can. The other stuff is being consistent and being careful. A huge part of my time was spent refining my questions: were they really asking what I wanted to ask and were they doing so accurately?

Can you give an example from your school action research experiences that **demonstrates the practicality** of your project?

To me it's what I learned. It made me more careful in explaining things. Just because they knew how to do something I didn't take for granted that they understood why they were doing it. So it helped me refine my teaching, my questioning skills, and probing a little bit deeper into what is really going on with my students.

What **ideas** might you have as to how to make the action research process even **more practical**?

I think if you were given the opportunity to make changes in your teaching practices and then reassess your students using the same methods as laid out in your research From your original study, you find out some information and typically make changes based on that information, but you don't necessarily continue your research to determine whether the changes were appropriate. A post research or a follow up, would be valuable. One other thing on that, how valuable it is depends on choosing something that's interesting to you. If you are just choosing something and it doesn't really matter to you, I don't think you get as much from it. But if it's something that involves your class and what you are currently teaching then it's more likely that you will benefit from it.

Do you think this would **encourage more teachers** to do action research?

Yeah I think so. A lot of teachers try things in their classrooms but they don't do research per se. I think enabling AR gives teachers a real opportunity to improve. I think you have to make AR assessable to the everyday teacher. It's hard because they are so time constrained, but if they know what they are doing more teachers may conduct AR in their classrooms.

While funding is always helpful, it's not always available.

Are you supported to attend conferences?

Yeah. I presented my capstone research at a conference. My advisor encouraged me and assisted me in obtaining some funding for travel expenses. So, it is supported but it is still not the easiest thing in the world to accomplish.

What other factors (not financial) do you think could help teachers **continue to practice** action research?

I think more backing from the schools... and collaborative work between the school district, local teachers, and education researchers.

These next 4 questions are about change but each focuses on a slightly different aspect.

What **personal or individual changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

AR makes you think about the research side of education as opposed to only the teacing aspect. Having done AR, now when I have a new idea instead of just going and trying it I want to get organized, check it out, do background research, see what's been done already. Now I want to conduct new ideas as research,.

whereas before I would just say, okay let's try this. I am more focused on research now having done this AR project. I come up with a lot of ideas but now they are more researched based rather than just randomly trying things.

I think it's pretty valuable because if you are just trying things in your classroom you are not benefiting anyone besides yourself and your students, but if you are conducting action research then you can benefit the entire math ed community. You can write up your findings or talk to other people about it and have something real to fall back on. This really did work and this is why it worked, and here is my evidence that it worked.

What **professional changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

I think a lot of mine would be tied in with assessment. Having done the capstone and writing up quizzes… that's something I spent a lot of time on… how to find out what students are really understanding through formal assessments, through questioning, different things like that.

What **curriculum and teaching practice changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

...I am more focused on my students' conceptual understanding after doing this capstone, and more careful about my assessment methods. This is beneficial for my students because now I focus on actual learning not just recipes for performing mathematics.

What **changes in student learning** have you seen from doing action research? Can you give an example? How valuable would you describe these changes to be?

When you change what you are teaching towards then your students start valuing that. That is part of what is going on in the whole reform movement right now.

Do you think **all teachers** can successfully conduct AR? Can you explain why or why not?

I think all teachers are capable of AR, but some of them haven't been educated how to go about doing research other than just trying something in the classroom. They are capable, but it may require additional training. Plus the schools need to allow time for teachers to conduct research in their classrooms and to somehow compensate them for their this type of work..

High need students can be defined as traditionally less engaged, less successful, or having a history of being underrepresented, etc. In what ways has AR affected your **high need students**?

I think it had a great benefit, not just in my project but, in other ones, because if you delve into the difficulties encountered by these students you find ways to help all your students.. You may also discover misconceptions that you can remedy and thus enable students to continue learning without those obstacles.

Writers on AR often talk about the importance of **interacting** with other **professionals** while doing action research. During your AR experience at MSU, whom (if anyone) did you interact with about your research while you conducted it?

Quite a few people actually, primarily my advisor (more explanation of the back and forth)… consulted with another professor, had other people that if they specialized in something we could check with them, I also had the cooperation of working with other TA's.

And, in your research after MSU, whom did you interact with? Do you think **community** is an essential component in AR (and who do you define community to be)?

I really haven't done anything since my project... I have more appreciation now because teachers really don't have enough time to do anything. Community is anyone you are working with.

In what ways, if any, are you able to **use the results** of your AR in your teaching practice today?

Quite a bit …

What about AR is still **useful** to you?

I think mostly just the ideas, how we learn to go about AR, the methodology type things. So, far most of it is the methodology, plus developing a certain amount of skill in how to work well with somebody, how to negotiate ideas… Procedures.

Is there anything else you would like to say that I have not covered in this interview?

I guess the main thing… the capstone was a really good experience for me… I haven't done AR before certainly nothing quite that structured and since then things occur to me and I think why don't I check this out. Now I don't want to try

new ideas with no assessment and no feedback I want to do it more carefully, to actually conduct research.

Specific Interview Questions Graduate G

You answered a 3 on the survey for "Feel more confident in teaching from doing AR" why did you give a 3 on this statement?

It's about the same. I feel a little more confident maybe. I could still be a good teacher without it, but I think it's a beneficial way to answer you're my own questions and build on them to benefit the larger community. For me, I learned a lot , but as far as confidence and teaching I don't know if it made that big of a difference.

You stated, "No matter what my job or position, I will continue to pursue action research." Have you continued to do? Why such a strong positive statement?

I have started a PhD program so I am doing more research now. All these ideas come up and it's something that I am interested in doing. Ideas still occurred to me before, but theywere not as structured… now I think, I should test this. Before I just wondered if my ideas were legitimate but now I think about the methodology to assess them, how can I check this out?

You stated, "I DO view action research as self initiated professional development. Every teachers should strive to improve themselves as an educator, and the pathway to this type of improvement is action research." Again, this is a very strong positive statement. Can you explain why you feel you have this view?

It's part of making your self better. Anything you want to be better at you have to work at and teaching you have to have some way to measure making improvements and I think that action research provides that measurement… The ultimate thing is did it work and you need that research to find out.

You have done 4-5 projects before MSMME. Can you comment on them? What kind of AR were they? And what does action research means to you?

I did some less structured stuff… (explains) again it was not as structured as the capstone project… I think it would be something where there are questions that you want to answer so it's on a personal level. And then you come up with a methodology of how you are going to test this,you make some kind of change or measure something that you do actively then you go back and evaluate how it

works. Another big step is that you act on it…ask yourself so what should I change because of this?

Going back to personal or individual change… (probing)…

I think that's the main thing. I have always been one of those people who asks how can I change, so that's not really new for me… naturally that's how I am… I have this idea, I should try this, do something different but the research makes it more structured. … I have always been interested in lots of different things and had lots of ideas. It's the, what to do with the ideas and how to make them valuable to somebody besides just me?

Interview Graduate H

Describe the action research process you experienced at MSU.

The Capstone Project was very much a work in progress while I was doing it. I was part of one of the first classes using the process. Along with our course work, we talked about what a capstone was and what it should look like. In the first year we were building on an outline for the project. In the second year we were following and improving on what we thought should be added. I developed my project according to that outline and those discussions. The help from my team was good. The outline was good. The guidance that I got from my team and from my Capstone classmates was really helpful. I expected to see a huge difference in my research but it confirmed something that I had not thought of – that the more ways I can show something/a concept the better the students can grasp it. The Capstone process showed me a lot of different things. It also showed me how valuable the data collection can be especially when it is useful. The usefulness of the research and how it applies to the classroom more importantly the students has much more significance to me than standardized test scores.

What suggestions might you have to make the **MSU AR model** stronger?

I do have a couple of suggestions. They might already be doing some of these, but we were doing our action research during the development of the program and because a lot of it is a summer program, I felt really isolated while I was working on it. There should be a component built in; a second class that should be mandatory. The class should be a brainstorming a discussion session where the participants and their peers work together through different areas of need in each other's classes. There needs to be more peer input along with the professors input, it happened a little in the beginning of my projects, but it was not enough. I needed more input from peers. Having a class where we were dissecting what was happening with our students, to get more input from my peers along with our advisor teams; I know that would have helped me. I kind of needed to have other high school and middle school teacher input. Maybe somebody would have had a

better idea of how to collect data and having someone bounce ideas off of, somebody at my level would have helped build my confidence in the project I was creating.

What is one thing you remember about the MSU AR model that was very helpful?

That it was specialized to me. That it was something that I needed to see happen better, something I needed to improve on. It was the best thing in the world, something that I had to complete for the good of my students. I was really excited about it and I still am. Considering the valuable answers that I got and the important feedback from the panel at my presentation I think I took a lot of valuable information out of that whole eperience.

Describe **other** action research **models** you have worked with and how effective you found them to be?

I actually did another one. It was an intense self-evaluation of my own teaching skills. I had to look at what I do in my classes through the eyes of a peer (from observations) and through our own eyes (through video). From this model I now have more confidence that I am doing good things in my classes with my students. I serve as a voice for my department and I am being heard because of my action research programs. We also have team collaboration in our department now that I can lead. I just can't say enough good things about that experience and it should happen to everybody.

How **confident** did you feel about the measures you took to ensure **validity** in your action research (i.e. that you weren't just confirming your own biases, finding what you wanted to find, or thought you would find)?

I am really sure of the validity for a couple of reasons. One was, I had classes to use as controls so my data was not biased. The other is that I was expecting different results than I got and if there was a bias there the data would have showed completely different results. Everything was out in the open. Those are my main reasons for saying that even though I was feeling isolated I really wasn't. If I had been, my approach would have been different but I wasn't and my experience paid off.

What guidelines for improving objectivity and validity would you recommend to your peers who would like to do action research in their classrooms?

One thing I think I should have done better is have a rubric built for my student evaluations and have someone else grade them. I know my students, and that might have biased some of the data with the way I grade them. I did my own grading and I give partial credit when I can tell the student's error is minor like a reversed number or a negative not carried through a problem. I would build a rubric and have someone else do the grading if I were to do an action research of this nature again.

Can you give an example from your school action research experiences that **demonstrates the practicality** of your project?

The practicality for me is that I gain confidence in what I am doing. Different exposures throughout the whole process, and working with the evaluation team, getting feedback from the team and peers are examples of what I mean about having a class where there is more peer input because it does build confidence. I always feel really isolated. I have gained enough confidence that I can stand toe to toe with other teachers I can argue most points now and I have valid backing to show them why and to be able to tell an administrator, this is what I am doing and these are the reasons why.

What **ideas** might you have as to how to make the action research process even **more practical**?

I can see why a lot of teachers won't go into this because they are afraid it is something that will grade them. I think more of us who have gone through the experience need to go out there and talk about how enlightening it is, and how valuable it is for building confidence and bringing more to your teaching skills and abilities. The whole thing to me was, I was testing how I was teaching. My main goal is to do the best I can do for my students. It should not come from administration that a teacher should be doing an action research project. It's so helpful in building confidence. You are not in it by yourself. I was building it for me that was the most powerful.

Do you think this would **encourage more teachers** to do action research?

I think if more of us who have gone through the process of actions research brought it to the attention of teachers more would do it. It is time consuming, but it is so enriching. If they see it is not administration driven, they would see the time is worth it. I was on a discussion panel for one of the action research projects I've done, and it got more people involved, it's a lot more powerful of a learning tool if it's coming from teachers themselves.

While funding is always helpful, it's not always available. Are you supported to attend conferences?

I am supported to do anything that I can show is beneficial to my students. I think conferences are so important for keeping up with building confidence and being able to talk to peers. We are isolated here at school for most of the time.

What other factors (not financial) do you think could help teachers **continue to practice** action research?

Having more exposure to what it is and what it's about; people who have already experienced it should be talking about it - a panel at MEA would be a good place, and the MCTM newsletter. Other departments should be doing action research too. All teachers should be going through that kind of experience.

These next 4 questions are about change but each focuses on a slightly different aspect.

What **personal or individual changes** have you undergone from doing action research?

Can you give an example? How valuable would you describe these changes to be?

Again, I want to state that my confidence level is so much different than when I started. I have confidence to talk to my supervisor; I have been placed on advisory committees, and my opinion is now valuable in our school system. The most dramatic change is how my students respond to me. My students catch things that I say or do in class. Having my students comfortable enough to tell me when I have made a mistake and can correct it, show me they are understanding it; they can see it… that and my opinion being important. My students come first.

What **professional changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

I do a lot of professional reading that I didn't do before. I have an ongoing hunger to do mentoring work. That is important to pulling in new teachers and getting them to start professional development right away. Advocating for professional development is a change. I am kind of head of the department in our school now. The administrators come to me for final say on things in my department; that's only happened in the last couple of years. Instead of just getting it (professional development) for me, I am pulling it around and trying to get other teachers involved in on-going professional development.

What **curriculum and teaching practice changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

I need to bring up again how I have been asked to serve on advisory committees. The program we've chosen is vital because it builds more continuity throughout the grades; we are a k – 12 school and it's building on the students' math experiences along the way bringing in more inquiry for the students so their experiences are more than just memorizing the steps. The idea is being sold more to our k-12 teachers, not the drill and kill, but having a good continuous/connecting program. We just installed everyday math and the professional development that goes along with it. It's awesome! The teachers are working together on professional development. It starts from the time of getting their books to the end of the school year and they have to do collaboration with each other.

What **changes in student learning** have you seen from doing action research? Can you give an example? How valuable would you describe these changes to be?

A couple of the ones I have already talked about with the students being comfortable in class; students are trying to take more math classes. Some of the standards are changing and geometry is one they have to take and they're confident in what they are doing. That is a huge improvement from what they were doing. The confidence in the teacher at student level… we are seeing a lot more students that are going into college and going

into trade schools than we have before. This year we will have 2 students take the advanced placement calculus exam. Last year was the first time; 1student took it.

Do you think **all teachers** can successfully conduct AR? (Probe - Can you explain why or why not?)

I think all teachers can do action research if they are not trying to do it by themselves. It has to be a collaboration between two or more teachers or a team or a master's program, but it can't be done in isolation. I don't think it's possible to try to do it by yourself… with at least some collaboration… at least peers… at least peers. But I do think it's possible, and everybody should be doing it.

High need students can be defined as traditionally less engaged, less successful, or having a history of being underrepresented, etc. In what ways has AR affected your **high need students**?

I think having the students engaged. Because the population of our school is between 99 and 100% Indian, the norm is they don't get involved in anything that is outside of their culture, and math is traditionally outside of their culture. I think the quality of what the parents want for their students is changing. The parents becoming more involved is something we have never had, but do now. The parents are cooperating with the teachers on having their students in classes that are challenging to them, and having them more prepared when they leave. The whole thing is changing because of the attitudes of the teachers. Our students are very quiet. A lot of them tend to not want to look you in the eye. A lot of teachers see this as being disrespectful. I have not had that problem with my students. If I have, it's only been for a week or two. To understand who your population is and how they learn is a big job. The professional development that I have had helps me to get to that place of knowing what my students needs are. My work has helped me develop my lessons to get to every student at their level. I am not "dumbing down" the material but bringing the material to them in a way that they can understand it right now.

Writers on AR often talk about the importance of **interacting** with other **professionals** while doing action research. During your AR experience at MSU, whom (if anyone) did you interact with as you conducted your research?

Most of the people that I interacted with were part of my advisory team, and, like I said before, that should be expanded to include more professionals mainly peers. We did have a little peer input but not very much. I really would like to have had more peer input during the process and not just input from my advisory team.

And, in research after MSU, whom did you interact with? Do you think **community** is an essential component in AR (and who do you define community to be)?

The community around us is very remote and rural. The community in one of my action research projects were peers, and within that community, we switched groups a lot so our thinking was stretched beyond just our grade level that we teach. Peers of different levels and professors were the professional expertise in that project.

In what ways, if any, are you able to **use the results** of your AR in your teaching practice today?

Almost every facet of what I present to my students in the classroom comes from one or the other action research projects. Hopefully I am improving every day because of the ongoing evaluations I do of my materials and lessons.

What about AR is still **useful** to you?

Ongoing evaluation, personal evaluation of how I am presenting material… evaluating my students in the classroom. Because I don't like testing, I have to focus on my objectives without being biased. I want to know that my students are learning it. Those are the tools I get from my professional development.

Is there anything else you would like to say that I maybe I haven't covered in this interview?

I said an awful lot. I made several points that I don't know if I made online (in the survey). Again, I want to stress how very important it is that every teacher goes through this process. It needs to be brought to the teachers themselves. I think a panel at MEA, somewhere where there is a large concentration of teachers where teachers can explain what they did and othere teachers can ask questions about the process. Something that is not administrator driven.

Specific Interview Questions Graduate H

Explain that the following comes from their survey and capstone information.

You mention that you continually evaluate your effectiveness by reflecting on your lessons. Can you comment on how you do this and what it does for you?

I have little notes and sticky notes. When I am with my classroom I don't always think to write things down so I jot down a sticky note. My students are wonderful at bringing up things I need to improve on whether they know it or not, I have to evaluate every day so that I know if my students are not getting something. I can find out why and restructure that lesson right away so they can understand it before we move on. When they are doing their warm up, when they first come in the classroom, I look for certain things to see if they need addressing… they have to have their assignment done before we go on with the lesson. I will go through and see how they did. If there is a specific item many are

missing, we re-do it before we move on. There has to be some immediate feedback and immediate turnaround (concept repair) otherwise they are holding on to their misconception. That is one way that I found works really well, catching the misconception right away helps so much in them getting the concept correct.

You stated you have others review your data. Who do you have review your data?

I have a few people I correspond with on line. We have a lunch group in my classroom where we talk about what is going on at our school and things we could work on to improve. I think it's very important to have a lot of input because I didn't have much input from my professor team. I would have liked to have more of that specifically for the different points of view and ideas and I try to make more of that happen now. Now, we talk about procedures. I want to get more collaboration going.

You made a comment that, "To stop action research after a formal degree program is cutting off my reaching future students"? Do you still feel this way?

Yes I do. If I was not using everything I have learned from my action research, I would be hurting my students' learning experiences. My students' needs are always changing and I need to see that. If I don't know where to look for a tool or don't know how to express differently to another person then I am not being the best teacher I can be. I need to evaluate every day. If I am not doing that then I am stagnant and the whole process was worthless.

You stated that you "facilitate explorations and ideas in cooperative learning". How do you do this, can you give an example?

Number one, I hate lecture. I don't like to lecture. I like to talk but I don't like to lecture. If I am in front of the class and lecturing my students are looking everywhere but at me. I can't force them to internalize what I say to them…to keep it in their brain, but if they are working with it, exploring it, figuring it out, or asking questions then they are internalizing it. I know I talk above their heads that is understandable. So, if they are working in cooperative groups, maybe one person understood and can explain It to the rest of the group. I would rather be watching what they are doing and asking questions. Facilitation, rather than opening up the top of their head and dumping in all these words, that's basically what I was getting at. Walking around watching what they are doing, having them exploring the concept that we talked about rather than just speaking it to them.

Interview Graduate I

Describe the action research process you experienced at MSU.

Great experience it was the first experience in all my years that I had done that type of research. It was a good process though they did not have the action research class when I was there, no class was offered at the time. We were just doing it with a little less structure. Now they have a whole class for it.

What suggestions might you have to make the **MSU AR model** stronger?

Well I think they have done that since then, they have a more formal class. To talk about what does your project look like… it was all kind of piece meal at that time now it's all more formal, which I think is much better.

What is one thing you remember about the MSU AR model that was very helpful?

The idea that you can run it past teachers who are in the field and are active researchers in their own right, then you can run things by them and they help you, they direct what you're doing.

Describe **other** action research **models** you have worked with and how effective you found them to be?

Having finished the program, then having since gone into a doctoral program, I haven't done any formal action research, other research, but not action research since.

How **confident** did you feel about the measures you took to ensure **validity** in your action research (i.e. that you weren't just confirming your own biases, finding what you wanted to find, or thought you would find)?

I think at the time the validity of it was not necessarily at the forefront of my mind, more, how to conduct formal research in my classroom. So, the validity was not as forefront as it would be now. At the time I don't think I was ensuring the validity of my research, I was more looking at how I could change my practice. I had done some research as part of the program. I am interested in the learning of Native American students, how they learn at home, how their culture is, how learning happens in the home in that sense, what came of my action research validated what I found out with the youth in my class and was confirmed with the elders.

What guidelines for improving objectivity and validity would you recommend to your peers who would like to do action research in their classrooms?

Again I'd say, look to a little bit more quantitative measures. It's hard to do social research. Maybe try to find prior research that validates what you're doing.

Can you give an example from your school action research experiences that **demonstrates the practicality** of your project?

I still use my research. What I found out about learning on the reservation I continue to use it now.

What **ideas** might you have as to how to make the action research process even **more practical**?

I can only speak form my experience and what I have seen in the classroom it seems what everyone is doing is practical.

Do you think this would **encourage more teachers** to do action research?

Action research has to do with your own classroom so I don't know if you could do action research that wasn't practical to your own classroom.

While funding is always helpful, it's not always available. Are you supported to attend conferences?

Usually depending on the situation.

What other factors (not financial) do you think could help teachers **continue to practice** action research?

I think action research to most teachers is not as formal an endeavor as you and I might think it is. We observe each other in our school, helping each other, by being reflective at our school I don't think we have teachers that understand action research in a formal sense.

These next 4 questions are about change but each focuses on a slightly different aspect.

What **personal or individual changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

Because of the research I did I still use what I've done. I use what I have learned about learning in the home and then through the action research knowing and seeing how successful my research was and it is still going on.

What **professional changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

From doing action research I think I got a taste of research and realized that I can do it and wasn't opposed to it. For me, once you start doing research, once you start reading, there is a lot I don't know, there is much that does pertain to me. I never thought I would get a master's let alone a doctorate… that action research component was a springboard for me continuing my degree. I need to keep reading, a lot of research is from the tower and just to sort through some of that.

What **curriculum and teaching practice changes** have you undergone from doing action research? Can you give an example? How valuable would you describe these changes to be?

I think I covered that. With my program it's more pedagogical. I really don't use a textbook… I develop my own curriculum… my students don't learn best from adult's authority role, so its more peer directed.

What **changes in student learning** have you seen from doing action research? Can you give an example? How valuable would you describe these changes to be?

Again, I just was talking about that… students learning, now it's more balanced being a writer for another project was more of a catalyst and the action research project validated that.

Do you think **all teachers** can successfully conduct AR? Can you explain why or why not?

All teachers may not have a formal notion of what action research is but I think all teachers can successfully be reflective on their practice if we can differentiate between the formalness of action research and practice, that way we can all do the latter.

High need students can be defined as traditionally less engaged, less successful, or having a history of being underrepresented, etc. In what ways has AR affected your **high need students**?

Well again, I think their learning has improved. I understand a little bit more about how they learn and in what context they learn. There is a 98% native population in our school so because of what I have done it helps me be a better teacher for my students who are all pretty much categorized as traditionally high need. I don't know if I would categorize them that way.

Writers on AR often talk about the importance of **interacting** with other **professionals** while doing action research. During your AR experience at MSU, whom (if anyone) did you interact with as you conducted your research?

Both my advisors and the professional at my school.

And, in research after MSU, whom did you interact with? Do you think **community** is an essential component in AR (and who do you define community to be)?

That's a big question. Absolutely, why do research if its not impacting the community, the community of students, the community of school, they are all kind of interconnected, the larger community, parents, elders, everything is connected. Otherwise, you are in your own little world doing your own little thing for your own little reason.

In what ways, if any, are you able to **use the results** of your AR in your teaching practice today?

I think I already covered that with the program.

What about AR is still **useful** to you?

The notion that I still am using similar reflection type things, for things in my classroom, what can I do to improve this? How can I be a better teacher? Because of this, and from that time, and other things, I have learned how to be better reflective.

Is there anything else you would like to say that I maybe I haven't covered in this interview?

I think you pretty much got it… I think action research was a piece - maybe one more thing - action research was a piece of what I have been coming to as a professional teacher. I think the catalyst for my change, moving from a very traditional teacher to being one who considers social change different ways of learning and different representation really came from working on this thesis and another project became transformative in my career. I still want to be the best teacher this side of the Mississippi, one of them anyway, I tell my students that and they say, "Oh my god." I've got to consider that and all kinds of things I didn't consider before … my work was the spring board in what I am doing now and my interest now and what I had done in a project prior to that. I hope it was helpful.

Specific Interview Questions Graduate I

You gave a 3 for the statement, "AR brings new vitality to your work as a teacher." Can you comment on why you gave this a 3?

Vitality struck me there. I wasn't sure what that meant and is it a 3.5 or what? Did it interject excitement or joy, energy? I wasn't sure what that word was talking about… (discussion about "vitality")… New life, so new life I think research doesn't necessarily give me new life it gives me new understanding.

How do you deal now with the "time issue", as you stated, to be able to do AR?

As I mentioned before I haven't done action research in a formal sense. I am a full time teacher and a part time doctoral student so more in being reflective. I do have time to be reflective.

You stated that it is "hard to account for all influencing factors with it comes to human beings." Can you comment on what you do to address this issue in your action research?

In our social disciplines there are so many factors, influences socially, emotions and understandings, and ourselves. When I try to be reflective on how I teach and how my students learn I have to consider all factors. I have to probe more talk with people and get at underlying ideas. We can all be scientists but to be a scientist with a human being it's not always easy.

You stated that your definition of AR is not formal, can you describe what your definition is of AR?

I think it is now a combination now of being more formal, doing prior reading, finding out what other people know and have done already and what you are interested in and then using that information in your classroom. An assessment in a certain way, then I can compare what I've gotten in my results and then I can talk to my own students about it… becomes less and less formal but now I understand I need to be more formal too, combining both together now I could go to other teachers in my department and try to validate some things I am doing… more formal is necessary if I want to publish something out there reading about prior experiences with others and I can now have something to compare it to instead of being in my own little bubble doing my own little thing.

You commented on the importance of being reflective while doing action research. How does being reflective enhance your action research?

You can't do action research without being reflective. You can't do social research without being reflective about trying to put the pieces together, taking about human beings instead of a number.

APPENDIX E

LETTERS TO GRADUATES

January 7, 2008

Dear [name],

Several years ago we instituted a capstone project/oral defense as a required component in our Master's of Science in Mathematics under the Mathematics Education Option (MSMME). It took the place of a two-hour oral examination covering all of the courses in a student's program of study. We felt that this action research project allowed us the flexibility of better meeting the needs of our students. However, we have reached the point where we need to evaluate the capstone project component of MSMME since it has grown to encompass seven credit hours of a student's 30-hour program of study. We need your help.

We have asked a doctoral student at MSU to conduct an evaluation study that will involve a survey of all graduates of our program during the last four years. In addition, a small sample of former students will be interviewed. The survey takes about 15 minutes. This survey is completely confidential in the following ways. The faculty will only receive the aggregated survey responses with all potential identifiers of individuals removed. Obviously, we hope everyone fills out the survey! No names or locations of participating graduates will be mentioned in any reports resulting from this study. Sarah Segal, the graduate student conducting the study, does not know any of the MSMME graduates and will comply with the confidentiality requirements of the Internal Review Board at MSU.

Please help us to evaluate our capstone project requirement by completing the short survey. The link for the survey is http://www.cltw.org/netcollect/MSMME_survey/MSMME_survey_1.htm. When you have completed the survey, Sarah Segal will send you a small gift as a token of our appreciation. See below.

I hope you enjoyed your holiday break and thanks for taking a moment to help our program.

Maurice Burke
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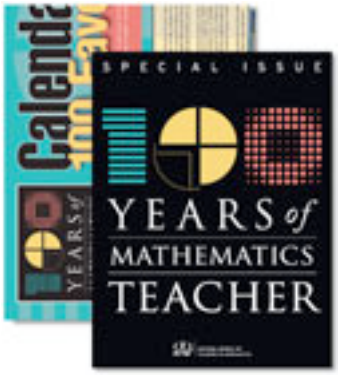
PS...In case you have not heard, Dr. Hogdson took a position at the University of Northern Kentucky in September. I know Ted would approve of this study of our capstone projects! We miss him and I am sure he misses us!



You will receive:

The Special 100 Years of Mathematics Teacher Issue
and
The 100 Favorite Calendar Problems Poster

From the NCTM website: “This year the Mathematics Teacher (MT) is celebrating 100 years of publication. That's 100 years of thought-provoking articles and activities that have inspired educators to provide more and better mathematics for all students. In honor of this centennial, NCTM has published a special issue of MT, with notable articles and fresh perspectives on mathematics education from the past 100 years and an overview of the journal's history. To commemorate the 100th Anniversary of the Mathematics Teacher, NCTM has also created a colorful poster of 100 of our readers' favorite problems from MT's "Calendar." The poster is designed for classroom use and has answers on the back.”

January 23, 2008

Dear [name],

Several weeks ago we sent you a letter requesting help in evaluating the capstone component of the Master of Science in Mathematics – Mathematics Education Option (MSMME) at MSU. I am sure you are very busy with the demands of teaching and have not had the time to respond. I hope as the hectic holiday season fades into the past that you will take a few minutes to fill out a survey that will assist us in our evaluation. Remember, this survey is completely confidential in that the faculty will only receive the aggregated survey responses with all of the potential identifiers of individuals removed. No names or locations of participating graduates will be mentioned in any reports resulting from this study. Sarah Segal, the graduate student conducting the study, does not know any of the MSMME graduates and will comply with the confidentiality requirements of the Internal Review Board at MSU. The link for the survey is http://www.cltw.org/netcollect/MSMME_survey/MSMME_survey_1.htm. When you have completed the survey, Sarah Segal will send you a gift as a token of our appreciation! See below. If you have any problems accessing the online survey, please notify Sarah at ssegal@montana.edu. Thanks for taking a few moments to assist in our program!!!

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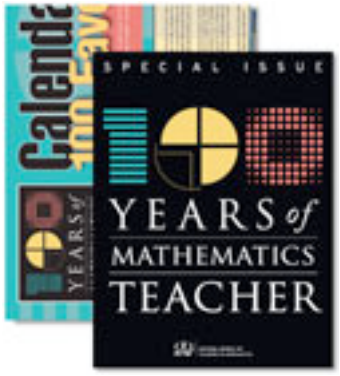

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February 25, 2008

Dear [name],

Several weeks ago we sent you a follow-up letter requesting help in evaluating the capstone component of the Master of Science in Mathematics – Mathematics Education Option (MSMME) at MSU. So far, over half of the MSMME graduates of the past five years have filled out and returned the survey. I am sure you are very busy and have not had the time to respond. This will be the final letter we send to you. It only takes a few minutes to fill out this survey and it will assist us in our research and evaluation of the program. We really need your help!

Remember, this survey is completely confidential in that the faculty will only receive the aggregated survey responses with all of the potential identifiers of individuals removed. No names or locations of participating graduates will be mentioned in any reports resulting from this study. Sarah Segal, the graduate student conducting the study, does not know any of the MSMME graduates and will comply with the confidentiality requirements of the Internal Review Board at MSU. The link for the survey is http://www.cltw.org/netcollect/MSMME_survey/MSMME_survey_1.htm.

When you have completed the survey, Sarah Segal will send you a gift as a token of our appreciation! See below. If you have any problems accessing the online survey, please notify Sarah at ssegal@montana.edu. Thanks for taking a few moments to assist in our program!!!

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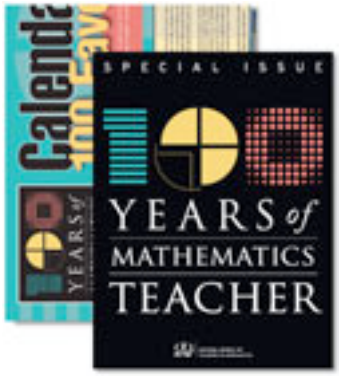

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