



Determining teachers perceptions of self empowerment through professional development facilitated by asynchronous distance delivery instruction in classroom-based action research
by Carl Johnston Graves, II

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

The continual pursuit of professional development by science teachers must be a natural progression of those entering the teaching profession. This pursuit can take many forms, but one common approach is to earn a master's degree from a college or university. Often this requires taking time from one's teaching to devote at least a year in study on the campus of the college or university. In the summer of 1997, the Master's of Science in Science Education (MSSE) Program was begun at Montana State University, Bozeman. The program used a combined model of both face-to-face and distance delivery courses. Master's degree candidates spent six weeks one summer on campus and then continued to take courses through asynchronous, on-line, distance delivery for five semesters. In addition, the candidates were engaged in action research, studying their own practice as a means of examining and improving their teaching.

The purpose of this study was to determine the effects of the MSSE candidates' perceptions of self-empowerment as a result of their professional development experience, which was facilitated by asynchronous distance delivery instruction and classroom-based action research. Teacher empowerment was defined in terms of the following five constructs: self-reflection, control, collegial relationships, confidence, and instructional strategies. A total of 42 MSSE candidates were studied over a period of three years. Two semantic differential surveys, one on action research and one on telecommunications, were administered at the beginning, middle and end of the candidate's degree program to measure attitudes concerning action research and telecommunications. An exhaustive qualitative study which included narrative surveys, focus group interviews, individual interviews, and observations of candidates' final action research projects was conducted.

With regards to action research and professional development, the results of this study suggest that action research is a meaningful professional development endeavor and that action research contributes to teacher empowerment. Empowered teachers develop a commitment to continued professional growth. Distance education allows students to engage in learning that is more learner-centered. The MSSE candidates demonstrated a significant statistical difference in their perceptions of both action research and telecommunications from the beginning of their program to the end.

DETERMINING TEACHERS' PERCEPTIONS OF SELF EMPOWERMENT
THROUGH PROFESSIONAL DEVELOPMENT FACILITATED BY
ASYNCHRONOUS DISTANCE DELIVERY INSTRUCTION IN CLASSROOM-
BASED ACTION RESEARCH

by

Carl Johnston Graves II

A dissertation submitted in partial fulfillment
Of the requirements for the degree

of

Doctor of Education

in Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

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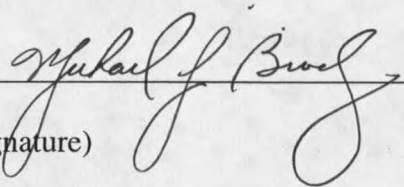
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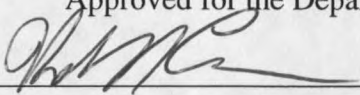
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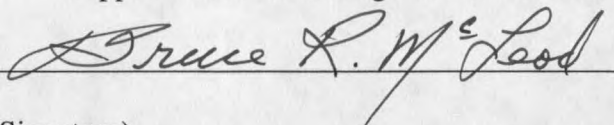
This dissertation has been read by each member of the dissertation committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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This work is dedicated to my mom, Geri (1921-2001) and my brother, Roger (1941-1999). You both provided me the inspiration to “stay the course.” And mom, thanks for continuing to teach me through the writings you left.

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ABSTRACT

The continual pursuit of professional development by science teachers must be a natural progression of those entering the teaching profession. This pursuit can take many forms, but one common approach is to earn a master's degree from a college or university. Often this requires taking time from one's teaching to devote at least a year in study on the campus of the college or university. In the summer of 1997, the Master's of Science in Science Education (MSSE) Program was begun at Montana State University, Bozeman. The program used a combined model of both face-to-face and distance delivery courses. Master's degree candidates spent six weeks one summer on campus and then continued to take courses through asynchronous, on-line, distance delivery for five semesters. In addition, the candidates were engaged in action research, studying their own practice as a means of examining and improving their teaching.

The purpose of this study was to determine the effects of the MSSE candidates' perceptions of self-empowerment as a result of their professional development experience, which was facilitated by asynchronous distance delivery instruction and classroom-based action research. Teacher empowerment was defined in terms of the following five constructs: self-reflection, control, collegial relationships, confidence, and instructional strategies. A total of 42 MSSE candidates were studied over a period of three years. Two semantic differential surveys, one on action research and one on telecommunications, were administered at the beginning, middle and end of the candidate's degree program to measure attitudes concerning action research and telecommunications. An exhaustive qualitative study which included narrative surveys, focus group interviews, individual interviews, and observations of candidates' final action research projects was conducted.

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CHAPTER 1

INTRODUCTION

Overview

The continual pursuit of professional development by science teachers must be a natural progression of those entering the teaching profession. The National Science Education Standards states that "professional development for teachers should be analogous to professional development for other professionals. Becoming an effective science teacher is a continuous process that stretches from preservice experiences in undergraduate years to the end of a professional career" (National Science Education Standards, 1996, p. 55).

Professional development takes many forms including teacher inservice provided by local school districts, professional organizations, state offices of education, and institutions of higher learning. Although no one form of professional development meets the needs of all educators, many teachers choose to combine professional development with an advanced degree. Reasons for choosing an advanced degree may include salary advancement, personal satisfaction, career advancement, career change and job requirement (Belcher, 1996, p. 8). For the purposes of this research project, the type of professional development being studied is a master's degree program in science education offered through the Montana State University system.

In 1996, the Master of Science in Science Education (MSSE) program was instituted on the campus of MSU-Bozeman with the cooperation of the Montana State University system. An intercollegiate, interdisciplinary degree program sponsored by three of Montana State University's (MSU) colleges--Agriculture; Education, Health and Human Development; and Letters and Science--the program utilizes a combination of on-campus and distance learning methods. The MSSE Program is coordinated by MSU's office of Intercollege Programs for Science Education with technical and logistical support provided by the Burns Telecommunications Center. The program is a unique, cooperative effort involving faculty from the departments of education, microbiology, earth science, biology, physics, plant and soil science and other fields (Boyce, 1998).

In contrast to earning a degree by physically being on the university campus where the courses are offered, a different technique adopted by the MSSE Program utilizes the offering of courses via asynchronous distance delivery method. Asynchronous distance delivery is defined as "learning which takes place between teacher and learner independent of time and place" (McMullen, Goldbaum, Wolfe, & Sattler, 1998, p.3). One form of asynchronous distance delivery is the use of a telecommunications system which utilizes electronic mail and on-line discussion groups. Students can "attend class" using a computer and a connection to the internet at whatever time of day or night they desire. The flexibility of this type of class delivery may be quite appealing to many students (Belcher, 1996).

A major goal of the MSSE Program is to increase literacy in science. Further, the program seeks to assist teachers to better understand the content and relationships in

different areas of science and to gain an appreciation of how best to learn and teach science (Reed, personal communication, November 12, 1997). The specific methodology selected to develop and enhance the professional development of teachers was teachers as classroom researchers (Boyce, 1998). These goals are consistent with the National Science Education Standards (1996) for professional development which state that "professional development activities must provide...opportunities for individual and collegial examination and reflection on classroom and institutional practice (p. 68) and must "connect and integrate all pertinent aspects of science and science education" (p. 62). The purpose of classroom research as stated by Cross (1990) is

to contribute to the professionalization of teaching, to provide the knowledge, understanding, and insights that will sensitize teachers to the struggles of students to learn. Classroom research consists of any systematic inquiry designed and conducted for the purpose of increasing insight and understanding of the relationships between teaching and learning (p. 136).

For the purposes of the MSSE Program, the type of classroom research being modeled through coursework and student implementation is referred to as action research. Action research is identified as research conducted by practitioners on their own practice with the purpose of gaining a better understanding of their own personal development and to make improvements in their practice (McNiff, Lomax, & Whitehead, 1996).

One of the transformations being observed in the paradigm of classroom research is that teachers are learning to become researchers through the use of action research. As a result of becoming action researchers, teachers are more reflective in their practice and sense a greater degree of empowerment within their professional settings (Nihlen, 1992).

Teacher empowerment has been identified by Miller (1993) as consisting of five major constructs. These constructs are self-reflection, control, collegial relationships, confidence, and instructional strategies. In addition, as a result of action research, teachers are adding to their knowledge of their practice. Kincheloe (1991) argues that "once teacher researchers begin to focus on knowledge production...their pedagogy is forever transformed" (p. 187). It is this transformation phenomenon embedded within the context of teacher empowerment that establishes, in part, the problem of this study.

The MSSE participants, once admitted to the program, are immersed in a professional development program of study intended to equip teachers to better understand the content and relationships in different areas of science and demonstrate an appreciation of how best to learn and teach science. Through the avenue of asynchronous distance delivery and the action research model, it is hoped that these graduate students will become better teachers, thus empowered teachers (Reed, N., personal communication, November 12, 1997). However, no determination of the degree to which students felt empowered as a result of participation in an asynchronous distance delivery, classroom research-based graduate program had been established.

Purpose of the Study

The purpose of this study was to determine perceptions of teacher empowerment through professional development in a graduate study program focusing on action research using asynchronous distance delivery methods. The context for this study arises from the Master's of Science in Science Education (MSSE) Program which began on the

campus of MSU-Bozeman during the summer of 1997. The MSSE Program is based on several principles: 1) all course work is interdisciplinary, combining science and education; 2) all students will conduct classroom-based action research; and 3) courses emphasize the interchange of knowledge between students with similar interests.

Participants spend six weeks on the campus of MSU taking courses during June and July of the summer they begin the program. The next six semesters of coursework are conducted on-line using MSU-Link, an Internet accessible, FirstClass Client® bulletin board service, an asynchronous distance delivery system utilizing group and personal email (Boyce, 1998).

A major educational emphasis of the MSSE program is the completion of a classroom research project. Students are required to take two action research courses through asynchronous instruction. Cross and Steadman (1996) state that:

Classroom Research may be simply defined as ongoing and cumulative intellectual inquiry by classroom teachers into the nature of teaching and learning in their own classrooms. At its best, Classroom Research should benefit both teachers and students by actively engaging them in the collaborative study of learning as it takes place day by day in the particular context of their own classrooms. Teachers are learning to become more effective teachers, and students are learning how to become more effective learners" (p. 2).

Classroom research, or action research, engages teachers in professional development as researchers to examine some aspect of their own teaching situation in hopes of better understanding and improving their practice. It is hoped that through action research, the MSSE Program will achieve one of its major goals, which is to "provide a model to increase appreciation of how best to learn and teach science" (N. Reed, personal communication to Northwest Association of Schools and Colleges,

February 1977). If "appreciation of how best to learn and teach science is achieved", the question of whether that translates into empowerment becomes critical.

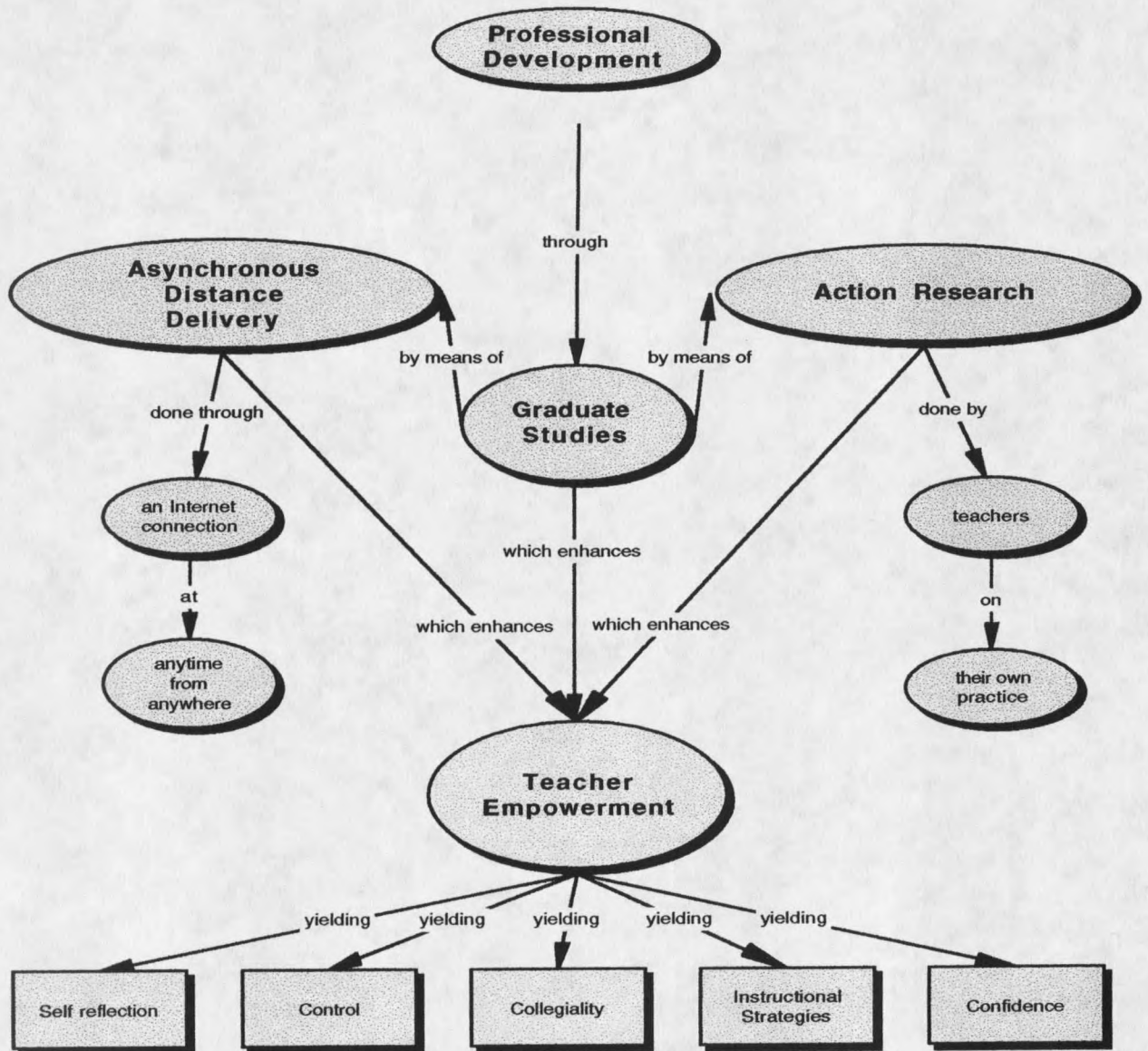
Research Question

The research question that guided this study was "What are teachers' perceptions of empowerment in their teaching as a result of professional development in an asynchronous distance delivery action research-based master's degree program?"

The following concept map (Figure 1) is offered as a means to assist the reader in visualizing the scope of this research question. Novak and Gowin (1984) advocate the use of concept maps, stating that "concept maps are intended to represent meaningful relationships between concepts in the form of propositions. Propositions are two or more concept labels linked by words in a semantic unit (p. 15).

The concept map begins with the research question dealing specifically with professional development. The proposition (link) to graduate studies is then made. The specific components of professional development examined in this study are action research and asynchronous distance delivery. Propositions defining the elements of the graduate study are then established by moving right to action research and left to asynchronous distance delivery. Finally, following the chart downward links the concepts of professional development through graduate studies by the use of action research and asynchronous distance delivery to teacher empowerment which is defined by five constructs (Miller, 1993).

Figure 1. Concept map of research question: Relationships of the major research components of professional development, graduate studies, asynchronous distance delivery, action research and teacher empowerment.



Definition of Terms

Research in the area of empowerment through professional development delivered by asynchronous distance delivery emphasizing action research does not require a command of technical vocabulary; however, several terms do require clarification in context of the MSSE Program and this study.

1. Action research: see Classroom research.
2. Asynchronous distance delivery: "learning which takes place between teacher and learner independent of time and place" (McMullen, Goldbaum, Wolffe, & Sattler, 1998. p.3).
3. Classroom research: "ongoing and cumulative intellectual inquiry by classroom teachers into the nature of teaching and learning in their own classrooms" (Cross & Steadman, 1996, p.2).
4. Confidence: "a feeling or consciousness of one's powers or of reliance on one's circumstances" (WWWebster Dictionary, 1999).
5. Control: "to exercise restraining or directing influence over" (WWWebster Dictionary, 1999).
6. Collegial Relationships: "a state of affairs existing between those having relations or dealings with an associate in a profession" (WWWebster Dictionary, 1999).
7. Empowerment: "to give official authority or legal power to; enable, to promote the self-actualization or influence of" (WWWebster Dictionary, 1999). Miller

- (1993) identifies five constructs of empowerment: "self-reflection, control, collegial relationships, confidence, and instructional strategies" (p. 70).
8. Instructional Strategies: "the action, practice, or profession of teaching and the art of devising or employing plans or stratagems toward a goal" (Webster Dictionary, 1999).
 9. MSSE.1 and MSSE.2: The first (.1) and second (.2) cohorts of the Master's of Science in Science Education Program (MSSE).
 10. Self-reflection: the consideration of some subject matter, idea, or purpose belonging to oneself (Webster Dictionary, 1999).
 11. Telecommunications: in regard to the MSSE Program, the personal and/or group exchanges between instructors and students using computing conferencing and electronic mail (or *e-mail*), usually via MSU-Link, which is accessed using First Class Client® software. MSU-Link is housed on the campus of MSU-Bozeman in the Burns Technology Center.
 12. Practitioner-researcher: used by Jarvis (1999) to describe practitioners (teachers) who do research.

Context of the Study

The researcher had a ready-made bias to this study in that he was an adjunct instructor in the MSSE program having taught or functioned as a Teaching Assistant in the following courses: EDCI 537 "Contemporary Issues in Science Education", EDCI 505 "Foundations of Action Research", and EDCI 509 "Implementing Action Research".

In addition, the researcher's graduate course of study included the following MSSE courses taught in an asynchronous telecommunication method: BIOL 514 "Life in Streams and Ponds of the Northern Great Plains", EDCI 503 "Evaluation and Measurement in Education", EDCI 536 "Construction of Curriculum", EDCI 551 "Improvement of Instruction Using Computers", MATH 517 "Advanced Mathematical Modeling for Teachers", PHYS 401 "Advanced Physics by Inquiry", and PHYS 511 "Astronomy for Teachers", and ES 580 "Principles of Earth Science". The researcher felt that his involvement in the MSSE Program as both an instructor and student brought an increased understanding of the issues surrounding this study and should not be viewed as a distracter to the study, but should serve to enhance the study. According to Lincoln and Guba (1985), prolonged engagement and persistent observation are two elements of research that add trustworthiness to the research project and provide depth to a researcher's work. In that regard, the researcher's direct involvement with the MSSE Program should be viewed as a strength of this research project.

Summary

Technological advances will continue to push the envelope of professional development opportunities as to when and where courses can be offered by instructors and taken by students. No longer is there a need to be "on location" in order to earn a graduate-level degree. As more courses and degree programs are offered via asynchronous distance delivery methods, new opportunities for learning will be opened.

Teachers, in their pursuit of understanding and applying the tools of their profession, gain experience, insight, and expertise in their field, thus possessing potential tools of empowerment. One strategy for achieving knowledge of one's teaching is through the use of classroom research. Kincheloe (1991) argues that "once teacher researchers begin to focus on knowledge production...their pedagogy is forever transformed" (p. 187). The degree to which professional development facilitated by asynchronous distance learning and focusing on classroom-based action research results in the empowerment of teachers was the purpose of this study.

CHAPTER TWO

LITERATURE REVIEW

Professional Development

Professional development is a process by which teachers engage in "active learning that builds their knowledge, understanding and ability (National Science Education Standards, 1996, p. 56). Loucks-Horsley, writing for the Eisenhower National Clearinghouse for Mathematics and Science Education publication Ideas That Work: Science Professional Development (1999) has identified five principles of effective professional development. The principles are:

1. Professional development experiences must have students and their learning at the core--and that means all students.
2. Excellent science teachers have a very special and unique kind of knowledge that must be developed through their professional learning experiences.
3. Principles that guide the improvement of student learning should also guide the professional learning for all teachers and other educators.
4. The context of professional learning must come from both inside and outside the learner and from both research and practice.
5. Professional development must both align with and support system-based changes that promote student learning (p.4).

One aspect of professional development for teachers is earning a master's degree in education or a specific discipline of education, such as science. There are numerous reasons why teachers pursue advanced degrees in education. Belcher (1996) found that among 297 technology and education graduate school respondents to a graduate school survey at Boise State University, the most important reason for attending graduate school was "that they would find it personally satisfying" (p. 8). Other reasons for attending graduate school included, in order of respondent selection, career advancement, ability to earn more, desire for a career change and job requirement (Belcher, 1996). When 333 continuing education respondents from a similar survey in Ohio reported, they stated that the "availability of a particular program ranked first, and convenient location ranked second highest" (Hanniford & Ventresca, 1993, p. 8). In addition, Hanniford and Ventresca (1993) discovered that "intellectual growth, earning a degree and learning a specific subject were cited as being very important by over 40 percent of the respondents" (p. 8). They also reported that many of the students are "goal oriented" (p.11). Furthermore, 69 respondents to a self-assessment of the doctoral program in higher education at the University of Georgia reported that "their primary purpose in pursuing the doctoral degree" was "preparation for professional practice" (Fincher, 1983, p. 5).

In spite of the benefits teachers gain from professional development, the process is also one that may create conflict. According to the NSTA Standards for Science Teacher Preparation (1998), "professional practice may result in internal conflict." The

Standards continue by stating that "True professionals have learned the art of disagreeing without being disagreeable and realize that professional growth requires taking risks."

Regardless of the reasons or obstacles for continuing one's education within the field of teaching, professional development is a recognized standard for science educators. The National Science Education Standards (1996) state implicitly that "professional development for a teacher of science is a continuous, lifelong process" (p. 57).

Summary of Professional Development

Professional development is a process of growth and change. Howser (1989) reports that "the value and attitude teachers had toward collegial relationships, curriculum changes, district mandates, and their own personal growth were associated, to a large degree, with whether or not they sought to grow and change" (p. 32). The American Association for the Advancement of Science (AAAS) in their Blueprints On-line (1997) state the following concerning professional development:

Perhaps the most important reason for continuing professional development for science, mathematics, and technology teachers is that it allows them to recognize the special expertise related to their work. Specialized knowledge becomes a source of authority for setting policies and making curricular decisions. A second reason is that pre-service education is simply not long enough or intense enough for teachers to master all the skill areas they need. Third, as knowledge in the fields of both science and teaching continues to expand, and as our society and its demands continue to change, teachers themselves must grow and develop. Finally, when teachers engage in long-term professional development, they build relationships with a wider community of peers, which improves teaching quality (p.6).

Action Research

Action research, one specific type of classroom research, has nearly a 50-year history (Foshay, 1998). Action research is defined by Berlin (1996) as "systematic and recursive inquiry and reflection in a collaborative learning community directed toward the understanding and improvement of practice" (Rhoton & Bowers, p. 73). From a historical perspective, action research has been an emerging field in research since World War II. Psychologist Kurt Lewin in 1946, educator Stephen Corey in 1955 and Lawrence Stenhouse, director of the Schools Council Humanities Project in 1983, have all contributed significantly to the development of action research as a research technique for teachers (Hollingsworth, S., 1992, p.2). According to Hollingsworth:

Three factors have made action research in the process model a viable alternative in the late 1970s and 1980s: (a) the difficulties of disseminating quantitative, experimental methodologies to local and social educational settings, (b) an increasing acceptance of the concept of curriculum as integrated with deliberation (Schwab, 1973), and (c) a professional and political reaction to the post-Sputnik accountability stance for improving and changing curriculum (p. 2-3).

The perceived role of practitioners in research has changed over the years. The more traditional model of research was one in which university-based researchers conducted their studies on teachers (Veal & Tippins, 1996, p. 81). As a result of that research paradigm, Kincheloe (1991) states that "the teacher is viewed as an aborigine to be studied objectively." He continued by saying:

Indeed, the status of teachers is quite low; can the 'natives' truly be expected to conduct their own research? Even though the practitioner may be in the school every day, engaged in an intensely personal relationship with students, he or she is simply incapable of conducting research in the situation. Research and theory building are the domains of the academic expert--teachers should stick to the execution of their tasks (p. 12-13).

Fortunately that view of teachers as subjects is changing. Because one of the goals in the field of educational research is the improvement of teaching and learning, a meeting of the minds of theorists, classroom teachers and curriculum writers has begun to occur. It has been recognized that theory generation does not always translate into improved learning. The recognized "experts" in the classroom are the teachers themselves, the practitioners. Only as practitioners are allowed to design, conduct and analyze research, and consequently implement changes based on their own research, will the improvement of teaching and learning occur (Houser, 1990).

Berlin (1996) reminds us that "within the current science education reform environment, action research is becoming endorsed as a means to broaden the research base, expand knowledge, and strengthen the impact of research" (p. 73). She continues by stating that "action research promises not only to improve practice, but also to contribute to the professional development of teachers and the professionalization of teaching" (p. 74).

Angelo (1991) has identified three major benefits of participating in classroom research. They are collegiality, positive student response, and intellectual excitement and renewal. In addition, he stated that "teachers found a new outlet for their intellectual energies in Classroom Research. They spoke of being 'revitalized' and 'challenged'..."(p. 14). Angelo also reports that university faculty participating in classroom research report "those faculty who initially found the approach helpful were using it and would likely continue to use it" (p. 122). He reported that one instructor's self-assessment stated that,

"My teaching seems more in depth. I have questioned and changed my own teaching goals. I am more aware of the needs of my students" (p. 122).

The use of action research in specific disciplines of science teaching has increased. Feldman (1999) addresses action research by physics teachers when he states that "It can be argued that all physics teachers, at all levels, including college, should be action researchers, to improve their teaching and to come to a better understanding of their educational situation" (p. 4). He further states that "Action research can, however, be conceptualized in a way that begins with the assumption that all good teachers pay close attention to their teaching, try out new ideas, and evaluate what they have done" (p.4).

Aside from the actual research benefits of action research, White and Klapper (1993) report:

As a result of their action research involvement in their implementation of their own innovations in their own classrooms, teachers' attitudes toward and perceptions of research, development, and evaluation do become more positive. Moreover, they display an increased self-confidence for inquiry and self-reflection on activities in their own classrooms. These teachers develop stronger feelings of personal professionalism in that they come to appreciate the importance of their own capabilities and professional responsibilities for identifying and making the curricular and instructional changes (reforms) needed to move our educational system toward the stature of world-class quality. Thus, teachers can become more deeply immersed in a challenging and increasingly complex profession (p.4).

Action research and effective professional development are strongly connected.

Bybee and Loucks-Horsley (2001) report that:

Effective professional development helps teachers learn and gives them tools for further, often less-formalized learning. One strategy that does both is action research, in which teachers determine what questions they are most interested in

asking about their students' learning and their own teaching and pursue those questions by learning ways of collecting and analyzing data and sharing their results (p.8).

There is a "downside" or a cost to teachers as researchers. Angelo (1991) identifies the "bottom line" costs of action research as time, coverage, and closure. Time, Angelo states, is "the most frequently mentioned 'cost' associated with using Classroom Research" (p. 12). Coverage he defines as "the perceived threat to coverage of course material" (p. 12). Many teachers are concerned that by doing classroom research, they will not be able to fully cover the requirements of the course. The third cost is closure, which Angelo describes as "those largely uncharted territories" of the ambiguity of classroom research data. In other words, what researchers do with the knowledge they have gained as a result of their research" (p. 13).

Yet another "cost" of teacher research is the perceived threat by those outside of teaching, administrators and others, that teachers as researchers will somehow overstep their role as teachers. As Hollingsworth (1992) reports:

Some might worry that the political implications of teacher empowerment and societal reform might lead us to a new and unknown world with unfamiliar epistemological and social norms. Others might be concerned that the growing popularity of the teachers as researchers movement will ensure that it becomes yet another form of power and hierarchy inside schools; becomes mandated, measured, and meaningless to actual improvement of practice; or simply becomes a new process for reproducing existing school structures and societal outcomes... What is clear is that the movement is part of the larger evolution of society into the post-information age--and teachers as researchers are no longer marginally involved (p. 7).

As Hollingsworth stated, society is moving and "teachers as researchers are no longer marginally involved" (p. 7).

The emerging role of teachers as researchers cannot be denied. According to Jarvis (1999), "Practitioner-researchers and their research are a sign of the times. Practitioner-researchers are an intrinsic part of the learning society, responding to the changes with practical knowledge that enables them to cope with the changes" (p. 167).

Summary of Action Research

Action research is a form of research conducted by practitioners on their own practice with the intent of finding ways to improve their practice. One of the goals of action research is a heightened sense of what occurs within one's practice. Through the process of self-reflection, teachers who participate in action research have reported an increase in collegiality, an increase in student learning and an excitement about teaching as a result of the action research process. The costs of action research include the time involved to conduct the research and the perceived or actual loss of instructional time due to conducting the research.

Asynchronous Distance Education

Asynchronous distance learning is "learning which takes place between teacher and learner independent of time and place" (McMullen, D., et al., 1998, p.3). In and of itself, distance learning is not a new approach to teaching. Correspondence courses through the mail, television and radio broadcasts of coursework, as well as the use of two-way interactive video and other technologies are all examples of distance education (The Institute for Higher Education Policy, 1999, p. 9). One specific form of asynchronous learning is the use of a telecommunications system which utilizes

electronic mail and on-line discussion groups. Users of this type of asynchronous distance delivery rely on a computer with some form of internet connection to access a system that serves as the clearinghouse for the course. In the case of the MSSE program, students use a computer and internet connection to contact the Burns Telecommunications Center at Montana State University-Bozeman using a bulletin-board system called MSU-Link. The flexibility of this type of class delivery may be quite appealing to many students (Belcher, 1996, p. 7).

There are numerous reasons why students may choose to participate in asynchronous distance delivery courses. Lacy (1999) identified five leading reasons as "flexibility (a better fit in schedule), work conflicts with on-site schedule, distance from campus, more time with family, and a desire for degree completion" (p. 87). A second report by The Institute for Higher Education Policy (1999) concurs by stating that "The students reported that they chose distance education because of the flexible schedule..." and "Students preferred not to commute and 'enjoyed the luxury' of not having to commit to a specific class meeting time" (p. 15).

According to Bull, Kimball and Stansberry (1998), "learners are more motivated to use computer mediated learning than they are to come to a traditional class" (p. 213). The authors continue to explain that the motivation is derived from the fact that there is "a reduction in external control, and there is usually no direct supervision in asynchronous environments. Hence the learner must take more responsibility, and with responsibility comes motivation" (p. 213). In regard to collegial relationships, Bull, et.al.(1998) note that:

Being part of a community invites belonging. This means that the learners must identify with the community and its goals. Being part of a computer mediated learning team invites belonging as does collaborative/cooperative learning which is focused on learner centered projects (p. 215).

Further, The Institute for Higher Education Policy (1999) reports that "distance learning students also had stronger analytical skills and written communication skills, and were more 'self-directed' than their on-campus counterparts" (p. 15).

Summary of Asynchronous Distance Delivery

Asynchronous distance delivery is a form of instruction that takes place at any time from any place. Asynchronous distance delivery methods have several advantages including the ability to take coursework from remote locations, ability to structure coursework according to one's own personal and professional schedule and to engage in learning that is more learner centered. Further, students in distance education courses may be more motivated, have stronger analytical and written communication skills.

Empowerment

The 1999 Webster's Dictionary defines empowerment as "to give official authority or legal power to; enable; to promote the self-actualization or influence of." As reported by Lichtenstein, McLaughlin, and Knudsen (1991), the term "teacher empowerment" became a common buzz-word in the 1980s. To many, especially policy analysts, it was realized that successful outcomes of educational reform centered in large part on the effectiveness of teachers to implement the reforms. Those who argued for

teacher empowerment often cited a "back-breaking educational bureaucracy" as the menace of the success of educational reform. "Reformers and practitioners alike embraced the concept of teacher empowerment as being fundamental to an enhanced sense of professionalism and, ultimately, to better teaching" (p. 1).

Definitions of teacher empowerment have since emerged from this debate. Lightfoot (1986) defines empowerment in terms of "the opportunities an individual has for autonomy, responsibility, choice, and authority" (p. 9). Lichtenstein et al. (1991) report that empowered "teachers possess an overall confidence in their own judgment, a strong belief in their ability to make intelligent and appropriate decisions in the classroom, and professional self-esteem" (p. 19). Miller (1993) identifies five constructs of empowerment. These constructs are self-reflection, control, collegial relationships, confidence, and instructional strategies.

Linking the Definitions of Empowerment

Reflective practice is the implementation of questioning in which a prepared set of questions is asked in order to provide the respondent opportunities to explore his or her knowledge, attitude, decision-making, experiences, values or beliefs. When the activity is performed on oneself, it is referred to as self-reflection. The process of reflection "relies much more on creating opportunities for respondents to think aloud and construct meaning for themselves" (Lee & Barnett, 1994, p.17). Russell (1994) defines reflection as "related to analyses of the nature of professional knowledge and the ways it is acquired, held and renewed, and it is driven by perspectives on the relationship between

thought and action" (p. 248). The National Science Teacher (NSTA) Standards for Science Teacher Preparation (1998) state that "Commitment to exemplary practice means staying abreast of the latest research in practice, examining one's own teaching, experimenting with new approaches, and sharing insights--in other words, becoming a reflective practitioner.

Control is defined as the ability "to exercise restraining or directing influence over" (Webster Dictionary, 1999). Kincheloe refers to this as "the principle of self direction" for teachers when he states that "Workers/teachers are ultimately their own bosses" (p.4).

Collegial relationships are "a state of affairs existing between those having relations or dealings with an associate in a profession" (Webster Dictionary, 1999). The National Science Education Standards (1996) recognize the need for collegial relationships by stating that "schools must explicitly support reform efforts in an atmosphere of openness and trust that encourages collegiality (p. 222). The Standards (1996) continue, stating that "Collegiality, openness, and trust must be valued; teachers must be acknowledged and treated as professionals whose work requires understanding and ability" (p. 223).

Confidence is "a feeling or consciousness of one's powers or of reliance on one's circumstances" (Webster Dictionary, 1999).

Instructional strategies are "the action, practice, or profession of teaching and the art of devising or employing plans or stratagems toward a goal" (Webster Dictionary, 1999).

Summary of Teacher Empowerment

Teacher empowerment is the degree to which a teacher feels he has the ability to affect change in his professional setting. In addition, empowerment is the degree to which teachers feel they have control the ability to make those changes. Components of empowerment have been identified to include self-reflection, control, collegial relationships, confidence and instructional strategies. Teacher empowerment is one aspect of teacher professionalism. To be recognized as a professional, teachers should also be recognized as having some power in their professional settings. The various definitions of empowerment are also interconnected, as indicated by Kalaian and Freeman (1987) who suggest that gains in self-confidence may, among other things "increase one's receptivity to feedback from others" (p. 11), continuing the process of reflection.

The five constructs of teacher empowerment as defined by Miller (1993) are interrelated within the literature. A link between instructional strategies, control, collegiality and confidence is reported by Lichtenstien, McLaughlin and Knudsen (1991), who state that:

broad and deep knowledge of the subject matter improves daily decision-making in the classroom; it allows teachers to convey mathematical ideas in diverse and creative ways to their students. Disciplinary knowledge informs decisions about what and how to teach to best serve student needs. In addition, disciplinary knowledge forges connections to a professional community of teachers and others who study and use mathematics, and relates to teachers' policy knowledge and involvement. Subject matter knowledge thus empowers by enhancing teachers' capacity both in and out of the classroom (p. 17).

Further, the NSTA Standards for Science Teacher Preparations (1998) state that "A commitment to practice beyond the level of one's own needs is fundamental to professional development. At the heart of this commitment is a willingness to acknowledge the need for trust and collegiality, and the value of sharing through a community of learners.

Action Research and Teacher Empowerment

The link between teachers as action researchers and empowerment is strengthening. Veal and Tippins (1996) state that "when teachers--as researchers--examine alternative teaching methods and approaches, they are empowered to create knowledge that is relevant to their professional lives and their classrooms" (p. 81). Kincheloe (1991) states that "our system of meaning rests on...a view of teacher professionalism which uses action research as a vehicle for empowerment..." (p. 34).

Nihlen (1992) reports that:

Within the research class, the teachers were able to develop a frame of mind about research that allowed them to look at and reflect upon their own work in order to make changes in their own classrooms and schools. Their 'praxis' empowered them in their own classrooms as well as in the school at large as they shared the data. (p. 5).

From a research study that included a teacher as researcher element, Miller (1993) reports that:

the teacher as researcher component seemed to empower the classroom teachers to begin to examine their practices both individually and collectively. They began to see that they had choices in the instructional strategies and methods. The inclusion of the teacher as researcher component enabled teachers to be able to substantiate and defend these choices (p. 134).

Angelo (1991) identifies three benefits to classroom research: collegiality, positive student response, and intellectual excitement and renewal (p. 13). These relate directly to Miller's (1993) definition of empowerment (p. 70).

Jarvis (1999) states that "action research differs little from reflective practice..." (p. 90). Jarvis continues to strengthen the connection between action research and reflective practice by citing Carr and Kemmis (1985) stating that "Action research is simply a form of self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own practices, their understanding of these practices, and the situations in which the practices are carried out" (p.162).

Kincheloe (1991) connects action research and self-directed teacher control by stating that teachers should "be free of control by supervisory forms which use the tyranny of pre-packed coverage of specific information at specific times, e.g., 'I want you on page 30 at 1:30'. Teachers freed from such constraints would need research skills to conceptualize and carry out the goals of their classrooms" (p.4).

The link between action research and collegiality is established by Kincheloe (1991) in what he refers to as "the principle of workmate cooperation", stating that "Teachers who are researchers share their finding with one another, discuss interpretations of the findings, and work together to implement strategies based on new understandings which emerge" (p. 5).

Kincheloe (1991) connects instructional strategies, which he refers to, in part, as "the educational act" when he states that "teachers are encouraged to contribute to our knowledge about the educational act, while at the same time they are challenged (by

administrators and one another) to push their knowledge to new levels via new questions involving topics which transcend the mere teaching technique. The central role of research is apparent "(p.4).

In his statement, Kincheloe not only makes a connection between research and instructional strategies, but also links reflective practice and collegiality by mentioning the emergence of "new questions" and by stating that teachers are "challenged by one another".

Tobin (1990) states that "when teachers undertake research they can focus on questions that concern them. Answers can lead to changes in the learning environment and ultimately to improved learning of student (p. 413). He further states that "Teacher/researchers can investigate what works in laboratory activities and what does not work. The cognition which accompanies discussions and arguments over interpretations of data is likely to drive understandings about teaching and learning to new levels" (p. 413).

Summary of Action Research and Teacher Empowerment

Action research is an empowering process. As teachers engage in action research, they often become more self reflective, have more sense of control, develop collegial relationships, increase their confidence and gain insights into their instructional strategies, all of which, by definition, lead to increased teacher empowerment. The connection between these concepts of action research and teacher empowerment were originally established in the researcher's concept map (Figure 1) and have subsequently been established in the literature.

Review of Methodologies To Be Used

Quantitative Procedures

A review of the literature yielded several methodologies that have been used to determine participants' perceptions of affective variables such as empowerment. Berlin (1996) reports the development and use of a semantic differential survey instrument for action research (p. 4). The 15-item instrument (Appendix A) was used to "measure attitudes and perceptions of teachers related to specific educational innovation topics and educational research" (p. 9). The researcher of this proposal contacted White and Berlin and received written permission (Appendix B) to use and/or modify the semantic differential instrument for use in this proposed research study.

Miller (1993) developed an instrument designed to measure teacher empowerment. The Teacher Empowerment Scale (Appendix C) consists of 27 response items based on Miller's definition of teacher empowerment (p. 70).

Qualitative Procedures

Qualitative measures included the use of participants' on-line responses and comments from survey questions (Appendix D), focus group interviews (Appendix E), personal interviews (Appendix F), journal entries, and action research projects. Yin (1989) suggested the use of a variety of sources of information and evidence as an essential component of qualitative methodology. These multiple sources assist the researcher to "triangulate" (Lincoln & Guba, 1985) the data. That is, the researcher is able

to cross-check data for accuracy and discrepancies, thus "improving the probability that findings and interpretations will be found credible" (p. 305).

Sources of Information

The semantic differential action research survey (Berlin & White, 1997) was modified to solicit responses specific to both action research and telecommunications. The instrument was administered during the first on-campus session, mid-way in the second semester of on-line coursework, and finally at the second on-campus session.

The Teacher Empowerment Scale was administered during the second on-campus session as a post-program instrument.

Participants' on-line responses and comments were gathered and stored both electronically and on hardcopy. Responses from discussion groups, journals, reflections, assignments, correspondence with instructors and other participants in the MSSE Program were gathered.

Interviews were conducted individually and in focus groups. The researcher collected interview data through writing and, with each participant's approval, through the use of audio tapes to insure accuracy of data collection.

On-line, web-based surveys were used at the end of the participants' completion of their action research project in order to gather data specific to the action research process.

Observations of participants at the final on-campus session were used. Each participant presented a "Capstone" Project during the final session. The researcher observed these presentations.

Summary of the Literature

The review of the literature attempted to establish the need for this research study. The major focus of this study will be to determine secondary science teachers' meaning of empowerment through an asynchronous distance delivery, classroom research-based master's degree program. The variables of the scope of the study include graduate studies and professional development, asynchronous distance delivery, action research, and empowerment through self-reflection, control, collegial relationships, confidence and instructional strategies. Consequently, the review of the literature is a reflection of these components.

The existing literature on professional development is conclusive--teachers require professional development, especially in light of standards-based reform.

Thompson and Zeuli (1999:1) state:

It is now widely accepted that, in order to realize recently proposed reforms in what is taught and how it is taught [as described in national standards documents]...teacher will have to unlearn much of what they believe, know, and know how to do while also forming new beliefs, developing new knowledge, and mastering new skills. The proposed reforms constitute, if you will, a new curriculum for teacher learning (p.341).

However, the literature offers little agreement as to the form professional development should take, be it graduate school or another means. However, national educational standards clearly state that professional development should and must occur within the teaching profession. There is a clear link between professional development and reflective practice (one component of empowerment) as stated by Ash (1993), who

wrote "when teachers use reflection, they can personalize the issue of professional development" (p. 3).

Classroom research, specifically action research, is becoming a more acceptable form of teacher-as-researcher practice. Bybee and Loucks-Horsley (2001) report that "strategies that appear most promising [in terms of professional development] encourage teachers to examine their own practices, often by using curriculum materials that they use with their students" (p. 7). Action research is a professional development strategy that allows teachers to examine their own practice, using materials (curriculum) readily available. The literature indicates that action research is becoming a means to broaden the research base, contribute to the professional development of teachers and strengthen the professionalization of teaching. As a result of participating in the action research process, many teachers' attitudes toward research become more positive. In addition, there is evidence that increased self confidence and self-reflection are often the result of the teacher as researcher model.

Asynchronous distance delivery is an emerging form of instruction. The research suggests that some learners are more comfortable with asynchronous distance delivery than more traditional classroom instruction. In addition, the ability to remain at one's current job and location is an attractive component of asynchronous distance delivery.

The review of the literature on teacher empowerment reveals that in order for educational reform to be effective, teachers must be empowered. An empowered teacher demonstrates autonomy, responsibility, choice and authority. Linked to those components of empowerment are teachers who utilize self-reflection, demonstrate

control, establish meaningful collegial relationships, display confidence in their teaching and have established solid instructional strategies.

Reviewing the literature on professional development, asynchronous distance delivery, action research, and empowerment has resulted in little connection between the components. The existing literature does not reveal whether or not teachers' perceptions of empowerment through both action research and asynchronous distance delivery exists. There is a need for research involving the study of empowerment through action research and asynchronous distance delivery. The lack of a research study in science education examining the meaning of empowerment as a result of action research and asynchronous distance delivery is the motivation for this research project.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter describes research procedures used in this study. The first section describes the subjects who were studied, sources of data, methods of data collection and analysis, and attempts to triangulate (Lincoln & Guba, 1985) the data. The second section describes the research design, sampling, and other procedures, statistical design, and methods of analysis used in the study. The rationale for a multi-methodological approach to this study was that no one design or method is best in the investigative research process and that "bridging" the methodological paradigms should help the reader draw conclusions with some degree of certainty (Tashakkori & Teddlie, 1998).

In an attempt to establish trustworthiness within the study, the researcher adhered to suggestions made by Lincoln and Guba (1985) to specifically address trustworthiness. This research project included prolonged engagement, persistent observation, triangulation, and member checking (Lincoln & Guba, 1985) in an attempt to provide trustworthiness.

Prolonged engagement is an activity that increases the likelihood that the findings are credible. Prolonged engagement is taking enough time to ensure that the culture has been learned, that testing for misinformation has occurred and that the building of trust has been established (Lincoln & Guba, 1985). Lincoln and Guba state that prolonged engagement "requires that the investigator be involved with a site sufficiently long to detect and take account of distortions that might otherwise creep into the data" (p.302).

Persistent observation, according to Lincoln and Guba (1985) is observation with the purpose of identifying "those characteristics and elements in the situation that are most relevant to the problem or issue being pursued and focusing on them in detail" (p.304). Further, the authors state, "If prolonged engagement provides scope, persistent observation provides depth" (p. 304).

Triangulation is a technique from which multiple sources of data are collected. These data may be multiple copies from one type of source, different sources of the same information, similar information gathered using different methods or multiple uses of different theories (Lincoln & Guba, 1985).

Another technique to increase trustworthiness is through the use of member checking. Member checking is a process whereby the participants being studied confirm and validate the "data, analytic categories, interpretations and conclusions" of the researcher (Lincoln & Guba, 1985, p. 314).

Research Question

This study attempted to answer the following question: What are students' perceptions of the effects of an asynchronous distance delivery, classroom research-based master's degree program on empowerment in their teaching profession? Quantitative data gathered will attempt to address the following questions:

1. Is there a difference in pre, mid and post tests in teachers' feelings toward action research?

2. Is there a difference in pre, mid and post tests in teachers' feelings toward telecommunications?
3. What is the measure of teachers' attitudes toward teacher empowerment at the end of the program?

Qualitative data will attempt to address these questions:

1. How do the MSSE students describe their experience with action research?
2. How do the MSSE students describe their experience with telecommunications?
3. How do the MSSE students describe their understanding of teacher empowerment?
4. How do the MSSE students describe their understanding of self-reflection?
5. How do the MSSE students describe their understanding of control?
6. How do the MSSE students describe their understanding of collegial relationships?
7. How do the MSSE students describe their understanding of confidence?
8. How do the MSSE students describe their understanding of instructional strategies?
9. What does action research mean to the MSSE students?
10. What does the use of asynchronous distance delivery mean to the MSSE students?

Subjects and Population Sample

This study involved two cohorts of the Master's of Science in Science Education students from Montana State University-Bozeman. The first cohort of 30 teachers began

their course of study in the summer of 1997 and graduated in the summer of 1999. The second cohort of 22 teachers began their coursework in the summer of 1998 and graduated in the summer of 2000. Due to attrition, some participants in both cohorts did not complete the program. Also, some participants in the first cohort extended the timeframe of their coursework and graduated with the second cohort. Participants who began in the first cohort but graduated with the second cohort were included in the study of the second cohort group.

Students in the MSSE Program were selected through an application process. Application requirements include having a bachelor's degree in an area of science or science education, certification to teach science in grades 6-8 or 9-12, at least two years of science teaching experience, an undergraduate GPA of 3.0 or higher, and recent GRE scores of 1000 (V+ Q). In addition, applicants must have access to a MacIntosh or Windows OS computer with a modem or direct Internet access (Reed, N., personal communication, November 12, 1997). A copy of the MSSE application and accompanying information letter are provided in Appendix G.

For the purposes of this study, all students in the first and second cohort were invited to participate. Those participants who sign an Informed Consent Agreement Form were included in the study. Two participants in the first cohort asked not to be included in the study, two participants have dropped out of the program and three participants graduated with the second cohort. The remaining number of participants in the first cohort was twenty-two. From Cohort Two, three participants chose not to be included in the study and one asked to have the data collection limited only to email

responses, no interviewing. The second cohort had a total of twenty participants. A copy of the Informed Consent Form is available in Appendix H.

The researcher was involved with both cohorts throughout each scheduled two-year master's degree program. The researcher was a member of the instructional team and either taught and/or served as a teaching assistant in at least one course of study during the first summer session on campus and at least one course of study during the on-line session. The researcher had access to each participant via electronic mail on MSULink. Further, the researcher was a member of the instructional team during the second on-campus session which culminated the degree program. In this way, the researcher established prolonged engagement with the study (Lincoln & Guba, 1985).

Through the use of the many observation methods including teacher comments, teacher surveys, direct observations, focus group, interviews and action research projects, the researcher sought to establish persistent observation (Lincoln & Guba, 1985). Further, during the data analysis process, the researcher sought to verify the data collected from participants through the use of member checks (Lincoln & Guba, 1985). Participants were asked to read and verify selected data, analytic categories and summations.

The researcher employed the use of an audit trail and reflexive journal to assist in establishing confirmability of the research project (Lincoln & Guba, 1985, p. 317). The audit trail procedure suggested by Lincoln and Guba included six categories:

1. raw data
2. data reduction and analysis products

3. data reconstruction and synthesis products
4. process notes
5. materials relating to intentions and dispositions
6. instrument development information (Lincoln & Guba, 1985, p. 319).

This researcher designed an internal audit coding system that was used throughout the data collection and writing process. All draft versions of the research included the audit coding system and readers were able to request an examination of the coded reference materials at any time during the writing process. Further, this researcher began and maintained a reflexive journal. The journal was available to readers and the auditor during the data collection and writing process. The journal was a collection of thoughts, issues and analysis of the research project.

Data Collection Instruments

The researcher chose a data collection strategy using a mixed tradition approach. The use of both qualitative and quantitative approaches "often provide new and uncharted information about the person or setting of study (Tashakkori & Teddlie, 1998, p. 95).

Quantitative Instruments

A semantic differential survey was used to solicit responses specific to action research (Berlin, 1997). The action research survey was modified to gather responses relative to telecommunications. The 15-item instruments (Appendix A) were used to measure the attitudes and perceptions of the MSSE students with regards specifically to action research and telecommunications. The responses were scored on a 5-point scale

based on the instrument designers' consensus as to what desirable teacher attitudes and perceptions were. The instrument designers conducted a pre- and post-test and analyzed the instrument for reliability and calculated an internal consistency reliability range from .66 to .94 related to educational innovations and .81 to .95 related to educational research. They state that "the overall Cronbach Alpha internal consistency reliability for the educational research instrument is .93 for the pretest and .89 for the post test" (Berlin, 1996, p.9). After the administration of both the action research and telecommunications surveys used in this study, an internal consistency estimate was computed for both survey instruments using the Cronbach Alpha internal consistency reliability. The value for the post-action research survey were .90, and the value for the post-telecommunications survey as .92, both indicating satisfactory reliability. For the purposes of this research study, the semantic differential surveys instruments were administered three times, once at the beginning of the study, a second time approximately nine months into the program of study and finally during the Capstone symposium the summer of graduation. The instruments are available in Appendix A.

The Teacher Empowerment Scale (TES) (Miller, 1993, p. 69) (Appendix C) was administered during the second on-campus session as a post-program instrument. The TES was not discovered by the researcher until the first two cohorts had been admitted to the program, so pre- and post-testing of the instrument was not possible. As a result of this limitation, the TES was used as a separate qualitative method to assist in the triangulation of data. The Teacher Empowerment Scale was determined to have a correlation coefficient (r) of .90 ($r^2 = .81$) (Miller, 1993, p. 69).

Qualitative Methods

Teacher Comments. Teachers' comments from on-line classes were recorded. These comments included journals, responses to instructors in on-line courses, and communications with other students on-line. These comments were restricted to "open forum" discussions and did not include any private messages sent from students to instructors or other students.

Teacher Surveys. Teacher surveys were used to gather data. These surveys were administered in person, on-line in MSULink and using a web-based format. The surveys were written by the researcher (Appendix D).

Focus Groups. Focus group interviews were conducted during the last semester of on-campus instruction. Morgan (1997) suggests that "focus groups provide access to forms of data that are not obtained easily with either of the other two methods [participant observation and open-ended interviews]" (p. 8) and that "the comparative advantage of focus groups as an interview technique lies in their ability to observe interaction on a topic" (p.10). Because the participants in this research project were members of a cohort and have taken participated together in the action research courses, the interaction between them in a focus group session was of interest to the researcher. As a result, all participants were invited to participate in an hour-long focus group. For each cohort, there were three focus groups of approximately seven participants each, although the size of the groups ranged from two to ten. This follows the group size suggestion of Morgan's (1997) rule of thumb that "specifies a range of six to ten" (p. 43). Each focus group was audio tape recorded and the data from each session was transcribed

by a professional transcriptionist and used for analysis. Focus group interview questions are available in Appendix E.

Interviews. Interviews of selected participants were conducted, following the suggestion by Holstein and Gubrium (1995) that "sampling for an active interview is an ongoing process; designating a group of respondents is tentative, provisional, and sometimes even spontaneous" (p. 74). Keeping with the suggestion of Holstein and Gubrium, casual interviews were conducted throughout the course of study. Formal interviews were conducted during the final on-campus session. Seven individual interviews were conducted with participants from Cohort One and five individual interviews were conducted with participants from Cohort Two. Data collected during formal interviews was audio tape recorded and analyzed after transcriptions from the tapes were made. Individual interview questions are available in Appendix F.

Observation of Teachers. During the Capstone Presentations, at which time students presented their cumulative course project, the investigator observed and recorded teacher actions, comments and responses.

Action Research Projects. The completed action research projects of each student were read and analyzed.

Pilot Study on Action Research and Teacher Empowerment. A qualitative pilot study of teachers' perceptions of action research and teacher empowerment was conducted on the first MSSE cohort after the completion of the students' action research projects. The pilot served as a guide to further refine the direction of this research proposal, specifically in the area of interview and focus group questions.

Data Analysis Strategy

Data analysis in the qualitative paradigm is an on-going process that occurs continually throughout the data gathering process. The data are viewed as interactions between the researcher and the sources of data. Data analysis is the reconstruction of the original constructs of data gathered by the researcher from the data sources. In this way, data analysis is not simply a reduction of the data, but an induction of the data (Lincoln & Guba, 1985). The researcher proposed to analyze the data through the means of reconstructing data and searching for themes.

The quantitative data was analyzed through comparison of pre-, mid- and post-test scores of a semantic differential action research and telecommunications instrument. The TES was used solely as a final numerical indicator of teacher empowerment.

Timeframe

The following timeline encompassed this course of study:

<u>Date</u>	<u>Procedure</u>
July 1997	Meet MSSE.1 students and administer pre-differential surveys
Sept. 1997	Begin collection of MSSE.1 student comments from on-line coursework
Mar./Apr. 1998	Administer MSSE.1 mid- differential surveys
July 1998	Meet MSSE.2 students and administer pre-differential surveys
Sept. 1998	Begin collection of MSSE.2 student comments from on-line coursework. Continue collection of MSSE.1 student comments

Dec. 1998	Conduct post-action research survey of MSSE.1
Jan. 1999	Begin Action Research Pilot Study of MSSE.1
Mar./Apr. 1999	Administer MSSE.2 mid- differential surveys
May 1999	Completion of Action Research Pilot Study
July 1999	Conduct focus group interviews; conduct individual interviews; administer MSSE.1 post- differential surveys; Observation of Capstone Presentations of MSSE.1
Sept. 1999	Continue collection of MSSE.2 student comments
Dec. 1999	Conduct post action research survey of MSSE.2
July 2000	Conduct focus group interviews; conduct individual interviews; administer MSSE.2 post- differential surveys; Observation of Capstone Presentations of MSSE.2
July 2000-Nov. 2001	Data analysis and writing
February 2002	Completion of research project

Summary of Methodology

The methodology of this qualitative research study utilized both qualitative and quantitative data collection strategies. Three quantitative instruments, two semantic differential surveys on action research and telecommunications, and the Teacher Empowerment Scale (TES) were used. An extensive qualitative data collection strategy including teacher comments from on-line courses, teacher journals, interviews, focus groups, and observations was utilized. A pilot study of the MSSE.1 cohort on teachers'

perceptions of action research and teacher empowerment was used to further define the direction of this study.

Analysis of the data was on-going as defined in the qualitative research paradigm. The researcher used the strategy of reconstruction of data in order to search for the emergence of themes. The literature identified definitions of teacher empowerment, action research, and asynchronous distance delivery that was used as a guide in the formation of emerging themes found in the research. Specific research questions were identified that also focused the direction of research analysis.

The researcher sought to establish verification of the study through the use of many and varied data collection strategies. In addition, comfirmability was established through the use of a researcher-designed audit trail and reflexive journal.

CHAPTER 4

RESULTS

Introduction

The purpose of this chapter is to present the quantitative results of the semantic differential surveys for action research and telecommunications and to provide descriptive narratives of the MSSE students' perceptions of professional development, action research, telecommunications and teacher empowerment. Quantitative data were obtained through a pre-, mid-, and post-administration of the semantic differential surveys for action research and telecommunications and a one-time administration of the Teacher Empowerment Scale (TES) at the completion of the MSSE Program. Qualitative data from the students were gathered from individual interviews, focus group interviews, e-mail correspondence, Internet-based surveys and comments made in students' Capstone projects. All interviews were audio taped and transcribed by a professional transcriptionist.

Analysis of the data was made specifically in regard to the constructs of empowerment as identified through the literature review: self-reflection, control, collegial relationships, confidence, and instructional strategies. Students' perceptions of action research, professional development, and telecommunications have been incorporated throughout all data reporting sections. One of the major questions of this dissertation was to determine what action research, professional development and telecommunications

meant to the MSSE teachers and how each of these impacted teacher empowerment. Further, additional themes that emerged from the data have been identified and reported. These themes include networking, the value of MSSE courses, the need to be together as a cohort the first summer on campus, the perceived respect from the teachers' students as a result of the teacher conducting research in their classrooms, increased evidence of leadership as a result of professional development, and increased professionalism. In an attempt to provide a thorough understanding of the interconnectedness of the elements of the study, students' perceptions and understanding of the impact of action research and the effect of distance education have been included in the reporting of each theme, as well as being separated as a distinct sections. Any names used in reporting have been changed and any identifying characteristics of students including city, state, and school have been eliminated or altered. Finally, a quantitative analysis of the surveys that were administered is reported.

Analysis of Quantitative Data

This section provides an analysis of the three quantitative instruments used in this study to answer the following research questions: 1) Is there a difference in the pre-, mid- and post-test scores in teachers' feelings toward action research? 2) Is there a difference in the pre-, mid- and post-test scores in teachers' feelings toward telecommunications? and 3) what is the measure of teachers' attitudes toward teacher empowerment at the end of the MSSE program? The semantic differential surveys for action research and telecommunications were administered the first summer the teachers began classes in the

MSSE Program, again approximately nine months into the program and at the conclusion of the program. The Teacher Empowerment Scale (TES) was administered at the conclusion of the program.

A one-way analysis of variance was conducted on the action research survey to evaluate the relationship between the pre-, mid- and post-survey responses concerning MSSE teachers' attitudes toward action research. The independent variable, the action research survey variable, included three factors: pre-survey, mid-survey and post-survey. The dependent variable was the means of the scores. The test was significant, $F(2, 126) = 13.78, p = .000$. The results of this test including the means and standard deviations are reported in Table 1.

Table 1. Descriptive analysis of the action research and telecommunications surveys.

		N	Mean	Std. Deviation
Action Research	Pre-survey	51	53.37	8.69
	Mid-survey	41	60.22	7.29
	Post-survey	35	61.77	7.96
	Total	127	57.90	8.84
Telecomm	Pre-survey	51	62.75	8.40
	Mid-survey	38	65.08	8.92
	Post-survey	37	67.65	7.57
	Total	126	64.89	8.51

Follow-up tests were conducted to evaluate pairwise differences among the means. Post hoc comparisons involved the Tukey HSD test. These test results indicated a significant difference in respondents' action research surveys from pre- to mid-survey, pre- to post-survey and mid- to post-survey. The results of these tests' mean differences and significance are reported in Table 2.

Table 2. Anova results of the action research and telecommunications surveys.

		Sum of Squares	Df	Mean Square	F	Sig.
Action Research	Between Groups	1790.552	2	895.276	13.782	.000
	Within groups	8055.117	124	64.961		
	Total	9845.669	126			
Telecomm	Between Groups	517.563	2	258.781	3.729	.000
	Within Groups	8534.882	123	69.389		
	Total	9052.444	125			

The results of the one-way ANOVA address the research question, "Is there a difference in the pre-, mid- and post-test scores in teachers' feelings toward action research?" The data show that there was a significant difference in the MSSE teachers' feelings toward action research from the beginning of the program to the end and from nine months (mid-survey) to the end of the program.

A one-way analysis of variance was conducted on the telecommunications survey to evaluate the relationship between the pre-, mid- and post-survey responses concerning MSSE teachers' attitudes toward telecommunications. The independent variable, the telecommunications survey variable, included three factors: pre-survey, mid-survey and post-survey for action research and telecommunications. The dependent variable was the means of the scores of each telecommunications survey. Each survey was analyzed and has been reported independently of the other. The test was significant, $F(2,125) = 13.8$, $p = .027$ for the pre-survey and the post-surveys (Table 1).

Follow-up tests were conducted to evaluate pairwise differences among the means of the telecommunications surveys. Post hoc comparisons involved the Tukey HSD test. These test results indicated a significant difference in respondents' telecommunications surveys from pre- to post-survey. The results of these tests' mean differences and significance are reported in Table 2.

The results of the one-way ANOVA answer the research question, "Is there a difference in the pre-, mid- and post-test scores in teachers' feelings toward telecommunications?" The data indicated that there was a significant difference in the MSSE teachers' feelings toward action research from the beginning of the program to the end.

A multiple regression analysis was conducted to evaluate how well the semantic differential surveys for action research and telecommunications measured teacher empowerment. The predictors were the pre-, mid- and post-surveys for action research and telecommunications, while the criterion variable was the Teacher Empowerment Scale.

In Table 3, indices are presented to indicate the relative strength of the differential surveys for action research and telecommunications as individual predictors of teacher empowerment. A multiple regression analysis was conducted to measure the relationship between the pre-, mid- and post-surveys of the action research and telecommunications surveys and the Teacher Empowerment Scale. The regression equation with the post action research survey was significant as a predictor of teacher empowerment, $R^2=.34$, adjusted $R^2=.32$, $F(1,28) = 13.9 = p=.001$. This model explains 34% of the variance in

the scores. The differential action research survey administered at the end of the program can serve as a predictor of empowerment.

Table 3. Multiple Regression Model of TES, action research and telecommunications surveys.

Model	R	R square	Adjusted R Square	Std. Error of the Estimate
1	.613a	.376	.206	7.27
2	.613b	.376	.240	7.11
3	.613c	.375	.271	6.96
4	.609d	.371	.295	6.84
5	.589e	.347	.296	6.83
6	.583f	.340	.315	6.75

1. Predictors: (Constant), ETRAW, PARRAW, EARRAW, PTRAW, MARRAW, MTRAW
2. Predictors: (Constant), ETRAW, EARRAW, PTRAW, MARRAW, MTRAW
3. Predictors: (Constant), ETRAW, EARRAW, PTRAW, MTRAW
4. Predictors: (Constant), EARRAW, PTRAW, MTRAW
5. Predictors: (Constant), EARRAW, MTRAW
6. Predictors: (Constant), EARRAW

PARRAW= Pre action research survey raw scores
 PTRAW= Pre telecommunications survey raw scores
 MARRAW= Mid action research survey raw scores
 MTRAW= Mid telecommunications survey raw scores
 EARRAW= End action research survey raw scores
 ETRAW= End Telecommunications survey raw scores

The results of the quantitative data show significant difference in the teachers' attitudes in action research and telecommunications. The following section provides narrative support of the differences shown statistically from the surveys.

Analysis of Qualitative Data

This section provides an analysis of the qualitative data gathered in this study to answer the following research questions:

1. How do the MSSE students describe their experience with action research?
2. How do the MSSE students describe their experience with telecommunications?
3. How do the MSSE students describe their understanding of teacher empowerment?
4. How do the MSSE students describe their understanding of self-reflection?
5. How do the MSSE students describe their understanding of control?
6. How do the MSSE students describe their understanding of collegial relationships?
7. How do the MSSE students describe their understanding of confidence?
8. How do the MSSE students describe their understanding of instructional strategies?
9. What does action research mean to the MSSE students?
10. What does the use of asynchronous distance delivery mean to the MSSE students?

As has been documented in the previous section, the quantitative data indicates that there was a significant difference in the MSSE teachers' feelings toward action research and telecommunications. The purpose of this section is to provide additional evidence of change in the MSSE teachers' attitudes toward the constructs of

empowerment, professional development, action research and telecommunications as reported through qualitative data.

Constructs of Empowerment

As defined in the literature review, the constructs of empowerment include self-reflection, control, collegial relationships, confidence, and instructional strategies (Miller, 1993). The following sections present an analysis of the ways in which the MSSE teachers define what each of these constructs meant to them, answering the following research question: "How do the MSSE students describe their experience with self-reflection, control, collegial relationships, confidence, and instructional strategies?"

Self-reflection. The MSSE teachers' responses to their perceptions of the effect of self-reflection were generally positive. Many of the students acknowledged that self-reflection had been a part of their teaching repertoire prior to their participation in the MSSE Program:

I probably am the king of self-reflection, but it [the program] has given me a more positive way [of look at it] instead of saying, "Oh, gosh that was stupid, my kids will hate me or whatever." It has given me a positive way to go with it and make it work as an improvement of my teaching and also what to reflect on and what not.

Another participant stated:

I've always been a very self-reflective person, sometimes I think to a fault. But, the way that this [program] has helped me in that self-reflection is not more of it, but in learning to deal with that self-reflection...how to take care of the things that I think need to be changed and how to continue the things that I think need to be continued.

While there was one student who reported that "I am not a big fan of self-reflection--not because I think it is unimportant, but because I just do not like to do it--so

little time," most students reported that the affects of action research on self-reflection were dynamic and widespread, affecting many areas of their teaching lives. The following statements note the positive effect of action research on self-reflection:

It seems as if I am thinking about what I do in the classroom all the time now. It's almost to the point of obsession. Every time I do something I ask myself, now how did that affect that student, or how could I do this differently to make it more effective?

It [action research] has made me think more about why I am doing different things in class. I think it keeps me more true to the goals of my teaching.

Action research has GREATLY affected my self-reflection. I find myself constantly questioning what I'm doing in my class--even while driving the car, taking a shower, trying to sleep--am I doing the right thing?, could I have done something differently?, how could I have improved?

I have always had a strong sense of self-reflection, have always thought deeply about what I was doing and what the results might be. I think that action research has helped me reflect more on the aftermath of what I have done--not only if it was successful or unsuccessful, but why it was successful or unsuccessful and how ongoing improvement might be made.

The project has helped me learn how important it is to self reflect. I must admit, before MSSE, I did such informal and infrequent self-reflection that it took awhile to get used to it.

MSSE teachers also reported that self-reflection in journaling gained importance in their lives. One teacher reported, "I would say that I journal a little bit more and I go back and read those journals." Another stated, "I think I've done a better job of writing those things down so I remember the following year...things that I want to change or things that worked well." A third teacher reported, "I think I was always reflective, but

now I think I'm trying to document it a little more. That's the main shift. I'm always thinking about what I'm doing and now I try to quantify it a little bit."

Even in their Capstone reports (the final paper presented at the end of the MSSE Program), students provided evidence of self-reflection:

Throughout the research design, implementation and analysis phases I engaged in reflective instructional practices. At each juncture I experienced new understandings and gained additional questions about teaching and learning. It brought into focus ideas about multiple intelligences and physics education that I have been considering for years.

Reflection has made me realize the importance of my relationship with students. Before I can expect students to go outside of their comfort level of book work, they must trust me. One way of establishing this relationship is to talk with students and find out their interests and to notice them...

As it relates to self-reflection, I now give more consideration to approaches and strategies used in my teaching methods. My own action research project, concept mapping, has demanded changes in most of my unit lessons.

Generally, the students reported that action research revealed the importance of self-reflection. Many students were able to move self-reflection beyond action research and into other areas of the teaching lives such as interaction with students, teachers, and lessons they prepared and presented. For most, self-reflection became a tool to assist one in focusing, but the acquisition of this newly honed skill may come with a price:

Action research has helped make me more reflective as a teacher. It has forced me to qualify and quantify (when possible) the changes I am trying to make in my classroom. I am more aware of the "why" behind each of my actions. It has also made me question everything I do as a teacher. This is very uncomfortable for me.

Control. A second construct of empowerment is control. This seemed to be one of the more confusing concepts when participants were asked to respond to their sense of

control. The confusion centered around what was meant by control—was it control in the classroom? control over curriculum? control of the students? control in terms of administration? As evidenced in the responses, most participants resorted to a “prior” definition of control of their own construction. One teacher said, “Control over the classroom? I would say there’s probably been little tidbits that I’ve learned along the way, that help me as far as that.”

Overall, however, students reported changes in their sense of control in varying degrees. Some reported that they did not experience any change in their control at all, stating that they had always felt in control. One teacher said, “I don’t think that it [action research] has changed my control level in my classroom. I have always felt in control.” Others stated, “I don’t think it [action research] has affected the control I feel at all. I have always felt very autonomous as to what I do in my classroom” and “I don’t think that it [action research] has changed my control level of my classroom. I have always felt in control.”

Still other participants in MSSE pointed to direct increases in their sense of control as a result of action research:

Action research has given me a much greater sense of control as a teacher. One action research project I carried out last spring dealt with science fair projects and has generated some change within the district. Action research allows the teacher to justify changes (or keeping things the same) with more than just "gut feelings". Instead, you have substantial backing.

Other teachers stated that control in their circumstances seemed to ebb and flow throughout the action research/professional development process experienced during their tenure in MSSE:

In some ways, action research has made me feel more "in control" than before. I know what's going on in my classroom to a higher degree and feel like I have been empowered to help my students succeed. In other ways, action research has made me feel out of control. It is such a time-consuming process that it is hard for me to justify doing it when I am in a new job situation with four different classes and three extra-curricular assignments.

Another teacher reported that the loss of control may be external pressure from society, something over which teachers have little power:

I feel as though I have less control. I look at this two different ways. The more I look into the research that is being done in the classroom, the more I realize that there is a large portion of our society that does not view teaching as a legitimate profession. Too many people feel that teaching is just a temporary job for people who do not know what else to do. When I see this I feel as though I do not have the power to teach or the control I need of my students because too much of our society is downsizing the importance of the educational profession.

The other way of looking at this is that my choice of research means that more control is given to my students and the teacher is simply there to guide. No longer is the teacher the "sage on the stage."

Collegial Relationships. Most participants reported improved relationships with colleagues, a third construct of empowerment. Many cited the time together the first summer as key to their success in the program. They viewed the benefits of being together in many ways. These benefits included comfort while taking distance courses, networking with other teachers in MSSE, problem solving, and developing trust and friendship. The following conversation among five MSSE students who returned at the end of their coursework to participate in the final Capstone symposium illustrates some of these points:

Meg: ...it's that first summer together, you get to know the other MSSE people and to be able to come back and give closure to it by all getting together again and presenting what we've learned.

Ali: There's still that camaraderie. Because when you get into some of those classes [like the] science content [courses], you already have people that you feel comfortable with and you know these people.

Meg: I personally, at the beginning of those [distance] classes, would look through the class list and see now who can I start calling or writing to. Then it was kind of nice when we had to take the education courses all together, that we were all kind of still kept as a group.

Rog: We were probably very free in our discussions in those times because we weren't afraid. I was not afraid of standing up here this morning, even though there were strangers in the room. I was not afraid of that because I figured not one of you is going to cut my throat, and I also felt the same way when I was writing or discussing some place else. I wasn't afraid. They may not agree with it, but they weren't going to comment...

Sam: Susie and I messaged to Chad and he sent a message back. Anybody who had just read those messages would say "wow, these guys aren't too nice to each other." But that's part of the things that people don't know, is the level of interaction going on.

Meg: Well, think of your own perception, seeing those people that we don't know in the discussions in our classes. Think of your own perception as to what you think these people are like in person. You don't have to do that when you're comfortable with somebody here because you know what they're like and you know where they're coming from.

Shauna: And on the other hand, I've had people that don't know me misinterpret something that I've put out there for the world to see, and even written privately. If they would have known me, then it's a different story.

Meg: Well, there's also that sense that if you do something in a discussion that somebody from the outside world doesn't understand, people from our group would come to your defense very quickly. I would know what they were talking about.

Others also cited the benefits of being together the first summer. One student reported that he “really enjoyed the interaction of people that first summer, getting together, talking...”

Some MSSE students reported that they have been able to influence and share with colleagues in their schools who are not involved in action research or other professional development activities:

Many of my [fellow] teachers are intrigued with action research and have watched me closely as I do my research. They have questioned me endlessly and some have come to me for advice as they embark on projects of their own. However, I'm not sure if any of them want to branch out as far as I have--they're not willing to put in what they perceive as a lot of extra work.

That has been the really fun part. I have been so excited about my research and the concept maps my students have been producing that whenever a staff member has asked me about my research, I just about give them an entire dissertation. I am sure they think I have gone a little overboard. But they are very interested and supportive of the project. I have shared results with the other three teachers on my team, my principal, vice principal, a math teacher from another team, 3 other teachers in my hallway, and the teacher who teaches emotionally disturbed students in my building.

...the people I work with now are a lot more sharing and do a lot of collaborative teaching. I am willing to share what I do in my classroom or what I find in my classroom, what I see in my classroom with other teachers. And in fact, I might add to that...I spend a lot of time in other teacher's classrooms.

Another participant stated, “I find myself actively recruiting discourse from my colleagues.” Other responses point directly to the importance of the MSSE cohort over colleagues in one's schools, especially as MSSE students embarked on the action research project and other components of the program. One teacher responded by saying, “On the other hand, it [action research] will enhance the relationships with the other members of the MSSE class. Participating in action research is one of our common

bonds.” Another teacher reported the support she received while working on her research by stating, “I have gained a lot from my colleagues in the MSSE Program. They have been the main contributors to my research. My in-school colleagues have not been as big a factor. My in-school colleagues look at this with some curiosity, but don’t want to get involved.”

Still other MSSE teachers expressed a greater sense of collegiality with members of their MSSE graduate cohort, while several even mentioned that the influence of their collegial relationships reaches to state and even national levels. The following statements are examples of this:

I am much more open with ideas in my department and with members of the cohort.

I feel as though I have increased my communications abilities with my colleagues both at a local and national level.

I have really enjoyed the interactions with my committee and the other members of the MSSE program.

Another benefit of involvement in MSSE was the collegial aspect which developed into networking:

Being part of a web, or network now with some very, very outstanding teachers, who I know will have lasting relationships, professional relationships and personal ones, where we will be able to encourage each other, share ideas. I really feel, this may sound silly, but I feel I’ve finally really truly become a teacher and I am not so sure I felt that way before.

In addition, participants highlighted trust and problem solving abilities as an outgrowth of the collegiality experienced through MSSE by stating, “I think there’s a trust level among our group that I value you as an educator...I would take your work over

someone else's just because it's a relationship that we've built" and "I think the networking also gives you some problem solving resources, where people have tried things and you find out they had that problem and tried this."

While the benefits of improved relations with colleagues dominate the responses, two participants reported having conversations with [in-school] colleagues that were more negative, questioning and condemning. One MSSE teacher reported, "I tried to tell a couple of the teachers about my project, but they see it as a 'requirement to get a Master's, not as a career changing innovation.'" The skepticism expressed by in-school colleagues sometimes took the form of questioning the professional development process:

For the most part, there has been support, but many of my [school] colleagues make comments like, "Why would you choose a project option for a Master's?" "I don't think that educational research really has that much merit, especially since every classroom is different". There is also a lot of skepticism regarding its [action research] validity. If anything, I find that I'm not sharing the details of my action research like I share teaching ideas or labs or projects.

The strong collegial relationships developed through the MSSE program are an indicator of teacher empowerment. The participants expressed their understanding of collegiality in many ways, but the term networking emerged as a repeated theme. When asked, "If you could project yourself ten years into the future, what do you see as having lasting benefits from your involvement in MSSE?", one participant stated, "I guess the networking. The thirty new teachers...that's a big benefit. Knowing that there is always some out there to talk to."

Confidence. A fourth construct of empowerment is confidence. Several participants reported that their involvement in the MSSE program did little to change

their confidence. One teacher reported, "I have always been confident in my teaching, but it [the MSSE Program] gave me a chance to test this confidence". In two cases, participants stated that their confidence decreased. For one teacher, this may have been more the result of cross-country move and the lack of administrative support, as she stated, "I am less confident as a teacher now than I was three years ago. I don't know exactly how much of this change is a direct result of action research and how much is a direct result of a cross-country move an new administration that appreciates nothing". The second teacher reported, "In some ways it [the program] has made me feel less confident. I find myself always questioning myself and second-guessing myself. However, I've never been very confident anyway—I just put on a good act!"

The majority of responses indicated an increase in confidence as a result of participants' involvement in the program. One teacher reported, "This is the area that I feel I have seen the most personal growth. My confidence as both a teacher in the classroom and as a teacher working with other teachers has increased dramatically." Another teacher stated, "I have more confidence. When I started this program, I was more 'I'm over here, I'm going to do my thing, I think I'm good at what I'm doing'...I feel much more confident." One teacher identified his increase in confidence in terms of professionalism. "I think the whole program has made me much more confident of myself as a professional." Another viewed the increase in confidence in terms of being a better teacher. "I think it's been a tremendous confidence builder for myself as a teacher."

The connection between confidence and action research was reported by numerous participants. The feeling of being on the cutting-edge of education was reported by one teacher:

It makes me feel as if I am on the cutting-edge of what is happening in education. I feel the power of being able to do my own research, see what is happening to my students in my classroom and making adjustments in response to what they tell me. I have a much more open communication with my students now and they are not afraid to tell me what they think.

One teacher stated that "Action research has increased my confidence as a teacher. It has provided me with a method for finding solutions to problems, helping me improve my teaching situation." The confidence to effect change in the classroom was reported by one teacher. "Action research has helped my confidence as a teacher by giving validity to something I think most teachers do to some extent each day. It has increased my confidence in my ability to make effective changes in my classroom."

Another teacher viewed the confidence gained through action research in terms of developing a professional tool by stating, "I definitely feel I have benefited from using action. It has built new confidence in my teaching. I no longer have to guess or use gut feelings to determine how a certain program or pedagogy is doing. I have a method or tool for discovery." Further, another participant cited the confidence gained through action research in terms of developing the ability to determine what "good" teaching involves by stating, "I believe that it [action research] has made me more confident in my own abilities to determine what will possibly work or not work. I would say that it has helped. How much, I don't know yet as I am still in the process of learning what "good" teaching is all about.

Another link reported by the MSSE teachers is that of confidence and instructional strategies. One teacher reported, "I think that it [action research] has made me more confident in my own abilities to determine what will possibly work or not work....I am still in the process of learning what 'good' teaching is all about." Yet another reported, "I feel much more confident as a teacher. I feel more aware of the students' understanding or lack of understanding of the material. Also I feel better equipped to ask them meaningful questions. I feel like my instruction is 'flowing', if that makes sense."

Instructional Strategies. MSSE teachers reported several changes that resulted in their instructional strategies, the last construct of empowerment. "My instructional strategies have changed in that I am now using a wider variety of sources. Previously, I would try new ideas, but the ideas would come from the same sources." Another commented, "My own personal action research has made me change my instructional strategies a lot. I went from teaching 50 minute classes to 100 minute classes. My instructional strategies had to change to accommodate the change in time in class." One student reported that, as a result of her Capstone project, changes were made in the use of case studies in her instruction. From her Capstone project she wrote:

Given that the findings of this study are consistent with the use of case study methods in other areas of teaching, further use and investigation is warranted not only in chemistry, but perhaps in other high school science disciplines, as well. It is clearly shown here that the use of the case was helpful increasing student interest and understanding in the subject, and in developing some relevance for students, on which they could build and integrate their learning. I am eager to use published case studies for chemistry that were discovered in the process of this research and to continue to develop case studies for my classes based on current, interesting and applicable happenings.

One teacher cited an increase in the attention given to instructional strategies. "I have looked at my teaching techniques more deeply. I have tried different techniques in my classroom." Another stated, "I try to incorporate a lot more varied instructional strategies than I used to. I am more aware of how much time I spend in traditional teaching methods as compared to what the newer research is supporting and I try to maintain a balance there, a lot more carefully, than I have in the past."

Another significant result of changes in instructional strategies reported by the MSSE teachers is in the area of assessment and student/self-evaluation:

I now more commonly use instructional strategies that provide me with more feedback from students. This allows me to continually monitor where students are in their learning and to make adjustments in curriculum where necessary. I also now tend to use more student-driven, inquiry-based types of instructional strategies which have been proven to be more effective in many cases.

One teacher reported, "It's [the involvement in the program as it relates to instructional strategies] affected my assessment and evaluation, so that has affected my instructional stuff." Others cited similar effects in their instructional strategies, especially as it related to assessment and evaluation:

The first thing is that it [the involvement in the program as it relates to instructional strategies] validated something that I was doing. It gave me resources so if some questioned an evaluation, it gave me more strategies I could apply.

...Also I do more frequent and meaningful assessment to determine student understanding of the material.

Action Research

This section provides an answer to the research question, "How do the MSSE students describe their experience with action research?" When asked specifically about the effect of action research on their practice, the MSSE participants spoke directly to many of the constructs of empowerment--control, instructional strategies, and self-reflection. Only one respondent viewed action research in a negative light, but in her response stated that self-reflection played a role in coming to the conclusion. She stated:

I think it's [action research] a lot of work for something I would do normally, again more of that personal reflection. And, I'm not sure that my action research project, by doing the whole project, necessarily is going to make me a better teacher. It certainly taught me a lot about the process of action research and gave me some things I can use when I'm working with my students and teaching them about the research process. I would probably have played around with group testing a lot anyhow, as a result of another class I took in the program, not necessarily the action research class.

One MSSE teacher saw action research as a tool for professionals, "I think it [action research] is one more tool that helps me as a professional develop into a better teacher." Others connected action research with various constructs of empowerment--control, confidence, and instructional strategies:

It is nice to know that all research that is done is not by "researchers" only. I never really thought about doing research in my classroom before becoming involved in action research. It is nice to have the control to be able to make changes that are obviously needed.

At times it [action research] makes me feel like a new teacher and therefore very unsure of myself, but that is because action research encourages risk taking. However, I am much more comfortable with a higher level of uncertainty than I would have been as a new teacher, because I know that I have the power to direct my learning.

I definitely feel I have benefited from action research. It has built a new confidence in my teaching. I no longer have to guess or use feelings to determine how a certain program or pedagogy is doing. I have a method or tool for discovery.

I think it's the confidence I've gained from it [action research], that a lot of things that I have always believed were really important in teaching. It verifies that those things are indeed important. It certainly has made me a better teacher. It has made me more in tune with my students, more in tune with really what they truly do understand and don't understand. It has also given me the tools for more accurate assessment of the skills that they have or the skills they're lacking.

Action research has given me an opportunity to reflect on my methods and pedagogies in a way that seems professional and not just willy-nilly. It builds a professional framework to guide and correct my practice. I think it has and does have a very positive influence on my teaching.

My topic for action research was something that I had been experimenting with anyway, however, having to do action research forced me to focus my questions, which related to my instructional strategies.

It [action research] made me look more deeply into different ways of assessment, which as in turn made me look more deeply into different ways of instruction. I'm trying to get away from so much lecture and let the kids experiment a little on their own.

One area in which the MSSE students stated that action research had an impact was in self-reflection. One teacher reported, "When I think of action research, it just seems like it is formalized reflection..." Another stated, "Action research has made me a little more formal about my reflection. The questions that I ask myself are deeper." One participant viewed action research and reflection in terms of success and improvement. "I think that action research has helped me reflect more on the aftermath of what I have done--not only if it was successful or unsuccessful, but why it was successful or unsuccessful and how ongoing improvements might be made." Another MSSE teacher viewed action research as a way to be forced to take the time to reflect:

I think that the process of action research has caused me to sit down and look at how I teach and what I teach. So often we do what we believe is the best for student learning without actually finding out. In the busy world of teaching, action research has "forced" me to take the time necessary to do some self-reflecting.

The following excerpt from one participant's final action research paper captures the on-going self-reflection process that grew out of doing action research:

This action research project is not complete. I would like to extend my research to include several additional areas with specific focus questions. For example, I would like to study whether there are gender differences that occur within Multiple Intelligence theory. Do the intelligences occur, as least roughly, along gender lines? Does this have an effect on achievement, self-concept and motivation, especially in the required science classes? I would also like to research alternative causes of late and/or missing homework assignments. Would a stricter late homework policy have an effect on the number of missing or later homework assignments? In addition, I would like to research the short-term motivational issues associated with block scheduling. Would a shorter class period have a positive effect on on-task behavior?

The MSSE teachers also spoke directly to the connection between action research and their perceived empowerment. One teacher said, " Action research has helped me to see more of a cause and effect in my teaching, which has been empowering." Another reported, "My action research project has empowered me as a teacher." Others stated empowerment in terms of personal empowerment, teaching, and confidence:

There is no question that action research has empowered me as a teacher. I have never have a problem with change, but now I have a method of validating that change--a way of showing how changes that I make in my teaching directly improve the learning environment of my students. It allows not only others to know that changes I am making are effective, but it assures me, as well.

Action research has helped me realize much more than I have in the past that what I do and I don't makes a significant difference. It has exposed me to the idea that I personally can assess parts of my instruction to let my students and myself know what is happening. It gives them a system of justification or validation.

I wish more teachers had exposure to action research. It seems so empowering to me. It's been a long winter, and I'm sick of my fellow teachers who just whine and moan about some particular problem. Why not search for a solution? The answers are out there; not everything is beyond our control.

Professional Development

The MSSE Program is a professional development program for middle school and high school science teachers. One of the themes that emerged from the data is that of professional development and professionalism. In their responses, the MSSE teachers often did not distinguish between professional development and professionalism, so for the purposes of reporting, professional development and professionalism are treated synonymously, although the researcher acknowledges that they do, indeed, have two very different meanings. In addition, a second theme of leadership emerged from the data analysis and is included in this section because professional leadership is one evidence of professionalism.

Professionalism. The MSSE teachers highly valued the professional development they received through the program and reported an increase in their perceptions of professionalism. When asked if her involvement in the program affected her outlook on teaching, one teacher replied:

It most definitely has. It's improved the outlook, increased the outlook. I think that [as] teachers...one of the hardest things for us is continue to do a good job when it's felt that what we do is not appreciated. I don't necessarily feel that way anymore, that we're not appreciated. I feel there is a professionalism to teaching and that not everybody sees it that way, but that it is there.

Another teacher stated that in order for teachers to be received as professionals, they must raise the standard of expectation. In her statement, the teacher also connects the raising of the standard with the process and outcomes of action research:

To me, teaching...is such an important job to have. If we want to consider ourselves professionals, then we have to rise to that level and to have it at that level means that we are examining something that we are doing. What we're doing in the classroom and that examination, that close examination, I understand now is really action research.

Perhaps as a result of their participation in the MSSE Program, several teachers voiced concern at the public's perception of the professionalism of teachers:

I made me cranky that we're not looked at as professionals. I think it's [the MSSE Program] probably made me realize that teachers are professionals and that we have an awful lot of training and we work very, very hard, but in general, society does not see that and because I've been going through this [program], it has made me angry sometimes.

The last year, I've been very disillusioned with things going on in public education, mostly because of poor leadership at the administrative level. But it's the positive things in MSSE that make me think there are some good things that we can do here.

...you're never really praised by the community for what you do as a teacher...On the other hand, if I would do well coaching, I get phone calls. The one thing this [program] has done is it was neat to come here and present and then have people say, "That's neat, you're doing some neat stuff. ...you know, you just don't get enough praise as a teacher.

A clear benefit stated by many of the MSSE teachers was that they perceived themselves to be better teachers as a result of their professional development in the MSSE Program. When reflecting on the outcome of the MSSE Program in terms of her professionalism, one teacher simply said, "The other difference is what you will be when you get done with this [the MSSE Program]. Are you going to be an administrator or a

counselor or move up in the administration? My pat answer to those kinds of questions is well, 'I'm just going to be a damn good science teacher'." Another teacher reported, "I think I take my teaching more serious. I'm more sensitive about it. We are professionals...you have to take what you do seriously." Yet another stated, "I mentioned in my speech that now I know I can make big changes in my classroom and that you need to do that to become a better teacher." Acknowledging that his goal was to become a better teacher through the program, one teacher stated, "I feel like I'm a better teacher having gone through this program. That's what most of us were here for." One teacher found himself to be quite negative after the first summer together, but then that feeling changed as a result of the professional development of MSSE:

... The very first fall, when I went back to school after being here that first summer, I found myself being very negative and frustrated about teaching because I was so pumped up from the time that I spent here that summer and I was expecting that same feeling from my colleagues and I really didn't get that. It was kind of the same old stuff. But, I guess I've learned that just to move beyond that. I have made myself a better teacher and if by presenting what I've done or if by showing in the classroom and other people pick up on it or they hear what other students [are] saying and ultimately that is going to benefit [my] teaching. So I guess what I am saying is I still feel really positive about teaching and about my role in the profession.

Other teachers reflected on their perceptions of professionalism in terms of a desire to continue to pursue professional endeavors. "It's [involvement in MSSE] made me see teaching as being more professional and it has encouraged me to continue my personal development in my career." Another stated her intent to move to the next level professionally. "...I think that within the next year or two I'm going to be starting on my doctorate..."

Leadership. Another form of professional development and professionalism that the MSSE students cited was that of leadership. Several teachers report of leadership opportunities in their own schools:

Now that I've had the exposure to the program and to the education classes...it has given me the confidence, the tools where I was part of a pre-curriculum study group last year and I found myself...talk[ing] about the standards and I could talk about things that I was doing in my action research. People...look to me for leadership and that's okay. I wouldn't have been ready to take that on or be in that position prior to this program or some of the courses that I've had.

I got involved in a district curriculum development last year and I probably wouldn't have done it had I not been in the program because I've finally learned a little more about different teaching...

I didn't get involved in too much of the school policies and tried to avoid it. Since this program, I've been asked to be on one board after another or one committee after another and before this, I had never been asked to be on a committee. I think that I must portray a new kind of confidence or I'm confident in my ability to make some decisions now that I have the knowledge, that I actually learned something in these education courses to apply to my everyday situation. I think that's really strong evidence, now that I've been asked to be on some of these really high level committees.

One teacher stated that she was empowered by her involvement in the MSSE Program to move into a national leadership role. "I feel empowered by future opportunities because I know that I have a lot of opportunities coming my way at the National States and Biomedical Research Institute. I never would have been at that level without this program."

Empowerment

One of the main focus research questions of this study was, "How do MSSE teachers describe their understanding of teacher empowerment?" Evidence of teacher empowerment as a result of professional development, telecommunications, and action research through the MSSE Program has been interwoven in the reporting of numerous

themes that emerged through this research project. However, several teachers responded directly to their perceptions of empowerment and those responses are reported here, rather than being included with other sections. One student noted that empowerment extended beyond her classroom, demonstrating itself in the relationship with her department chair. "I noticed another interesting type of empowerment that was very satisfying was when my department chair, really over the last two years, has come to me a lot more for advice on the latest trends in education, "edubabble", as she calls it. She asks my opinion about a lot of things." Another teacher reported, "...this program...has given me the ability to say what I do in my classroom I know works. I am the expert now and I can tell you it will work that way. I've become the expert." A third teacher stated, "It [the MSSE Program] makes me feel that some of what I do is definitely the right thing and good work...It empowers me by giving ME a way of knowing the difference." A second teacher also noted the differences in how she viewed teaching and related components. "It is neat because I know that I see things differently now and I am empowered. I'm not afraid to try new things with the kids..."

Telecommunications

A second major component of this research study and its effects on teacher empowerment was telecommunications or distance delivery of coursework. Although evidence of the impact of distance delivery of courses has been included in other sections of this research, statements from several teachers relating directly to the effect of telecommunications are included here. One teacher cited that, "I think it [telecommunications]...allows us to really make our world a little bit smaller so that we

get more out of it that way...it allows us to reach out and talk to other teachers..."

Another teacher reported, "I think the telecommunications format...gives people greater access to classes and I think that's most empowering." A third teacher cited the efficiency of using telecommunications as a benefit:

I think, in general, the ability [to] communicate with all the other people in the program, sharing frustrations and the fact that not having to make a phone call, but being able to send somebody a message and them send in it back to you, the efficiency of that, helped a lot.

And finally, one student commented about the accessibility of telecommunications:

I think it's [telecommunications] strong in the fact that for the most part, it's readily accessible. You are capable of meeting with other people, even though you're not meeting with them face to face. You can use it [telecommunications] to meet with other people across the country. You're getting new ideas. You're bouncing ideas off of other people. So, it's strong in that it's a resource that is just there you for, pretty much 24-7.

Additional Themes

Through the data analysis process, two additional themes emerged. These include the MSSE teachers' perceptions of the courses in the MSSE program and the impact their professional development throughout the program had on their students. The analysis of these additional themes is provided in the following sub-sections.

MSSE Courses

Initially, many of the MSSE teachers questioned the value of the program, the courses and the use of distance delivery. However, as the following teacher stated, these fears were overcome by the value and rigor of the courses:

I wondered and I questioned the value of the program...when I started. Is it going to be worthwhile? Am I going to learn something? Using long distance technology and learning is going to be a great tool... As far as rigor, the classes were at least as rigorous, if not more rigorous, than something you would take on campus. The value of learning technology along with learning your content, to me, is just tremendous. It's like a double whammy there--you are learning two things.

Other students also cited the rigor of the courses in the MSSE program as being of benefit. One student said, "I felt like they [the courses] were rigorous. I felt like I learned as much as I learned by being on campus. You are teaching yourself. You have to dig and scratch a little bit to find the answers and that is really what part of learning is." Another reported that, "...this program was rigorous enough. We did a lot of writing in the program..." As one teacher shared her involvement with colleagues outside the MSSE Program, she reported that, "Most people said they'd never do a program this rigorous, no way." Another teacher had a similar experience when a colleague of hers equated the MSSE Program and correspondence coursework:

I get defensive, very quickly, because it's [the MSSE Program] not a once a week or once a month [commitment]. It's not, "Oh, I've got to this paper in, I've been doing this correspondence course and it's supposed to be done this week." I think it's [the MSSE Program] more rigorous and consistent throughout the time frame, where you can't just save it up for a weekend. You've got to be involved in [these courses].

The MSSE teachers valued the interdisciplinary nature of the program. One teacher not only cited the rigor of the coursework, but also the interdisciplinary nature by stating, "It's rigorous and the interdisciplinary nature of it...get quite a balance where other programs probably expect you to be a biology person or elementary science [person]. Others stated similar feelings regarding the interdisciplinary nature of the

courses, valuing the combination of both education and science courses offered in one program:

With the sciences, it's so valuable to have those science courses as well as the education classes, I think, because I learned a lot more about science courses that I probably never would have taken.

I think the combination of the two [science and education courses]... You can choose from physics, chemistry, biology, earth science, any of the sciences, as well as your education classes.

I think the balance of those two [science and education courses] really does make it [a] science education master's, and that is what appeals to me because that is my profession.

Every science class that I took here I could take back to my classroom, and the education classes all had things that I could take to the classroom. It was a well-rounded master's degree. I feel like I earned something useful.

Several teachers spoke specifically to the education courses offered through the MSSE Program. Several teachers came into the program with negative attitudes toward education courses in general:

I don't have such negative thoughts about education classes [as I did before]. When I first started MSSE, I thought, "you gotta take the bad with the good, so we're stuck with these education classes." What I've decided is that all teachers should have to [take] education classes after they've been in the classroom for five years because we finally have some framework where the ED classes become meaningful.

But an added bonus was the education [courses]. I came in very skeptical because of my previous experience in education classes and I felt as much as a guru in my content, [but] I also grew in that dimension of my teaching, in the educational perspective. I'm really pleased with that result because I didn't expect it. I expected the content growth, but I didn't expect the professional growth.

It was nice to have education classes that were science education classes.

One student viewed the culminating project--the Capstone--as the component of the course that brought the rigor and completion to the program:

Capstone, that was probably the biggest difference. I have never taken another master's, but I have seen colleagues that are doing master's at the same time as I am and I don't think any of them are doing anything that approaches the depth and detail and academic rigor and introspection of our capstones. I have proof-read papers that were their projects and there was not any comparison.

Impact on Students

The MSSE teachers cited numerous examples of the impact the MSSE program had on the students they taught in their classrooms. The responses varied from a keener sense of understanding the students to a feeling of sympathy that the teachers could more easily identify with their students as a result of them being "students" in the MSSE Program. Finally, the teachers reported growth in their teaching and now view themselves as better teachers.

Several teachers cited the negative impact that doing action research and the MSSE Program had on their teaching, primarily from adding more to an already overloaded work and life schedule. "It's too difficult to do action research and teach. If anything, action research has made me feel out of control in terms of my workload. If I weren't taking classes in addition to teaching, living and researching, it may not seem too overwhelming." Another teacher expressed the notion of "cramming" the program into two years and the impact that had on her teaching, but acknowledged that there would be a positive payoff. "I think one thing I noticed is that cramming it [the MSSE Program] into two years like we did and taking as many courses as you do, I don't know if you're as an effective teacher in the classroom...The real value will come in the next couple of

years." Other teachers noted the benefit of the program, even though it was acknowledged that teaching suffered. "I think my teaching during the program probably suffered a lot more than I might like, but I know eventually, I would become a better teacher..."

The MSSE teachers reported that the students they taught seemed more understanding of them because the students viewed their teacher as a "student":

In a couple of ways, I was a student at they same time they [my students] were, so I would be up doing my homework and so I was going through the same thing they were going through. Also, they saw me using what I was learning, pretty much immediately or with the same time. It interested them and for me it reinforced my [learning].

Just the fact that when they [my students] know they're doing this kind of research and hey know that you're going to school in order to [learn]...you can sit there and say [to them], "You know, I do the same thing. It's okay, we'll both make it." I understand how my students feel from their perspective, plus, they seem to really enjoy being a part of this thing. It seems to make them feel better about themselves somehow or more important.

My students were totally into my work. Student involvement and classroom research were affected....When I did my practice [for the Capstone presentation], some of my students came because I wanted them to critique my Powerpoint [presentation], like I do theirs. They all made little notes and two of them afterwards said, "That was so cool." I will use it and show them what I learned in my work. They like being..."subjects."

...I explained to my students when I was doing the activities where I collected data for the action research and for the capstone project, I said this is for me. I am getting a master's degree and you are helping me out by responding. I really feel that it was important for me to communicate that and they thought they were pretty cool, in their terms, that here was a teacher that was also a student. I also think that it's important for them to see that even though I've been teaching for a long time and I always push for that goal [of] life-long learning.

The MSSE teachers also reported changes in their own students as a result of their involvement in the program. Some viewed the impact on their students in terms of direct

results from the action research project. One teacher reported, "The process of conducting action research has not changed my confidence, while the results of my project have. My project showed how difficult it is to achieve true conceptual change in students." Another viewed the value of action research as beneficial for the students. "I would like you to know that action research at all levels is very important. I am thankful to have been exposed to it on the level I have. I feel strongly that my students have benefited greatly." One teacher cited that her use of Classroom Assessment Techniques (CATS) impacted her students. "I think my students benefited because they were using all those CATS and I thought they were beneficial." The impact and importance of viewing students as individuals was reported by one MSSE teacher at the conclusion of her action research project. "Taking the time to really look at my individual students. I've always paid attention to my students, but with my action research being about multiple intelligence, you are really looking at individual ones..." Another teacher reported, "I think there is a huge change there in that I am more in tune to the way the students learn and I am able to assess what's happening in the classroom..." Finally, one teacher cited that the impact on their involvement in the program on the students resulted in a change the students' awareness of teaching itself. "I think they [my students] are more aware of the fact that teaching isn't just a person up there saying, 'This is what you have to know, so and so forth.' They become more aware that teaching is also a little bit of a learning process."

Teachers in the MSSE Program acknowledged that their involvement made them better teachers. Along with being more empathetic towards their own students, they also

cited an increase in enthusiasm, a heightened sense of professionalism and a general feeling that the MSSE Program was worthwhile:

I guess the way I would say it [explaining empowerment] is that I feel like I'm a better teacher now than I was two years ago and I may have gotten to this point without the program, but it would have taken a heck of a lot longer.

Doing this [the MSSE Program], the mere act of doing this, made me better in the classroom, all up and down the line. It made me more empathetic with my students because I was a student as well. It gave me the tools to use. It made me more flexible, sometimes, in my classroom. The mere act of going back to school made me better at what I do.

Action research has helped me to be a better teacher as I'm finding out what works and what doesn't and I change accordingly.

I was ready to get out of the classroom this last spring with a lot of frustrations, mostly administrative. In our district we've had a lot of problems. But after these two weeks [the Capstone symposium], I'm very ready to get back and I also feel that I'm going to do as good a job as I can in the classroom...I feel good about being a teacher.

Well, the students are going to have a better teacher. They're also going to have a person...who is...enthusiastic about what I've done, but I guess to put it in simple terms, they are going to have a teacher who really considers himself a professional...

CHAPTER 5

CONCLUSIONS

Introduction

This chapter presents conclusions drawn from this study, a discussion of the broader implications of the findings and implications for further research. The areas of discussion will focus primarily on the key components listed in the purpose of the study: "What are teachers' perceptions of empowerment in their teaching as a result of professional development in an asynchronous distance delivery action research-based master's degree program?" These components include teacher empowerment and its constructs, action research, professional development, and telecommunications. Additional themes including the impact of action research on teachers' students, specific components of the MSSE Program and MSSE teacher's views of professionalism will also be addressed.

ConclusionsTeacher Empowerment

The study findings suggest that the MSSE teachers exited their master's degree program more empowered than when they began. As a whole, the teachers reported increases in their perception of the constructs of empowerment: self-reflection, control,

collegial relationships, confidence and instructional strategies (Miller, 1993). In addition, many MSSE teachers reported or evidenced additional components of empowerment as identified by Duhon (1999): autonomy, problem-solving, responsibility, growth (personal and professional), choice, control and decision-making. Evidence of these additional components of empowerment was demonstrated through the teachers' final action research projects, public presentations of their capstone projects, changes in teaching assignments, and acceptance to other teaching-related positions, such as leadership roles in professional organizations, serving as teaching assistants for MSSE courses or serving in other professional capacities. One MSSE teacher is currently serving as a teacher consultant on a NASA project, several have served as teaching assistants or been asked to teach university courses, one was sponsored to attend a national conference on multiple intelligences (the focus of her action research study), one is currently serving in a formal mentor teacher capacity and yet another is serving as a regional director of her state's science teachers professional organization.

Self-reflection. Self-reflection was viewed by many teachers as key in their development both as an individual and as a professional. Many stated that, while they had "always been" self-reflective, as a result of the MSSE program they reached a new awareness and use of self-reflection. Self-reflective practices were more common in teachers' lives as a result of action research and this translated into a heightened awareness in regards to teaching practices and decisions concerning students. Several teachers discovered that self-reflection increased as a result of journaling. By and large, the teachers viewed self-reflection as a tool that made them better teachers, thus more

empowered teachers. In a follow-up study conducted by this researcher (Graves, 2001) teachers reported that they continue to engage in self-reflective practices, which resulted in teachers being more analytical and organized. These findings are supported by Boras (1998) who states that "If learning...is to be equated with 'commitment to meaningfulness,' we need individuals able to take charge of their own inner transformation and growth" (p. 12). Self-reflection is a process that enables learners (teachers in this case) to take charge of inner transformation and growth.

Control. The construct of control was the most confusing component of empowerment for the MSSE teachers to identify. Many were uncertain what was meant by control: was it control in the classroom? control in their personal lives, control over curricular decisions, textbooks or other issues of control? Several of the teachers reported not experiencing any change in control over the course of the program, while others reported a great deal of change in control. Several teachers reported that the action research process resulted in a greater sense of control. This translated into control over curricular, instructional, and assessment decisions as well as other aspects of day-to-day interaction with students. Even though no change in control was reported by some teachers, the sense was that not gaining control was not viewed as a loss in any regard. Several teachers moved during their program of study and that resulted in changes in perceptions of control. Still others reported an increase in control throughout the program, most notably in the areas of classroom and curricular decision-making. In the Follow-up study (Graves, 2001) one teacher reported that their sense of control changed, resulting in now having a strategy to help when something went wrong in the classroom.

Another reported being "more comfortable" saying what she knows in regard to issues related to the classroom, students and instruction.

Collegial relationships. The teachers in the MSSE Program indicated that, as a result of the program, their collegial relationships were strengthened. Many cited the close bonds they formed with other members of their MSSE cohort during the first six weeks on the campus of MSU-Bozeman as being key to their collegial relationships. Even those teachers who did not graduate with the cohort with which they began their program of study indicated that collegial relationships made through their courses of study were of extreme value. Perhaps due to the nature of asynchronous telecommunications and the structure of the coursework presented on-line, stronger collegial bonds were formed. Many of the courses presented on-line, both science content and education courses, required students to work in cooperative groups, thus strengthening collegial relationships. In the Follow-up Study (Graves, 2001), teachers reported that the collegial relationships formed during the two-year MSSE graduate program were highly valued. Many teachers remain in close contact with others of their cohort and one stated that the MSSE relationships were stronger than any professional relationship developed either in undergraduate school or in her teaching situations.

Confidence. Confidence was one of the areas in which teachers reported the greatest change as a result of their involvement in the MSSE Program. Many cited the connection between action research and confidence. Others reported an increase in confidence as a result of the courses they took in their programs of study. The perception of confidence for the teachers was not limited to the classroom. An increase in

confidence was noticeable for many teachers in dealing with administrators, fellow teachers and parents. Along with an increase in confidence comes an increase in professionalism. As teachers view themselves as more confident, in turn, they view themselves as more professional.

The process of action research resulted in increased confidence. As teachers examined an aspect of their practice, designed and implemented a study, and analyzed and shared results, their confidence increased. This resulted in a change in attitude from “I don’t know what to do” to one of “I have a better understanding of what constitutes good work and I have the tools to pursue an avenue of study to assess the situation.” In the follow-up study (Graves, 2001), one teacher reported that confidence in the form of experiencing “grounding and a foundation” regarding action research was crucial, adding to her sense of confidence. Confidence also resulted in teachers being more prepared, with an increase in flexibility and adaptability.

Instructional Strategies. An increase in the confidence, use, and variety of instructional strategies used by the MSSE teachers was apparent. For some teachers, their action research or capstone projects were directly related to instructional strategies. As a result of their studies, some, MSSE teachers changed, some quite dramatically, their approach and use of instructional strategies. MSSE teachers often reported an increase in their understanding of the relationship between assessment and instructional strategies. Teachers now use more and varied instructional strategies and, as a result of increased confidence, are not afraid to incorporate new strategies in their classrooms.

Action Research

Action research was a major required component of the MSSE graduate program and all graduates completed two courses in action research. MSSE teachers viewed action research as a critical tool for educators that resulted in increased confidence, self-reflection and a deeper understanding of instructional strategies, all components of teacher empowerment. Mills (2000) states:

Action research is also about incorporating into your daily routine a reflective stance—the willingness to look critically at your teaching so that you can improve or enhance it. It is about a commitment to the principle that as teachers we are always distanced from the ideal but are striving toward it anyway—it's the very nature of education! Action research significantly contributes to the professional stance that teachers adopt because it encourages them to examine the dynamics of their classrooms, ponder the actions and interactions of students, validate and challenge existing practices, and take risks in the process. When teachers gain new understandings about both their own and their students' behaviors through action research, they are empowered...(11).

The results of this study clearly document that teachers in the MSSE Program are empowered as a result of action research.

Action research provided the MSSE teachers with concrete tools and strategies necessary to identify issues relevant to their teaching, design and implement a course of research, and analyze and report their findings. MSSE teachers quickly realized and gained an appreciation for research, discovering that research is not done by “researchers” only. MSSE teachers reported an increase in professionalism as a result of action research. Mills (2000) cites the benefits of action research by stating, “Action research is largely about developing the professional disposition of teachers, that is, encouraging teachers to be continuous learners—in their classrooms and their practice”

(p. 11). The MSSE teachers demonstrated, through their action research projects, their capstone projects, survey data and narrative data, the wherewithal to be continuous learners. Responses from the follow-up study (Graves, 2001) indicate that nearly all of the teachers continue to use action research skills and strategies in their daily teaching. As a result of action research, the MSSE teachers were empowered to

- Make informed decisions about what to change and what not to change.
- Link prior knowledge to new information.
- Learn from experience (even failures).
- Ask questions and systematically find answers (Fueyo & Koorland, 1997).

Professional Development

Professional development is at the forefront of the education reform movement in the United States. Rhoton & Bowers (2000) remind us that

The *National Science Education Standards* recognize professional development as a key component of the science education system, one often neglected when concentrating on the core elements closest to the critical teacher/student interface of content, teaching, and assessment (p. 4).

The experience of the teachers in the MSSE Program was one in which the core elements referred to by Rhoton and Bower were not neglected. Rather, the MSSE Program provided a balanced marriage of science content, teaching and assessment. Rhoton & Bowers (2000) continue by stating that "Learning opportunities that support teachers in teaching...consider each of the professional development standards, both in content and pedagogy (p. 4). In addressing this need for both content and pedagogy, the MSSE teachers completed a program that required a nearly equal number of graduate

level credits in science content and education courses. In addition, the majority of science content courses were developed with sound pedagogical strategies modeled by the instructors of the courses. Many of the assignments asked teachers to work directly with students in their classrooms on the content being presented in the course, with emphasis on inquiry, lab strategies, and assessment, all in the context of the course's content.

Action research meets the requirements of being a sound professional development tool. Osterman and Kootkamp, as reported in Rhoton & Bowers (2000) "provide a wonderful rationale for action research as a professional growth opportunity in their 'credo for reflective practice':

1. Everyone needs professional growth opportunities.
2. All professionals want to improve.
3. All professionals can learn.
4. All professionals are capable of assuming responsibility for their own professional growth and development.
5. People need and want information about their own performance.
6. Collaboration enriches professional development (p.11).

The MSSE teachers demonstrated evidence that each of these statements were met or exceeded during their involvement as students in the MSSE Program. As teachers in the MSSE Program, they were presented with numerous opportunities for professional growth. Choosing to pursue an advanced degree is evidence of a desire to want to improve. The science content and education courses offered the teachers situations in

which they had to assume responsibility for their own professional growth and development. Action research, while taught through a class setting, became a very individualized process in which each teacher made research decisions based on his own needs and the focus of his study. Through the courses, the teachers were provided information about their performance. Self-reflective practices also served as an indicator of information about each teacher's performance. And finally, the cohort arrangement of MSSE provided a collaborative environment which served to support many of the teachers throughout and beyond their programs of study. These results that the teachers experienced echo what Goynes, et.al. (1999) said regarding teacher professional development. "Teachers need to continue developing their skills and learn all they can about their profession as well as learn new skills for working in an empowered environment (p. 8).

In reporting on the impact the MSSE Program had on professional development, many teachers were quick to say that they felt more professional after completing the degree. To many, teaching became less of a job and was identified as a profession. An understanding of trust in a professional setting was established and reported, both with cohorts and instructors in the program. Numerous graduates from the MSSE Program have continued in professional development opportunities. These activities have taken the form of serving as a mentor, sitting on committees and professional boards, taking leadership roles in one's school and providing professional development for other teachers.

Professional development is, in and of itself, a growth process, but as teachers engage in professional development that emphasizes both science content and pedagogy, the empowerment of teachers has an opportunity to flourish. Couple that with action research, the opportunity to study one's own practice and wrap it in a supportive, collaborative setting and the results are overwhelming—teachers came away from the process more empowered.

Telecommunications

Nearly two-thirds of the required coursework of the MSSE Program was offered through asynchronous telecommunications—distance learning. This medium afforded an opportunity for teachers to pursue their master's degree from home, without the restrictions of travel and set class schedules. The use of MSULink provided a bulletin-board based forum for discussion and the retrieval and submission of homework. While the teachers entered MSSE with varying amounts of technology expertise, all quickly adjusted to the technology. The use of distance education assisted in making the world smaller. Teachers could be at any point on the globe, and as long as they had access to a computer and the internet, they could be instantly re-connected to their courses and cohort colleagues. The distance component of the program gave MSSE students greater and more varied access to courses. The accessibility of courses and cohorts from any location, at any time was viewed to be empowering.

Summary of Empowerment

At this point in the discussion of this research study, it should become apparent to the reader that the issues of teacher empowerment are so embedded in the many constructs presented (self-reflection, control, confidence, collegial relationships, instructional strategies, professional development, action research, telecommunications) that it is nearly impossible to ferret out a meaningful cause and effect relationship that definitively tracks teacher empowerment. All of the reported constructs add to the development of empowerment and no single construct in and of itself is responsible as a single cause-agent for teacher empowerment. Each of the five components in the definition of empowerment (Miller 1993), self-reflection, control, collegial relationships, confidence and instructional strategies, were examined in this study and each provide evidence that MSSE teachers exited their programs of study more empowered. Consequently, MSSE teachers have a greater sense of teacher self-efficacy. Short & Greer (1997) state that, "Self-efficacy develops as an individual acquires self-knowledge and the belief that they are personally competent and have mastered the skills necessary to effect desired outcomes (p. 138). In addition, the Follow-up study (Graves, 2001) indicated that the MSSE teachers retained empowerment since completing their program of study. In the follow-up personal interviews, they continued to cite examples of both empowerment and self-efficacy. The teachers provided evidence that the acquisition of empowerment is long-term rather than short-term. Many of the teachers in this research study continue to demonstrate evidence of empowerment by their involvement in ongoing professional development, interactions with other teachers through mentoring,

continuation of action research in their classrooms and by assuming leadership roles in their profession. These teachers are empowered—they have advanced professionally to the point that they can best be described as “Skilled teachers of science [who] have special understandings and abilities that integrate their knowledge of science content, curriculum, learning, teaching, and students” (National Science Education Standards, 1996, p. 62).

Additional Themes

Impact on the Teachers’ Students

Change in teachers results in changes in students. It could be argued that this is true both in a positive and negative sense. Action research is clearly one of the strategies that facilitates teacher change, empowers teachers and, as a result, impacts student change. According to Mills (2000), “By now it should be evident to you that educational change that enhances the lives of children is the main goal of action research.” He also reminds us that:

While action research is not a universal panacea for the intractability of educational reform, it is an important component of professional development disposition of teachers because it provides teachers with the opportunity to model for their students how knowledge is created” (p.11).

The use of modeling was evident in many venues of the MSSE Program. Instructors in both on-campus and on-line courses modeled solid pedagogical strategies. The MSSE teachers modeled research strategies in their classrooms as they engaged in action research, most often with their students as the focus of their studies. Teachers in this

study reported that their students seemed to have more understanding of them because the teachers were “students”. The reverse was true also. Teachers in the program had a greater appreciation for the life of a student, since they themselves were students also. Teacher change regarding flexibility, homework and deadlines also changed which directly impacted their students. As teachers learned more about their teaching through action research, assessment and other strategies, the new knowledge positively impacted the students. A common phrase repeated by many of the MSSE teachers can be paraphrased as follows: “I am a better teacher now and my students are the recipients of the positive changes in me.”

Rigor of Courses

One of the “surprise outcomes” of the program expressed by the teachers related specifically to the rigor of the coursework, especially the education courses. A common pre-program perception was that education courses were a part of the degree program that had to be “endured”, but at the completion of the program, many teachers reported a profound change in attitude regarding the value of education courses. This is due to the perception that the undergraduate courses the MSSE teachers took were often viewed as a “waste of time” or “something to be endured” in order to earn a bachelor’s degree.

Another characteristic of the coursework appreciated and valued by the teachers was the interdisciplinary approach to the program. With nearly equal numbers of credits in both science content and education courses, the teachers received a well-balanced course of study. The inter-relationship between content and pedagogy is directly related to the success of professional development and teacher empowerment. According to

Sparks and Hirsh (2000), "Effective professional development makes the connection between subject matter and pedagogy. It expands teachers' repertoire of research-based instructional methods to teach that content and help students master new skills. Such programs create regular opportunities for serious collaborative planning, develop classroom assessment skills, and connect teachers to other professionals within and beyond their schools" (p. 5). The teachers in the MSSE Program were able to study content and pedagogy simultaneously. They participated in serious collaborative planning throughout the design and implementation of the action research projects. They engaged in developing classroom assessment strategies and connected with other professionals, mostly by means of asynchronous telecommunications. These activities aided in the empowerment of the teachers.

On Cohorts and Collegiality

One specific aspect of the MSSE Program about which the teachers expressed strong views was that of the cohort concept and the need to be together as a group at the beginning of the course of study. In the Follow-up Study (Graves, 2001), several teachers reiterated the importance of their success being related to the collegial bonds that were formed during the first six weeks on the campus of MSU-Bozeman.

Discussion of the Broader Implications of the Findings

Professional development, action research, asynchronous telecommunications, and teacher empowerment are complex issues in education. The interplay among these

issues is complex and dynamic. The discussion of the findings of this research project will be divided into two sections, knowledge claims and value claims.

Knowledge Claims

Knowledge claims can be constructed only in light of a close examination of the theories that guided the inquiry, an explicit description of the educational events and an explanation of the concepts and theories that guided both data collection and reporting (Novak & Gowin, 1984, p. 171-72). The following discussion is organized into these components. In light of this discussion, it is important for both the reader and researcher to be reminded of Novak and Gowin (1984) who say, "We cannot say this or that is true; what we can say is that, based on the educational events observed, the kind of data collected, and our data transformations, our knowledge claims are valid..."(p.171).

Professional Development and Action Research. Action research as a professional development strategy was examined in this research project. The following discussion combines these two concepts in light of the fact that the MSSE Program (professional development) utilized action research as a major strand in its professional development.

A study of the literature yielded the following theories that provided a framework for understanding professional development:

1. Professional development is a natural progression of teachers.
2. Professional development takes many different forms.
3. Professional development involves risk taking.
4. Professional development is a process of growth and change.

The following theories about action research were based on a review of the literature:

1. Action research in educational settings is conducted by teachers on their own practice to better understand and inform their practice.
2. Action research improves learning and teaching.

Based on the literature, an investigative methodology was designed to answer the major research question, "What are teachers' perceptions of the effects of an asynchronous distance delivery, classroom research-based master's degree program on empowerment in their teaching profession?" The research design incorporated the use of two semantic differential surveys to measure teachers' feelings of action research and telecommunications. In addition, teachers' perceptions of the action research process and telecommunications were gathered after the completion of the second action research course through an on-line survey. At the conclusion of the MSSE Program, seven randomly selected teachers from the first graduating cohort and four randomly selected teachers from the second graduating cohort were personally interviewed. Focus group interviews were conducted at the conclusion of the MSSE Program, with a total of 17 teachers from the first cohort and 13 teachers from the second cohort participating. An examination of written documents such as action research papers and capstone projects written by the MSSE students was conducted by the researcher. During the final week of the their Capstone Seminar, each teacher also completed the Teacher Empowerment Survey (TES).

Although not a part of the original design of this project, a follow-up study was conducted was conducted by the researcher in October – December 2001. During this time, 6 of the original 11 teachers who had been randomly selected for personal interviews were re-interviewed and asked to complete the action research, telecommunications and empowerment surveys.

An examination of the data yield the following knowledge claims about action research and its role in professional development:

1. Action research is a meaningful professional development endeavor. The teachers in the MSSE Program were involved in risk taking and evidence of growth and change was documented.
2. Action research contributes to empowerment. Evidence of teachers' increased perception of all constructs of empowerment (self-reflection, control, collegial relationships, confidence and instructional strategies) as defined by Miller (1993) was documented.
3. Statistical significant difference was measured in teachers' attitudes toward action research from the beginning to the ending and from the middle to the end of the program of study as measured through the semantic differential survey for action research.

Telecommunications. A review of the literature on asynchronous distance learning and telecommunications provided the following theories upon which this research study was conducted:

1. Distance education affords the opportunity for students to take coursework from remote locations.
2. Distance education allows students and instructors to structure coursework according to personal and professional schedules.
3. Distance education allows students to engage in learning that is more learner centered.

Data was collected to measure teachers' feelings toward the use of telecommunications in the MSSE Program. Attitudes towards telecommunications were determined through interview questions at the end of the MSSE Program.

The following are knowledge claims made about telecommunications in this research study:

1. Statistical difference in the teachers' attitudes toward telecommunications from the beginning to the middle and from the beginning to the end of the MSSE Program.
2. The semantic differential survey for telecommunications did indicate an increase in the comfort level concerning the use of telecommunications from the beginning to the middle and from the beginning to the end of the MSSE Program.
3. Telecommunications is a convenient method of delivering master's degree coursework by providing flexibility for the learners to access the materials according to their personal and professional schedules from any remote location that has internet access.

4. Telecommunications provided a means for the MSSE teachers to maintain and collegial relationships established during the initial on-campus courses.

Empowerment. A review of the literature on teacher empowerment yielded the following theories upon which this research study was established.

1. Empowerment is the degree to which a teacher feels she has the ability to affect change in her professional setting.
2. Empowered teachers continually engage in the components of empowerment which including self-reflection, control, collegial relationships, confidence and instructional strategies.
3. Empowered teachers develop a commitment to continued professional development.
4. Empowered teachers create knowledge relevant to their professional lives.

Data was collected to measure teachers' feelings toward empowerment in the MSSE Program. The Teacher Empowerment Scale was administered at the end of the program to measure empowerment. Attitudes toward teacher empowerment were determined through interview questions at the end of the MSSE Program. Specific interview questions addressed each of the components of empowerment. Evidence of empowerment was gathered through a thorough examination of teachers' action research projects and Capstone projects.

The following knowledge claims about teacher empowerment can be made:

1. The MSSE teachers demonstrated empowerment at the end of their program.

2. The MSSE teachers demonstrated evidence of an increase in self-reflection, control, collegial relationships, confidence and instructional strategies throughout their professional development in the MSSE Program.
3. The MSSE teachers created knowledge relevant to their professional lives.
4. The Teacher Empowerment Scale yielded no statistical measure of empowerment. However, the TES yielded a predictor of empowerment through the use of the semantic differential survey for action research administered at the end of the program.

Value Claims

Value claims are answers to value questions. There are five kinds of value claims described by Novak and Gowin (1984) as follows:

1. Instrumental value claims, taking the form, Is X good for Y?
2. Intrinsic value claims, taking the form, Is X good?
3. Comparative, taking the form, Is X better than Y?
4. Decision, taking the form, Is X right?
5. Idealized, taking the form, Is X as good as it can be? (p. 173)

The following value claims are based on the value questions posed at the beginning of this research study. Each question is stated and the resulting value claims follows.

How do the MSSE teachers describe their experience with action research?

MSSE teachers describe their experience with action research as being very positive. Nearly all contend that the creation of knowledge in their professional setting was empowering.

What does action research mean to the MSSE students?

Action research is good and academically sound as a professional development strategy. It creates a learning environment in which the constructs of teacher empowerment (self-reflection, control, collegial relationships, confidence and instructional strategies) can be developed. Action research produced confidence in the MSSE teachers. The teachers view themselves as more professional and value the strategies of action research. Action research affords teachers the opportunity to create knowledge relevant to their specific professional situation. The use of action research as a professional development strategy in a program such as MSSE is a right decision.

How do the MSSE teachers describe their experience with telecommunications?

MSSE teachers describe their experiences with telecommunications as mixed. Some teachers highly valued and appreciated telecommunications and others endured it as a necessary component of MSSE. Asynchronous distance delivery is a good method for the delivery of professional development courses.

What does the use of asynchronous distance delivery mean to the MSSE teachers?

Telecommunications means flexibility. Most teachers reported that asynchronous distance delivery allowed them the ability to pursue the degree while continuing to teach and attend to family responsibilities. Telecommunications also means being able to

remain in contact with members of the cohort, allowing collegial relationships to continue.

How do MSSE teachers describe their understanding of teacher empowerment?

MSSE teachers describe empowerment as positive. Empowerment of the MSSE teachers was evidenced in numerous forms including additional leadership roles, serving on committees in one's school or school district, continued research in one's classroom and a greater sense of professionalism. The constructs of empowerment, self-reflection, control, collegial relationships, confidence and instructional strategies, were evident in the MSSE teachers as demonstrated through interviews, action research projects and Capstone Projects. Teachers are more empowered as a result of the professional development they received through MSSE. Empowerment is good for teachers. The constructs of empowerment equip teachers with the skills necessary to become more professional. The empowerment of teachers is right and should be viewed as a goal of any professional development endeavor.

How do MSSE teachers describe their understanding of self-reflection?

The teachers described self-reflection as positive. Many teachers reported being self-reflective prior to beginning MSSE, but all reported an increase in their use of self-reflection through the professional development process. Self-reflection practice is an empowering process and is right for teachers.

How do MSSE teachers describe their understanding of control?

The understanding of control was mixed as reported by the MSSE teachers. Many felt their control had not changed as a result of the professional development they

received. External factors such as administrators, school boards, scheduling, or curricular issues were reported to thwart any sense of control. Others reported an increase in control, especially in terms of gaining control as a result of confidence or an increase understanding of instructional strategies.

How do MSSE teachers describe their understanding of collegial relationships?

The teachers highly valued the collegial relationships formed in MSSE. Many felt that it was imperative for MSSE teachers to be together in a face-to-face situation at the beginning of the professional development program. Many teachers reported and it was observed by the researcher that strong collegial relationships continued throughout the duration of the program as the teachers supported one another as “critical friends” in action research. Collegial relationships are good and are vital to professional development by affording opportunities for self-reflection and professional dialogue.

How do MSSE teachers describe their understanding of confidence?

MSSE teachers understand confidence as one of the benefits of professional development that manifested itself in numerous areas on the teachers’ professional lives. The MSSE teachers reported being more confident in dealing with administrators, parents and students. As a result of conducting action research, teachers were more confident in what they were doing in their classroom. Through the courses teachers took, it was reported that an increase in confidence occurred concerning instructional strategies and understanding science content. Confidence in teachers is good, it is empowering. Students, parents and administrators benefit as a result of increased confidence in teachers.

How do MSSE teachers describe their understanding of instructional strategies?

MSSE highly valued the greater understanding of instructional strategies gained through their professional development. An increase in the understanding of instructional strategies resulted in increase in confidence, control and overall professionalism. Instructional strategies were often changed through self-reflection, dialogue with colleagues and action research. An increase in the understanding of instructional strategies is good and should be a key component of any professional development activity.

Additional Value Claims

The following value claims can be made as a result of this study.

1. The science content courses of the MSSE Program are rigorous and are highly valued by the teachers in the program.
2. The education courses of the MSSE Program are rigorous and are highly valued by the MSSE teachers. This came as a surprise to many of the teachers who viewed education courses are something to be “endured.”
3. The interdisciplinary structure of the MSSE Program, balancing science content and educational pedagogy was highly valued by the students.

Implications for Further Research

The implications and findings of this study can provide direction for further research. As professional development continues to be refined as new knowledge is gained through the educational reform movement, the impact of action research,

telecommunications, reflective practice and other influences, a clearer understanding of the impact of each on teacher empowerment may become clearer. Since most of the research in this study focused on teachers' perceptions of empowerment, data could be gathered directly involving the MSSE teachers' students, administrators, department, school or school district. Evidence of new or expanded leadership responsibilities assumed after the completion of the master's degree would afford evidence of empowerment. Several possibilities for research are suggested.

1. Longitudinal studies of the MSSE graduates could answer the following questions.
 - a. What are the MSSE graduates perceptions of empowerment five years after the completion of the degree?
 - b. In what ways are MSSE graduates using action research strategies five years after the completion of the degree?
 - c. In what ways are MSSE graduates demonstrating the five constructs of empowerment: self-reflection, control, collegial relationships, confidence and instruction strategies five years after the completion of the degree?
 - d. What are MSSE graduates perceptions of telecommunications five years after completion of the degree?
 - e. What are MSSE graduates perceptions of professional development five years after completion of the degree?
 - f. What evidence of leadership and other professional responsibilities are demonstrated five years after the completion of the degree?

2. Classroom-based studies on the effects of the MSSE degree program on teachers' students could provide insight into the following questions.
 - a. What effect do the teachers' degrees have on science instruction in the teachers' classrooms?
 - b. What effect do the teachers' degrees have on student performances?
 - c. What effect do the teachers' degrees have on the types of lessons and activities used in the classrooms. Are the lessons inquiry-based, more open-ended?
 - d. What effect do the teachers' degrees have on student standardized test scores?
 - e. What effect do the teachers' degrees have on student readiness for college or vocational training?
3. School district-level studies of the effects of an advanced degree can further the initial exploration begun in this study. One question for research includes the following.
 - a. In what ways has the MSSE teacher impacted the science department?
 - b. In what ways has the MSSE teacher impacted the school district?
 - c. In what ways has the MSSE teacher impacted their educational community?
4. Telecommunications studies on the effectiveness of MSULink and WebCT can provide direction for the instructors of MSSE courses. There is a current movement to utilize WebCT, an internet, web-based instructional platform, for MSSE courses. This would totally replace MSULink which is a bulletin-board based discussion

format that uses FirstClass Client software. The current advantages and/or disadvantages of each platform are unknown. Questions for research concerning MSULink versus WebCT include the following.

- a. What are the advantages and/or disadvantages of WebCT over MSULink for instructors of the courses?
- b. What are the advantages and/or disadvantages of WebCT over MSULink for students in the courses?
- c. What are the advantages and/or disadvantages of WebCT over MSULink in the development of an on-line community of learners?
- d. What are the advantages and/or disadvantages of WebCT over MSULink in terms of on-line connection issues such as access, speed of connection, accessibility to course materials, ease of use?

Further research in this area can help to identify and establish the potential of professional development opportunities built on the foundations of action research and telecommunications. Not only will these studies assist in evaluating the impact of teachers involved in professional development, but can also assist in measuring the potential benefits and/or pitfalls of professional development of teachers on the students in their classrooms, fellow colleagues, administrators and the educational community in which the teachers work.

APPENDICES

APPENDIX A

SEMANTIC DIFFERENTIAL ACTION RESEARCH AND
TELECOMMUNICATIONS SURVEYS

Semantic Differential Action Research Survey

Directions: For each pair of words below, place an X in the blank that best tells how you feel about:

EDUCATIONAL (ACTION) RESEARCH

passive	_____	_____	_____	_____	_____	active
understandable	_____	_____	_____	_____	_____	mysterious
frill	_____	_____	_____	_____	_____	necessary
bad	_____	_____	_____	_____	_____	good
changing	_____	_____	_____	_____	_____	constant
tool	_____	_____	_____	_____	_____	toy
strange	_____	_____	_____	_____	_____	familiar
weak	_____	_____	_____	_____	_____	strong
confining	_____	_____	_____	_____	_____	expanding
sad	_____	_____	_____	_____	_____	happy
brave	_____	_____	_____	_____	_____	scary
crutch	_____	_____	_____	_____	_____	tool
boring	_____	_____	_____	_____	_____	exciting
jump in	_____	_____	_____	_____	_____	hold back
more	_____	_____	_____	_____	_____	less

White & Berlin (12/2/96)

Semantic Differential Telecommunications Survey

Directions: For each pair of words below, place an X in the blank that best tells how you feel about:

passive	_____	_____	_____	_____	_____	active
understandable	_____	_____	_____	_____	_____	mysterious
frill	_____	_____	_____	_____	_____	necessary
bad	_____	_____	_____	_____	_____	good
changing	_____	_____	_____	_____	_____	constant
tool	_____	_____	_____	_____	_____	toy
strange	_____	_____	_____	_____	_____	familiar
weak	_____	_____	_____	_____	_____	strong
confining	_____	_____	_____	_____	_____	expanding
sad	_____	_____	_____	_____	_____	happy
brave	_____	_____	_____	_____	_____	scary
crutch	_____	_____	_____	_____	_____	tool
boring	_____	_____	_____	_____	_____	exciting
jump in	_____	_____	_____	_____	_____	hold back
more	_____	_____	_____	_____	_____	less

White & Berlin (12/2/96)

White & Berlin, Brody, Graves, Woolbaugh (6/1/97)

APPENDIX B

PERMISSION TO USE SEMANTIC DIFFERENTIAL SURVEYS

X-Sender: awhite@postbox.acs.ohio-state.edu
Date: Tue, 12 Feb 2002 14:44:22 -0500
To: John Graves <graves@montana.edu>
From: Arthur White <white.32@osu.edu>
Subject: Re: permission to use BWARM
Cc: berlin.1@osu.edu
Status: RO

John, the BWARM acronym is not for the instrument. It stands for the Berlin and White Action Research Model (BWARM). The instrument used in these reports is a semantic differential designed to measure the attitudes and perceptions related to Educational Research. You certainly have our permission to use the instrument. The following reference could be used:

Berlin, D. F., & White, A. L. (1997). Action research and science and mathematics education: A longitudinal study. Paper presented at the International conference on Science, Mathematics and Technology Education, Hanoi, Vietnam.

Good luck, Art White & Donna Berlin

APPENDIX C

TEACHER EMPOWERMENT SCALE

Teacher Empowerment Scale

Directions: Please answer to the best of your ability.

1. My influence regarding appropriate curriculum and teaching strategies reaches beyond my classroom.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

2. When the decisions are made that affect my teaching, I am always involved.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

3. I continue to keep up with current research about classroom teaching strategies in my field.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

4. I have power over the use of science curriculum in my district.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

5. I reflect on my teaching strategies quite often.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

6. I have power to make curricular decisions in my school or district.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

7. Teachers and administrators ask my opinion about specific teaching and learning strategies.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

8. I do research in my classroom that influences my decisions of proper teaching practices.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

9. I believe that I can make a difference in the learning and educational growth of children.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

10. I have control over what I teach in my classroom.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

11. My collegial relationships center around discussions of teaching and learning.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

12. My teaching strategies cause children to learn.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

13. Discussions with other teachers center around the topic of teaching strategies.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

14. When I talk with other teachers, helping students learn better seems to be at the forefront of the conversation.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

15. I believe that what I do as a teacher can make a difference in the educational practices of my classroom, school or district.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

16. When I am with my fellow teachers, the subject of conversation usually revolves around student learning.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

17. I am confident of my ability to teach science.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

18. I am motivated to teach science.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

19. I am constantly reflecting on my teaching practices.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

20. When I learn something new, I get very excited.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

21. I enjoy trying new materials and new teaching strategies.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

22. If I am the minority at a staff meeting involving the instructional techniques of a student, I will generally state my opinion.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

23. I know what works in the classroom and don't have to try very many new techniques.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

Miller, K. (1993).

APPENDIX D

INTERNET SURVEY QUESTIONS

Internet Survey Questions

Please describe how action research has affected the following areas in your professional lives:

- Self-reflection
- Control
- Collegial relationships
- Confidence
- Instructional strategies
- Empowerment

What does action research mean to you?

How did you come to your conclusion regarding action research?

What else do you want me to know?

APPENDIX E

FOCUS GROUP INTERVIEW QUESTIONS

Focus Group Interview Questions

I'm interested in your perception of teacher empowerment as a result of your involvement in:

Telecommunications

Action research

Professional development through MSSE

Now that you have completed the MSSE program, what would you say to someone who says to you, "You've done this program that includes on-line courses. So what? How is the MSSE degree any different from a master's degree from Lesley College or any other university program?"

APPENDIX F

INDIVIDUAL INTERVIEW QUESTIONS

Individual Interview Questions

On your telecommunications survey you marked a response of (strong...weak). In what ways do you think telecommunications are ...?

On the same survey you marked a response of (more...less). In what ways do you want ...?

In what ways did telecommunications help you in your AR project?

On your Action Research survey you marked (frill...necessary). In what ways is AR ...?

On the same survey you marked (jump in...hold back). In what ways does AR make you want to ...?

In what ways did your school administrator(s) help you in your AR project?

In what ways did your fellow teachers help you in your AR project?

If you had to highlight the most important thing you have gained from doing an AR project, what would that be?

If you had to highlight the most important thing your school has gained from you doing an AR project, what would that be?

If you could project yourself 10 years into the future, what do you see as having lasting benefit from your involvement in MSSE?

What about the AR project process was NOT helpful to you?

How has your involvement in MSSE affected your relationship with your administration?

Fellow teachers?

Other teachers in MSSE?

Students?

Parents?

Others?

How has your involvement affected your instructional strategies?

Outlook on teaching?

Professionalism?

Self-reflection?

Confidence?

Control?

View of technology in learning for you, personally?
View of technology in teaching?

What comments/recommendations would you make to someone just beginning the AR process for themselves?

If an administrator asked you to establish a paid professional development program focusing on AR, what you tell them?

What else do you want me to know about your involvement in MSSE?

APPENDIX G

MSSE LETTER

Master of Science in Science Education

A Distance Degree
Opportunity from
Montana State University

Degree Program Highlights

- Designed for middle and high school science teachers by experienced science, science education, and mathematics faculty with the collaboration of outstanding classroom teachers.
- Many courses taught on-line by asynchronous, computer-mediated communication.
- Work at home without frequent trips to campus.
- Participate in classes when it is most convenient for you.
- On-campus summer experiences.
- Emphasis on the National Science Education Standards.
- Personalized capstone project for each student.
- Interdisciplinary-intercollege program.
- Large selection of science content courses.

Tell Me More About the Degree

The intercollege-interdisciplinary Master of Science in Science Education (MSSE) degree program was approved in May, 1996, by the Montana Board of Regents of Higher Education and is offered by Montana State University-Bozeman. This new program is sponsored by the Colleges of Agriculture; Education, Health and Human Development; Letters and Science; and Graduate Studies. The Office of Intercollege Programs for Science Education coordinates the MSSE Program; MSU's Burns Telecommunications Center provides technical support for the MSSE.

The program of study begins with summer classes at the MSU-Bozeman campus, continues with distance learning courses that students take from their homes or workplaces, and ends with a second on-campus summer session which includes presentation of the results of a personalized capstone project. About two-thirds of the courses and credits will be taken off-campus by asynchronous, computer-mediated communication. Thirty semester credits are required for the degree. Students typically will complete the degree in two or three years.

In addition to completing a group of core courses (15 credits total), students develop interdisciplinary combinations of science courses (15 credits total) from offerings in biology, chemistry, earth science, microbiology, plant sciences, physics, and other areas of science. Interdisciplinary efforts and incorporation of both science content and pedagogy have been encouraged during the development of courses. Each student

seeking the degree is advised by a three-person faculty committee, and programs are designed taking into account the student's background, interests, and career goals.

MSU-Bozeman has gained valuable experience in offering on-line courses through its National Science Foundation-funded National Teachers Enhancement Network (NTEN) project. During the past six years those participating in MSU's NTEN project have offered many on-line science courses to teachers nationwide. In addition to increasing awareness, acceptance, and expertise among faculty and administrators, such experience with distance delivery has resulted in the development of an infrastructure for both faculty and student support that enables MSU to provide high quality learning experiences at a distance.

What Courses are in the Program?

All students complete a minimum of 15 credits of core courses. The six courses of the first group below are required; in addition to taking these six courses, students select one or more courses from the second group to complete the core requirement.

MATH 427 "Integrating Mathematics and Science Through Modeling" (3 cr, dist)

EDCI 500 "Professional Symposium in Science Education" (1 cr, campus)

EDCI 503 "Evaluation and Measurement in Education" (2 cr, dist)

EDCI 505 "Foundations of Action Research in Science Teaching and Learning"
(2 cr, dist)

EDCI 509 "Implementing Action Research in Teaching and Learning" (2 cr, dist)

EDCI 537 "Contemporary Issues in Science Education" (2 cr, campus)

EDCI 508 "Advanced Educational Psychology" (3 cr)

EDCI 536 "Construction of Curriculum" (2 cr, campus and dist)

EDCI 543 "Social Equity" (3 cr)

EDCI 550 "Advanced Teaching Strategies" (2 cr)

EDCI 551 "Improvement of Instruction Using Computers" (2 cr)

In addition to completing core courses as described above, each student also develops interdisciplinary combinations of science content courses (minimum 15 credits) from offerings in biology, chemistry, earth science, plant sciences and physics by selecting courses from two or three areas. Science content courses are:

Cell and Molecular Biology - Microbiology

MB 538 "Cell and Molecular Biology" (3 cr, campus)

PS 545 "Agricultural and Medical Biotechnology" (3 cr, dist)

MB 539 "Infection and Immunity" (3 cr, dist)

Biology

- BIOL 513 "Terrestrial Ecology of Plains and Prairies" (1 cr, dist)
 BIOL 514 "Life in Streams and Ponds" (1 cr, dist)
 BIOL 516 "Terrestrial Ecology of the Northern Rocky Mountains" (2 cr, campus)
 BIOL 519 "Biology of Riparian Zones and Wetlands" (2 cr, dist)

Chemistry and Biochemistry

- CHEM 505 "Critical Concepts in Chemistry" (3 cr, campus)
 CHEM 507 "Modern Organic and Biochemistry" (3 cr, dist)
 CHEM 560 "Quantum Principles" (3 cr, campus)

Earth Science

- ESCI 511 "Hydrology of Streams & Ponds of the N. Great Plains" (1 cr, dist)
 ESCI 512 "Mountains and Plains Riparian Processes" (2 cr, dist)
 ESCI 513 "Plains Landscapes" (1 cr, dist)
 ESCI 514 "Mountain Streams and Lakes" (1 cr, dist)
 ESCI 516 "Northern Rocky Mountain Landscapes" (2 cr, campus)
 ESCI 517 "Electronic Hydrology" (2 cr, dist)
 ESCI 518 "Physical Landscape Ecology Field Measurement"(1 cr, campus)

Physics

- PHYS 401 "Physics by Inquiry I" (3 cr, campus)
 PHYS 511 "Astronomy for Teachers" (3 cr, dist)
 PHYS 561 "Modern Physics for Teachers: Particles and Waves" (3 cr, campus)
 PHYS 580 "Advanced Physics by Inquiry" (2 cr, dist)

BIOL = Department of Biology; CHEM = Department of Chemistry and Biochemistry; ESCI = Department of Earth Sciences; EDCI = Department of Education; MATH=Department of Mathematical Sciences; MB = Department of Microbiology; PHYS = Department of Physics; PS = Department of Plant Sciences. Dist = distance delivery course offered by asynchronous, computer-mediated communication. Campus = course offered on-campus during a summer session.

How Are the On-line Courses Taught?

Courses are offered by asynchronous, computer-mediated communication. From their home, workplace, or other convenient location, students use a personal computer (either MacOS or Windows-based) equipped with a modem or having a direct Internet connection to connect with instructors and participants from across the country. On-line courses may use manuals, textbooks, case histories, problems, computer software, databases, Web sites, evaluation activities, and other sources of information - but there are no lectures. Instructors and students work through the material together, discussing topics and issues by using a computer network that allows for private messages and group discussions. Courses are structured, but not conducted in real time; therefore, students

can access the class at times during the day or night that are most convenient to them. The equipment needed is a MacOS or Windows-based microcomputer. Internet access by modem or by direct connection is required.

Applicants should have the following:

- A bachelor's degree in an area of science or science education
- Certification to teach science in grades 6-8 or 9-12. Applicants who do not have certification, e.g., some of those teaching in private schools, will be considered on a case-by-cases basis.
- At least two years of successful science teaching experience in middle or high school or other appropriate educational setting (e.g., museum, community college).
- An undergraduate GPA 3.0 or higher
- Recent GRE scores (general test).

Who Are the Instructors?

The MSSE degree program was developed by Montana State University faculty members who are active in science, science education, and mathematics. The program is a unique, cooperative effort of several colleges and departments. Faculty members of the departments of Biology, Chemistry and Biochemistry; Education, Earth Science, Mathematics, Microbiology, Plant Science and Physics will teach most courses. Faculty members of other departments and units will play a major role in some courses. When appropriate, courses may be taught by faculty members of other institutions. Instructors have doctorate degrees in the subjects they teach; science courses are offered through the appropriate science departments.

What Other Distance Learning Programs are Available?

The Department of Mathematical Sciences at MSU-Bozeman has added a distance learning component to its popular Master of Science in Mathematics option Mathematics Education degree program. For details contact Department of Mathematical Sciences, Wilson Hall, Montana State University, Bozeman, 59717. Phone 406-994-5344. Montana State University also offers a Master of Education in Curriculum Instruction with a concentration in Technology Education. Most courses are offered by distance learning. Contact: Technology Education, 115 Cheever Hall, Montana State University, Bozeman, MT 59717. Phone 406-994-5775.

Answers to Frequently Asked Questions.

How long will it take to complete the MSSE degree? Because different students have different responsibilities at work and home, not all students will progress in the program at the same pace. It is possible to complete the degree requirements in two academic years and three summers. It is expected that most students will complete the degree in 2-3 years.

Can I transfer courses and credit taken at another institution? In some cases, yes. There are several guidelines governing use of courses taken at MSU or another institution before being admitted into a specific graduate program. For details you should contact the office of Intercollege Programs for Science Education or the College of Graduate Studies.

Should I take the GRE examination? Yes, you should take the GRE general test and be able to provide verbal, quantitative and analytical scores. Most successful applicants will have a combined verbal + quantitative + analytical score of 1500 or higher. We do not require scores for subject tests. Prospective applicants may learn about the GRE by calling 1-800-473-2255 (1-800-GRE-CALL), sending e-mail to gre-info@ets.org, or looking at <http://www.gre.org>.

Where will I live when I attend the two summer sessions? Campus housing is typically available in the summer for individuals as well as for families.

How do I apply for admission into the MSSE degree program? Contact Intercollege Programs for Science Education at MSU-Bozeman to obtain copies of the "Graduate Application for Admission" form.

Are there students now enrolled in the MSSE Program? Yes, the first cohort (30) began study during a six-week, on-campus session summer 1997. The second cohort (22) started summer 1998. These students now are taking courses by distance (asynchronous, computer-mediated communication). The students are from AK, AZ, CA, CO, IL, KY, MT, ND, OH, PA, SD, TN, TX, UT, WA, WY, Canada and Norway.

Will a new cohort start the MSSE graduate program in 1999? Yes, a third cohort will begin study during a six-week summer session on campus summer 1999.

What makes this degree different? The program is unusual in two important ways. First, it is an intercollege, interdisciplinary effort. Second, many of the courses will be taken by distance learning.

If interested, when should I apply for admission? Applications are accepted at any time. For more information about the Master of Science in Science Education or to obtain preliminary application and application materials, contact:

Intercollege Programs for Science Education
401 Linfield Hall

Montana State University-Bozeman
Bozeman, MT 59717-2805
Fax: 406-994-3733

Joan Muhs

Administrative Assistant

Phone: 406-994-3580

E-mail: smrc@montana.edu

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Comments: kboyce@montana.edu

Last Updated: 16 April 1999

at the Burns Telecommunications Center

on the campus of Montana State University-Bozeman

<http://btc.montana.edu/nten/sciedmasters.shtml>

APPENDIX H

LETTER OF CONSENT

To: «FirstName» «LastName»

Date: February 10, 1999

From: John Graves

MEMORANDUM OF UNDERSTANDING AND PERMISSION STATEMENT

I have been selected to participate in a research study based on my membership in the MSSE Program. This research is in support of a doctoral dissertation study currently titled "Students' Perceptions of the Effects of an Asynchronous Distance Delivery, Classroom Researched-Based Master's Degree Program" being conducted by John Graves. The purpose of this study is to determine students' perceptions of teacher empowerment through an asynchronous distance delivery, classroom research based master's degree program.

As a participant, I agree to:

- Be interviewed on one or more occasions during the study
- Grant access to past and ongoing records of my MSULink messages and other exchanges with instructors and students in the MSSE Program in regard to thoughts and reflections concerning coursework and assignments (with the right to deny access on sensitive items)
- Respond to occasional questions via MSULink, the World Wide Web, e-mail, journal, regular mail, telephone or in person.

I have been informed that:

- Any exchange will be kept confidential
- No identifiable reference to me, my students, or my school will be made

- General findings may be shared with the MSSE Project, and information may be used in future publications
- My interviews may be tape recorded and transcribed
- Transcripts will be made available to me at my request, and I am allowed to make additions, deletions, clarifications, or corrections as needed
- I may withdraw from participation in this study at any time by written communication to the researcher

Under the conditions listed above, I agree to participate in this research study.

Participant's Signature: _____

Date: _____

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