



Distance-mediated mentoring : a telecommunication-supported model for novice rural mathematics and science teachers

by Jennifer Lyn Luebeck

A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Education in Secondary Curriculum and Instruction
Montana State University

© Copyright by Jennifer Lyn Luebeck (1998)

Abstract:

Rural educators face unique professional challenges and limitations. This study investigated the effectiveness of an innovative distance-mediated mentoring program for rural novice mathematics and science teachers. Four purposes were pursued: 1) characterize and document the nature and development of the mentor-novice relationship; 2) describe how discourse influenced the novice teachers' perceptions about mathematics and science teaching; 3) determine whether telecommunication effectively supported a distance-mediated mentoring relationship for novice rural teachers; and 4) investigate program effects on novice teachers' attitudes, concerns, and professional growth.

A qualitative research design was implemented during academic years 1996-98. Primary data collection focused on nine rural novice teachers and their mentors and included three sets of interviews spanning three semesters, field observation of classrooms, schools, and communities, and analysis of electronic mail messages over a four-month period. Supporting data were collected during observation of workshops and training sessions, and through surveys administered to all program participants in early 1997 and 1998.

Categories of mentor-novice communication were identified: curriculum and content, validation of teaching practice, classroom and school issues, moral support, and social talk. Impact on mathematics and science teaching was accomplished by: sharing materials and activities; planning units and projects; locating resources; classroom and student concerns; long-range curriculum design; and improvement of teaching practices.

Professional growth (for both novices and mentors) occurred through individual contact with partners and interaction within the larger mentoring community in both face-to-face and on-line venues. Telecommunication was highly valued by successful users. Technical difficulty curtailed access for a significant number of teachers, but they maintained successful relationships via telephone, mail, and meetings.

Recommendations include: 1) consider subject and grade level, teaching responsibilities, and school size and setting when matching partners; 2) encourage early face-to-face encounters; 3) educate mentors to perceive novice needs and monitor intervention outcomes; 4) limit structured support to two years and/or implement ongoing evaluation based on systematically increasing expectations; 5) support a telecommunication component with early and repeated user training and remediation as well as provision of alternative modes; and 6) design specific, structured on-line conference folders and activities to motivate meaningful participation by novice and mentor teachers.

DISTANCE-MEDIATED MENTORING:
A TELECOMMUNICATION-SUPPORTED MODEL FOR
NOVICE RURAL MATHEMATICS AND SCIENCE TEACHERS

by
Jennifer Lyn Luebeck

A thesis submitted in partial fulfillment
of the requirements for the degree

of

Doctor of Education

in

Secondary Curriculum and Instruction

MONTANA STATE UNIVERSITY-BOZEMAN
Bozeman, Montana
May 1998

© COPYRIGHT

by

Jennifer Lyn Luebeck

1998

All Rights Reserved

This research is partly supported by the National Science Foundation under Cooperative Agreement No. DUE 9255792. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

D378
29672

APPROVAL

of a thesis submitted by

Jennifer Lyn Luebeck

This thesis has been read by each member of the thesis 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.

Elisabeth Swanson
Committee Co-Chair

Elisabeth Swanson
(Signature)

5/11/98
Date

Lyle Andersen
Committee Co-Chair

Lyle Andersen
(Signature)

5/14/98
Date

Approved for the Department of Education

Gloria Gregg
Department Head

Gloria Gregg
(Signature)

5/15/98
Date

Approved for the College of Graduate Studies

Joseph J. Fedock
Graduate Dean

Joseph J. Fedock
(Signature)

5/15/98
Date

STATEMENT OF PERMISSION TO USE

In presenting this thesis in partial fulfillment of the requirements for a doctoral degree at Montana State University-Bozeman, I agree that the Library shall make it available to borrowers under rules of the Library. I further agree that copying of this thesis is allowable only for scholarly purposes, consistent with "fair use" as prescribed in the U.S. Copyright Law. Requests for extensive copying or reproduction of this thesis should be referred to University Microfilms International, 300 North Zeeb Road, Ann Arbor, Michigan 48106, to whom I have granted "the exclusive right to reproduce and distribute my dissertation in and from microform along with the non-exclusive right to reproduce and distribute my abstract in any format in whole or in part."

Signature

Jennifer L. Luebeck

Date

5/11/98

ACKNOWLEDGMENTS

I wish to thank the members of my doctoral committee for their patience and support as I worked my way through this process. Special thanks goes to Dr. Leroy Casagrande for the wisdom he dispensed on various ski lifts over two seasons. Carol Thoresen, STEP Evaluator, also provided incredible inspiration and support from the sidelines.

Words are inadequate to thank Micki, Diana, and the rest of the staff at "STEP Central" for their help with transcription, data entry, graphic design and construction of this document. Chocolate may be required.

My fondest regards go out to the many, many teachers in my study, both novice and experienced, who shared their very honest insights and truly made me part of the community of Montana educators. An extra hug goes to Ken Miller, John Graves, and Mike Pierre, the three co-chairs of the ECS Program who kept me "in the loop."

Finally and most importantly, I am indebted to Elisabeth Swanson and Lyle Andersen, directors of the STEP Project and my doctoral committee co-chairs, professors, employers, and friends. The opportunities, funding, and personal support you have provided over five years have allowed me to grow professionally and personally, and have led me to new academic adventures.

TABLE OF CONTENTS

Page

CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW	1
INTRODUCTION	1
PURPOSE OF THE STUDY	4
RELATED QUESTIONS	5
SIGNIFICANCE OF THE STUDY	6
REVIEW OF RELEVANT LITERATURE	8
Rural Isolation and Beginning Teacher Needs	8
Science and Mathematics	11
Teacher Induction and Mentoring Programs	14
Telecommunication	18
MONTANA'S MENTORING NEEDS	24
GOALS OF THE STEP PROJECT	25
DEFINITION OF TERMS	27
SUMMARY	28
CHAPTER 2: DESIGN AND METHODOLOGY	30
INTRODUCTION	30
CONTRIBUTIONS TO THEORY AND PRACTICE	31
BACKGROUND AND SETTING FOR THE STUDY	33
The Early Career Support Program	33
Components of the Early Career Support Program	34
Telecommunication in the Early Career Support Program	35
History of the Early Career Support Program	37
Results from Year One	43
SELECTION OF STUDY PARTICIPANTS	44
Core Group vs. Survey Group	44
Core Group Selection Procedures	45
ROLE AND EXPERIENCE OF THE RESEARCHER	48
METHODS AND PERIODS OF DATA COLLECTION	50
Interviews	50
Formal Interviews	50
Informal Interviews	52

TABLE OF CONTENTS-Continued

	Page
Review of Documents	52
Electronic Mail and Conference Folders	52
Historical Documents	53
Field Research.....	53
Field Observations.....	53
Participant Observer Journal	54
Workshop Notes and Summaries.....	54
Surveys.....	55
ANALYSIS OF DATA	56
Interviews.....	58
Surveys and Other Data Sources	59
Issues of Research Design and Data Reporting.....	60
Reliability.....	60
Validity.....	61
Attrition.....	63
Limitations of the Study.....	64
CHAPTER 3: ANALYSIS OF DATA AND FINDINGS	66
INTRODUCTION	66
DESCRIPTION OF POPULATION AND RESEARCH SUBJECTS.....	68
Overview of Survey Respondents.....	69
Survey #1 (Spring 1997).	69
Survey #2 (Spring 1998).	70
Overview of Core Group Subjects.....	71
Comparison/Contrast of Core Group Subjects.....	71
Comparison/Contrast of Core Group Communities	73
Anonymity and Pseudonyms.....	73
CORE GROUP NOVICE TEACHER PROFILES.....	74
Barb: Elementary Mathematics/Science	75
Wendy: High School Mathematics.....	77
Pamela: Elementary Mathematics/Science.....	78
Catie: Elementary Mathematics/Science	80
Phil: High School Science.....	82
Renee: Middle School Mathematics/Science	85
Paula: Elementary Mathematics/Science	88
Tina: Elementary Mathematics/Science.....	90
Daryl: High School Mathematics.....	92
Reporting of Core Group Data	94

TABLE OF CONTENTS—Continued

	Page
PURPOSE 1: THE NATURE OF THE MENTOR/NOVICE RELATIONSHIP	96
Concerns, Goals, and Expectations of the Novice Teachers	96
Barb.....	97
Wendy.....	98
Pamela.....	98
Catie.....	99
Phil.....	100
Renee.....	101
Paula.....	102
Tina.....	104
Daryl.....	107
First Encounters	108
Relationships Within the Core Group	112
Barb and Tina.....	112
Wendy.....	117
Pamela.....	119
Catie.....	121
Phil.....	123
Renee.....	125
Paula.....	127
Daryl.....	129
Summary of Core Group Attrition.....	131
"Second-Year Syndrome"	132
Frequency of Contact.....	133
Categories of Mentor/Novice Communication	135
Curriculum and Content.....	136
Validation.....	139
Classroom and School Issues.....	140
Moral Support.....	141
Social Talk.....	145
Survey Results.....	145
Shifting Balances in Communication.....	146
PURPOSE 2: INFLUENCE ON MATHEMATICS AND SCIENCE TEACHING	149
Mentor Impact on Mathematics and Science Teaching	149
Materials and Activities.....	150
Special Units and Projects.....	151
Resources.....	151
Classroom and Student Concerns.....	152
Curriculum Design.....	153
Teaching Practices.....	154
Models of Instruction.....	155
"None of the Above."	156

TABLE OF CONTENTS—Continued

Page

ECS Program Impact on Mathematics and Science Teaching.....	157
PURPOSE 3: MENTORING VIA TELECOMMUNICATION.....	160
Metnet Documentation.....	161
Core Group: Metnet Experiences.....	166
Sophisticated Users: Barb, Tina, and Catie.....	167
Optimistic: Pamela and Paula.....	169
Disenchanted: Wendy and Renee.....	170
Uninitiated: Phil and Daryl.....	172
Summary of Metnet Use.....	173
Use of ECS Program Conference Folders.....	175
Advantages of Telecommunication.....	177
Disadvantages of Telecommunication.....	180
PURPOSE 4: EFFECTS OF MENTORING ON ATTITUDE AND PROFESSIONAL GROWTH	183
Areas Supporting Professional Growth.....	184
Confidence.....	184
Encouragement.....	184
Enthusiasm.....	185
Sense of Community.....	186
Validation.....	187
Parallel Thoughts from Mentors.....	188
Program Satisfaction	189
RELATED FINDINGS: SURROGATE MENTORS	190
SUMMARY.....	193
CHAPTER 4: IMPLICATIONS, DISCUSSION; AND RECOMMENDATIONS.....	194
INTRODUCTION	194
SUMMARY FRAMEWORK AND IMPLICATIONS.....	195
A Framework for Broad-Based Distance Mentoring.....	196
Level One: Mentor Preparation.....	199
Level Two: The Many and the One.....	200
Level Three: Support Mechanisms.....	201
The Novice-Mentor Relationship	203
Mode and Frequency of Contact.....	203
Predictors of Compatibility.....	203
Importance of Personal Contact.....	204
Need for Mentor Flexibility.....	205
Partnerships in Stasis.....	206
Benefits of Group Dynamics.....	207
Duration of the Relationship.....	207

TABLE OF CONTENTS-Continued

	Page
Mathematics and Science Teaching.....	208
Modeling Good Practice.....	208
Knowledge vs. Implementation.....	209
Long-Term vs. Day-to-Day Needs.....	209
Limited Follow-Up by Mentors.....	210
Telecommunication as a Mentoring Tool.....	211
Ineffective Use Patterns.....	211
"Gateway" Obstacles.....	211
Minimal Conferencing.....	212
High User Satisfaction.....	213
Telecommunication Promotes Reflection.....	213
Mentoring Benefits to Professional Growth.....	214
Self-Assurance in Teaching.....	214
The Community of Practitioners.....	214
Effects on Mentors.....	215
RECOMMENDATIONS FOR PRACTICE.....	215
Generalizability of Recommendations.....	216
Recommendations: Mentoring Relationships.....	216
Facilitate Earlier Matches.....	216
Match Content and Grade Level.....	217
Encourage Personal Encounters.....	218
Strengthen Mentor Involvement.....	219
Remain Flexible Regarding Mismatches.....	219
Support the Community of Practitioners.....	220
Consider "Second Year Syndrome".....	220
Recommendations: Telecommunication.....	223
Encourage and Support Use.....	223
Provide Timely Training.....	223
Structure Conference Folders by Topic.....	223
Motivate Meaningful Discussion.....	225
Summary of Recommendations.....	226
Mid-Study Technology Improvements.....	227
RECOMMENDATIONS FOR RESEARCH.....	228
Focus on Telecommunication.....	228
Investigate the Surrogate Mentor.....	229
Compare Mentor Training to Mentor Practice.....	229
Include Performance Assessment and External Reporting.....	230
Consider the Time Factor.....	231
Examine What Novices Bring to the Setting.....	231
Study Effects of Setting and Attitude on Novice Success.....	232
CONCLUDING STATEMENT.....	232

TABLE OF CONTENTS—Continued

	Page
REFERENCES CITED	236
APPENDICES.....	242
APPENDIX A: DESIGN AND ANALYSIS DOCUMENTS.....	243
Research Time Line.....	244
Research Questions/Data Collection Methods.....	245
HyperResearch™ Coding Sample for Pamela.....	247
APPENDIX B: FORMS AND PROTOCOLS	250
Memorandum Of Understanding And Permission Statement	251
Introductory Interview: Novices.....	252
Introductory Interview: Mentors	254
Interview #2: Novices	256
Interview #2: Mentors	258
Interview #3: Novices	260
Interview #3: Mentors	262
Novice/Mentor Survey.....	264
APPENDIX C: ECSP WORKSHOP PROGRAMS	268
Billings, November 16-18, 1995.....	269
Great Falls, April 18-20, 1997.....	270

LIST OF TABLES

	Page
Table 1: Novice Teacher Experience Upon ECS Program Enrollment.....	42
Table 2: 1997 Survey Respondents by Gender and Program Experience.....	69
Table 3: 1997 Survey Respondents by Grade Level and School Size.....	70
Table 4: 1998 Survey Respondents by Gender and Program Experience.....	71
Table 5: 1998 Survey Respondents by Grade Level and School Size.....	71
Table 6: Prior Experience of Core Group Novices.....	74
Table 7: First Encounters Within the Core Group.....	108
Table 8: Frequency of Contact Between Core Group Partners.....	134
Table 9: Frequency of Non-Metnet Contacts (Novices).....	134
Table 10: All-Purpose Metnet Use by Novices.....	135
Table 11: Topics Discussed by Mentor Partners (1997 Survey)	146
Table 12: Sample Tally of Metnet Exchanges (Paula and Mentor).....	162
Table 13: History of Metnet Use Within Core Group	165
Table 14: Metnet Use by Rural Novice Teachers (1997).....	165
Table 15: Metnet Use by Rural Novice Teachers (1998).....	166
Table 16: Advantages of Telecommunication.....	179
Table 17: Most Beneficial Components of ECS Program.....	190

LIST OF FIGURES

	Page
Figure 1: Metnet Window and Desktop Samples.....	36
Figure 2: Sample Postings to Early Career Folder	37
Figure 3: Sample Metnet Exchange–Curriculum and Content	138
Figure 4: Sample Metnet Exchange–Moral Support.....	143
Figure 5: Catie’s Conversations–Metnet Excerpts.....	147
Figure 6: Internal Framework for an Effective Distance-Based Mentoring Program in Mathematics and Science.....	198

ABSTRACT

Rural educators face unique professional challenges and limitations. This study investigated the effectiveness of an innovative distance-mediated mentoring program for rural novice mathematics and science teachers. Four purposes were pursued: 1) characterize and document the nature and development of the mentor-novice relationship; 2) describe how discourse influenced the novice teachers' perceptions about mathematics and science teaching; 3) determine whether telecommunication effectively supported a distance-mediated mentoring relationship for novice rural teachers; and 4) investigate program effects on novice teachers' attitudes, concerns, and professional growth.

A qualitative research design was implemented during academic years 1996-98. Primary data collection focused on nine rural novice teachers and their mentors and included three sets of interviews spanning three semesters, field observation of classrooms, schools, and communities, and analysis of electronic mail messages over a four-month period. Supporting data were collected during observation of workshops and training sessions, and through surveys administered to all program participants in early 1997 and 1998.

Categories of mentor-novice communication were identified: curriculum and content, validation of teaching practice, classroom and school issues, moral support, and social talk. Impact on mathematics and science teaching was accomplished by: sharing materials and activities; planning units and projects; locating resources; classroom and student concerns; long-range curriculum design; and improvement of teaching practices. Professional growth (for both novices and mentors) occurred through individual contact with partners and interaction within the larger mentoring community in both face-to-face and on-line venues. Telecommunication was highly valued by successful users. Technical difficulty curtailed access for a significant number of teachers, but they maintained successful relationships via telephone, mail, and meetings.

Recommendations include: 1) consider subject and grade level, teaching responsibilities, and school size and setting when matching partners; 2) encourage early face-to-face encounters; 3) educate mentors to perceive novice needs and monitor intervention outcomes; 4) limit structured support to two years and/or implement ongoing evaluation based on systematically increasing expectations; 5) support a telecommunication component with early and repeated user training and remediation as well as provision of alternative modes; and 6) design specific, structured on-line conference folders and activities to motivate meaningful participation by novice and mentor teachers.

CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

Introduction

Rural educators face unique challenges and limitations in terms of time, resources, and professional growth. For several years, educational researchers have been investigating the needs of beginning rural teachers and factors which contribute to the professional isolation of teachers in rural settings (Carlsen & Monk, 1992; Davis, 1987; Lemke, 1994; Reed & Seyfarth, 1984; Veenman, 1984). In response to their findings, a variety of programs and experiments have been initiated in the past decade in an attempt to enhance the professional development of rural teachers. A substantial number of those programs have explored the use of mentoring partnerships (Hersh, Snyder & Stroot, 1993; Schatzman, 1995) and, more recently, the use of various telecommunication environments for professional exchange (Kellogg, 1996; Muscella & DiMauro, 1995; Rogan, 1997). The body of knowledge documenting the implementation and success of beginning teacher induction programs, mentoring relationships, and computer networks which affect rural teachers is growing steadily.

To attend to the special problems created by vast distances, isolated communities, and small school enrollments, telecommunication has been introduced as a way to connect beginning teachers with appropriate mentors who may be separated by hundreds of miles and several hours of travel. Such a *distance-mediated* mentoring program was initiated in Montana in Spring 1995 by the Systemic Teacher Excellence Preparation (STEP) Project, a National Science Foundation-funded Collaborative for Excellence in Teacher Preparation (CETP) which was designed to produce broad changes in the teaching of mathematics and science throughout Montana. The Early Career Support Program (or ECS Program) was one component of STEP's five-year commitment to nurture teachers through the years spanning the teacher training process as well as through the first years of career experience:

The Early Career Support Component of STEP is perhaps the most exciting piece of the STEP [P]roject in that it allows teachers in the field who have a vast experiential base to directly impact the thinking and teaching of teachers early in their careers. Through the mentor/early career relationship people learn from each other as they quickly discover that each brings an exciting perspective to the partnership. (Graves, 1996, p. E-4)

Numerous benefits of mentoring such as provision of products and materials, improved self-perception, and enhanced professional growth have been documented through research and are described in the review of literature later in this chapter. Successful mentoring has been associated with contributing factors such as time to meet, proximity of classrooms, and similar assignments of grade level and content area (Wildman, Magliaro, R.

A. Niles, & J. A. Niles, 1992). The introduction of a distance-mediated mentoring model opens a new avenue of inquiry: Can the benefits of site-based mentoring be preserved or even enhanced in a setting where novice teachers and their mentors are separated by distance?

Trade-offs in quality and opportunity are inevitable in the shift from a site-based to a distance-mediated mentoring model. For example, distance-mediated mentoring affords rural teachers a greater opportunity to connect with experts in similar subject and grade level areas. An off-site mentor can discount school politics and add objective external perspective when reacting to a novice teacher's concerns. Networking experiments have shown that trust and warmth are not necessarily sacrificed in a distance-mediated setting, and the inclusion of a telecommunication component widens the window of opportunity for interaction. However, distance-mediated mentoring necessarily falls short in its ability to help novice teachers with school and classroom specifics, and may require adaptations to support elements of the teaching process that are easily dealt with through face-to-face contact and observation.

Research results indicate that "Mentoring in some cases has proven to be a less than ideal reform tactic, especially when programs have been implemented with too little conceptual understanding of mentoring, unrealistic expectations, and poorly thought out implementation strategies" (Wildman & Magliaro et al., 1992, p. 205). To defend against such possibilities,

the STEP Project's Early Career Support Program was crafted around a nationally-respected mentor training curriculum and was modestly implemented until its effectiveness and potential for growth were evident. This study sought to assess the effectiveness of distance-mediated mentoring against the standards set by previous research on site-based mentoring programs. As the study progressed, those standards were refined by identifying and incorporating the study participants' own perceptions of effective mentoring.

Purpose of the Study

The purpose of the study was to investigate the effectiveness of a distance-mediated mentoring program for rural mathematics and science teachers in Montana. Special attention was paid to the development and maintenance of the mentoring relationship and to the application and perceived value of the program's telecommunication component. To achieve these ends, data was collected, analyzed, and interpreted in order to:

1. Characterize and document the nature and development of the relationships established between mentors and beginning rural teachers in a distance-mediated mentoring program.
2. Describe how discourse between mentors and beginning rural teachers in a distance-mediated mentoring program influenced the beginning teachers' perceptions about mathematics and science teaching.

3. Determine whether telecommunication effectively supported a distance-mediated mentoring relationship for beginning rural teachers.
4. Investigate the overall effects of the distance-mediated mentoring relationship on beginning rural teachers' attitudes and concerns about teaching, as well as their professional growth and development.

Related Questions

The following questions were investigated in relation to the Montana STEP Project's Early Career Support Program as a prototype distance-mediated mentoring program:

1. What were the nature and frequency of the exchanges and discourse that were part of the mentoring relationship?
2. In what ways did the mentoring relationship change over the course of the academic year?
3. How did the mentors attempt to meet the needs and alleviate the concerns of the beginning teachers during the academic year?
4. In what ways did the mentors and beginning teachers exchange ideas and materials related to mathematics and science teaching?
5. How were shared ideas and materials related to mathematics and science teaching incorporated by the beginning teachers?
6. Did the mentor teachers follow up on science and mathematics teaching ideas and materials which they shared with beginning teachers?

7. How was telecommunication used to maintain and strengthen the mentoring relationship?
8. How often did the mentors and beginning teachers exchange electronic mail? Access bulletin boards? Obtain on-line materials?
9. What changes occurred in the attitudes of both beginning teachers and mentors toward telecommunication during the academic year?
10. Were the beginning teachers satisfied with telecommunication-based mentoring? (Did they feel "mentored"?)
11. What were the initial concerns of beginning teachers, and how did they change as the year progressed?
12. In what ways did the beginning teachers evidence professional growth attributable to mentoring during the academic year?

Significance of the Study

Beginning teachers without support may become disillusioned and overstressed; their reaction is often to retreat to the safer ground of authoritarian teaching methods and teacher-centered instruction (Odell, 1990, p. 15). When this happens, students are denied the experiences derived from reform mathematics and science instruction (e.g. cooperative group work, hands-on experiences, and learning through discovery). Such constrained teaching situations are only compounded by high teacher turnover. If new teachers arrive every few years in a small school, the students who pass

through their classes may never benefit from the creative additions to curriculum and varied teaching strategies that proliferate in direct proportion to a teacher's growing sense of familiarity and confidence in the classroom.

Odell offered three main goals of mentorship: to provide guidance "so as to promote the professional development of beginning teachers" (p. 16); to provide support and information "so as to reduce the concerns of beginning teachers" (p. 17); and "to increase, through mentoring, the retention of beginning teachers" (p. 17). She added that:

It is not extreme to conclude that if the realities of beginning teaching are not dealt with constructively, and if beginning teachers are not appropriately supported and encouraged when they are most vulnerable, we risk having beginning teachers revert to less effective teaching methodologies. We also risk having promising new teachers leave the profession. (1990, p. 15)

The findings of this study add to the knowledge base regarding mentoring programs nationwide, particularly those for rural teachers. Through the use of telecommunication and distance-mediated mentoring, STEP's Early Career Support Program addressed each of the factors limiting rural professional development as defined by the Northwest Regional Educational Laboratory: geographic isolation, professional isolation, community attitude, time, fiscal resources, and irrelevant opportunities (Miller, 1991, pp. 5-6). If shown to be successful in enriching, motivating, and retaining rural mathematics and science teachers, the ECS Program can serve as a prototype for other programs that provide mentoring for new teachers in

school districts where resources (both human and financial) do not allow for an in-district mentoring program.

Review of Relevant Literature

The STEP Project's support program for beginning Montana mathematics and science teachers blended mentorship, telecommunication, and rural teaching issues in a unique and innovative combination. An extensive search of the literature unearthed virtually no research on programs that have addressed all of these areas simultaneously; however, numerous studies have been conducted in each of the areas individually and are summarized here.

Rural Isolation and Beginning Teacher Needs

Enochs (1988) characterized the rural community by its "relatively small size, remoteness from urban service centers, and a non-industrial economy" (p. 2). He qualified this definition by noting that due to consolidation a remote rural school may have a relatively large student population, and that schools with small enrollments may be located close to major cities. In a 1994 report on rural schools for the Department of Education, Stern adopted the U.S. Census Bureau definition of "rural" areas as places in open country outside urbanized areas, or in communities of less than 2,500 residents, or where population density is less than 1,000 residents per square mile. By that definition, all of Montana, save for a handful of

cities and their environs, can be classified as rural. And within Montana and states with similar population density, there exist regions where isolation is far more extreme than Stern's definition implies.

Teaching in a rural school can have many positive implications. After a review of literature, Lemke (1994) determined that most rural teachers are "home-grown," having been raised near where they later teach. She went on to list several benefits of rural teaching: small class sizes, more personal relationships with students, greater potential for individualized instruction, increased student and parent participation, and greater teacher impact on decision making. However, difficulties are also inherent to rural teaching, many of them arising from the concept of isolation.

Aspects of isolation in rural schools have been identified and categorized in a variety of ways. Davis (1987) collected information from over 600 teachers in rural regions of Ontario and Australia. He was able to identify three sub-categories of isolation: (a) social isolation, which implies separation from family and friends; (b) cultural isolation, or the absence of movies, plays, concerts, and sports events; and (c) professional isolation, which prevents teachers from sharing experiences and learning from each other (pp. 12-13). He also discovered that isolation is not necessarily a direct consequence of rurality; some teachers did not perceive themselves as isolated although they taught in rural areas.

Rural teachers, whether they feel isolated or not, can be overwhelmed by the needs and expectations of the community. In an interview study of 24 newly appointed rural teachers in Australia, Gibson (1994) discovered that 79% of them were concerned with problems arising from community situations. Gibson recommended further effort on the part of induction programs:

Create within these teachers an awareness of community dynamics that influence the teaching-learning environment. . . . The expectations of stakeholder groups may be of great importance to the preparation of teachers unfamiliar with rural communities and the role of the teacher in those communities. (p. 74)

In 1991, the Northwest Regional Educational Laboratory conducted a survey of nearly 100 teachers, parents, and other education-connected individuals in an attempt to define professional isolation issues for small, rural schools. In his summary of the findings, Miller listed six factors limiting professional renewal for rural teachers:

1. Geographic Isolation: Thirty or more miles to another school, institution of higher education or other sites providing opportunities for professional renewal.
2. Professional Isolation: The lack of opportunity to share and interact with peers.
3. Community Attitude: Community attitudes and beliefs appear unfavorable toward professional development activities during school hours.
4. Time: Demands on time outweigh available time.
5. Fiscal Resources: Limited or non-existent financial resources for supporting professional growth opportunities.
6. Irrelevant Opportunities: Professional opportunities do not match the personal or instructional needs of rural educators. (1991, pp. 5-6)

Stone (1990) cited social, cultural, geographic, and professional isolation as the most common reasons that teachers leave rural positions. She also cited the demands of "rural reality" as defeating for teachers: examples include teaching multiple subjects in multi-grade classrooms, being expected to prescribe education programs for special needs students, and leading extracurricular activities.

The difficulties inherent in rural teaching are particularly acute for new teachers because they lack both experience and resources. Although findings regarding beginning teacher needs vary somewhat, areas of universal deficiency include classroom management and discipline, contact with others beyond the classroom, availability and adequacy of teaching materials, working with individual and exceptional students, and other issues related to motivation and self-improvement (Reed & Seyfarth, 1984; Veenman, 1984).

Science and Mathematics

Science and mathematics teachers face unique obstacles in providing instruction for rural students. In a comparative study of rural and nonrural science teachers in Texas, researchers analyzed a 100-item survey returned by 183 science teachers in 39 counties. Both the rural and nonrural groups listed similar areas of greatest need: "'identify free instructional materials,' 'motivate students to learn science,' 'use hands-on teaching methods,' 'learn about science career opportunities,' and 'use computers for science

instruction''' (Ogden, Horn, & Chao, 1994, p. 22). The rural teachers in the sample expressed a significantly higher need for more collegial interactions and ways to alleviate the burden of multiple class preparations.

Nationally, rural science teachers differ significantly from their more urban colleagues in terms of preparation. Carlson and Monk (1992) examined data produced by the Longitudinal Study of American Youth, which included 456 middle and secondary science teachers from 93 schools. Through t-tests and multivariate analysis they concluded that rural science teachers took fewer science and science methods courses and were more likely to have majored in education but less likely to have majored in a science field, conditions which indicate an increased need for mentoring support.

Sunal (1991) felt there was a lack of research examining how variables in rural science education affect student science achievement (p. 202). His own study involved 105 science teachers representing rural portions of an Appalachian state. His three-part data collection package included a survey about school and classroom conditions, a questionnaire investigating teachers' perceptions and evaluation of the science program in their schools, and interviews and site visits to a subgroup of participants. He found that:

Teachers in small schools identified a need for inservice programs which would enable them to get together with other teachers both within the county system and regionally to share ideas. Other needs identified were free materials workshops and laboratory activity related workshops. Nearly one-third of teachers in small schools commented on a need to relieve the isolation they often felt since typically there were no other teachers in a particular specialization, such as chemistry, in their school. (1991, p. 206)

By quantifying his results, Sunal was able to correlate teacher and school variables with science achievement among rural school students as measured by the Comprehensive Test of Basic Skills (CTBS). At the ninth grade level, he found a significant positive relationship ($p < .05$) between CTBS scores and a group of school and classroom variables which included (a) availability of certified teachers with science majors and (b) opportunities for teachers to interact professionally with their peers.

Literature on the limited resources and program deficiencies faced by rural science teachers is more accessible than is data specifically referencing rural mathematics teaching. Mathematics teachers do have unique professional needs: they must be familiar with alternative methods of instruction and assessment; able to represent mathematical ideas using manipulatives and technology as well as paper and pencil; and able to create a variety of learning environments to suit the ages and abilities of their students. The National Council of Teachers of Mathematics recommended that "Teachers should be able to turn to colleagues for information concerning any aspect of mathematics education in order to expand their views of mathematics, their resources for teaching, and their repertoire of teaching and learning skills" (1991, p. 169). In a rural setting, such colleagues may be few and far between.

Teacher Induction and Mentoring Programs

Teacher induction is the term generally used to describe entry into the teaching field and the support that is planned for new teachers entering the profession (Veenman, 1984, p. 165). Zetler and Spuhler defined induction as a set of procedures "the collective intent of which is to facilitate the pace and quality of the new teacher's development into a competent practicing professional" (1997, p. 3). Teacher induction programs typically have included the provision of paperwork about regulations and procedures, early orientation visits, attendance at beginning teacher groups, special conferences and workshops, and partnership with experienced teachers (Veenman, 1984, p. 165).

Hersh et al. (1993) listed five goals that are often addressed by induction programs: (a) the improvement of teaching performance; (b) increased retention of promising beginning teachers during the induction years; (c) promoting the personal and professional well-being of beginning teachers by improving teachers' attitudes toward themselves and the profession; (d) satisfying mandated requirements related to induction and certification; and (e) the transmission of the culture of the system to beginning teachers (p. 3). Hersh gave special emphasis to mentoring, noting that "Those teachers who are involved in a mentoring program are more likely to stay" (p. 3). Zetler and Spuhler (1997) agreed that while mentoring is not the only form of

induction, their study found it to be the single best form of assistance a district can provide for its new teachers.

Mentoring plays a role in new teacher retention. Montana's Office of Public Instruction does not monitor retention rates or keep other statistics related to teacher turnover among new teachers in the state. However, at the national level, researchers estimate beginning teacher attrition at 30 percent within the first two years of teaching, and ranging from 40 to 50 percent within five years (Odell, 1990; Odell & Ferraro, 1992). Following a four-year retrospective study of teachers who received mentoring during their first year, Odell and Ferraro found that "only four percent of those teachers had left the profession each year" (p. 200). This rate paralleled the annual attrition rate of 4.1% for teachers at all experience levels nationwide, and implied a five-year attrition rate which was roughly half that for beginning teachers in general. "This suggests that mentoring may have reduced the high attrition rate typically found for beginning teachers to the lower attrition rate usually found for more experienced teachers" (Odell & Ferraro, p. 203).

Beginning teachers receive multiple benefits from experienced teachers' ability to interpret classroom situations and modify educational decisions. Experienced teachers, for instance, display decision-making skills that are lacking in novice teachers. In a comparative study, Westerman (1991) found that where expert teachers related new information to prior learning, assessed student understanding, and set the stage for new learning, "Novices

did little to relate present learning to past or future learning" (p. 297). She also found that novice teachers took curriculum guidelines much more literally than their expert counterparts, and demonstrated less flexibility in lessons: "The narrow focus of their planning, based almost solely on the curriculum objectives, seemed to limit what went on in the classroom" (p. 299).

In a study of 39 first-year teachers who graduated from three different teacher education programs at Harvard University, Merseth (1991) learned that "Although researchers know that first-year teachers have similar concerns, novices often do not know this. They frequently believe that they are the only ones with discipline or management questions or worries about student motivation" (p. 144). The existence of a mentor provides both an awareness of the bigger picture and an emotional outlet:

The chance to interact with a colleague by asking questions, sharing materials, or planning collaboratively has other benefits of an emotional nature. The beginning teachers sense this support from the helping or nurturing attitudes of their colleagues and depend upon it to get them through those first, difficult, lonely months. (Wildman, Niles, Magliaro, McLaughlin, & Drill, 1987, p. 12)

Mentors receive reciprocal benefits from partnership with a beginning teacher. Hofmann & Feldlaufer found that adopting the mentoring role can improve teachers' perceptions of themselves as professionals and improve their own instructional skills (1992, p. 101). In their study of a Connecticut mentoring program, they determined that teacher professionalism was enhanced through collegial relationships, the support of new teachers, and

promoting and maintaining professional standards. Mentor teachers in the study cited professional growth opportunities as having a major impact on their self-perceptions and improvement of instruction (pp. 102-103). These responses are similar to those of Ohio mentor teachers studied by Hersh et al., who noted an increased sense of confidence and professionalism even as they helped beginning teachers improve their instructional and management techniques (1993, p. 11). Mentoring has been shown to influence professional growth in novice teachers; one purpose of this study was to determine whether distance-mediated mentoring can achieve the same goal.

The role of the mentor teacher is flexible and many-faceted. Mentors should encourage new teachers to reflect on their teaching; they should be able to share materials, serve as a sounding board, observe their colleagues in the classroom and provide feedback that will link theory to practice and encourage reflection. "They must help new teachers see the interdependence of good instruction and classroom management" (Shulman, 1989, p. 6).

Wildman & Magliaro et al. (1992) analyzed the responses of 150 mentor teachers who were asked to describe their activities. They identified six categories of direct assistance: (a) encourage reflection; (b) direct and support novices' actions and plans; (c) provide direct assistance in developing a process, policy, or product; (d) provide a menu of information and products for the novice's possible use or modification; (e) provide products and ideas that enable the novice to solve a problem; and (f) encourage and support the

novice teacher (pp. 208-9). The mentor teachers also listed contextual factors which influenced the success of the mentoring relationship. The three factors they considered most critical were time to meet, proximity of classrooms, and similar assignments of grade level and content area (1992, p. 210). For a rural teacher, proximity may be impossible; it remains to find a way to match rural novices with mentors teaching similar grade levels and/or content areas, using a medium that is flexible in terms of time.

Telecommunication

In an isolated rural school, the nearest colleague with strengths in a beginning teacher's areas of concern regarding content area and grade level may be many miles away. Involving beginning rural teachers in a mentoring relationship with an experienced teacher in a similar setting is now feasible using telecommunication, even if the two teachers and their classrooms are separated by hundreds of miles.

As telecommunication networks offering electronic mail, bulletin boards, and real-time conferencing become ever more accessible, they increase the potential for effective interactions between teachers in various settings. Besides its ability to link sites that may be separated by hundreds of miles, computer conferencing offers other advantages. One of its greatest benefits is *asynchronous* communication, which gives teachers the freedom to interact at any time of day or night and the ability to save items for further consideration and elaboration at a later time (Clarken, 1993). Interviews

conducted in a study of thirty-nine beginning teachers revealed that the 24-hour availability of the computer was considered a benefit by the beginning teachers. "No matter when the beginner logged on to the system, there usually were messages from other participants. One participant noted, 'It's easier to schedule the computer, which is significant. I can do it at 3:00 a.m if I want'" (Merseth, 1991, p. 144). In another study, student teachers who used a communication network revealed that the most popular usage hours were from 8:00 p.m. to 12:00 midnight (Thompson & Hamilton, 1991, p. 6).

Clarcken (1993) found that on-line conferencing also engendered a decreased emphasis on the social or political aspects of a discussion in favor of greater emphasis on what was being said. Because it released the conversants from social and political constraints, telecommunication provided a safe forum for the exchange of personal feelings and frustrations. From her study of beginning teachers, Merseth (1991) concluded that privacy and confidentiality were important factors in using a computer network. One of the respondents in her follow-up interviews wrote that "You could ask questions that you wouldn't ask at your school. It might be too inflammatory. What do you do if the department head's a jerk? You can't really ask that at school" (1991, p. 145).

According to Murphy, Merseth, and Morey (1990), two specific features set electronic network support apart from more traditional forms of new teacher assistance: first, "all the participants give advice to each other" (p. 35),

promoting a professional development model that defines the help-giver as a collection of individuals rather than one person; and second, much of the advice comes from "colleagues of equal status, negating much of the expert-novice interaction" (p. 35). Although they recognized the importance of assisting new teachers with specific site-based needs, Murphy et al. found that a computer network, by its collective nature, can also address local concerns:

This local detachment, combined with multiple perspectives of different individuals from diverse subject matter fields, generalizes the specific incident or situation to a higher level of abstraction. . . . [This] seems to foster the ability of novices to perceive more broadly and more generally, helping them gain perspectives on their own teaching and on the teaching of others. (p. 35)

Communication by computer network lends itself to thoughtful expression and thereby stimulates beginning teachers' reflection skills (Cadigan, 1993, p. 33). Concisely presenting a problem to other network participants requires making decisions about which aspects of the problem are most important. Teachers in Merseeth's Harvard University project noted that they received fresh insight through the process of reflecting on ideas and experiences that they wanted to communicate in writing (1992, p. 680).

Overall, the research on computer networks for teachers indicates positive results. Merseeth (1992) found that communication among teachers via computer networks provided benefits such as: readily available resources; an atmosphere of collegiality, support, and shared professional growth; improved reflection skills; and an awareness that problems are shared by

others. McMahon (1997) also listed several benefits of network-based professional development:

(1) supporting group discussion, (2) accommodating teachers' busy schedules, (3) integrating professional development with classroom practice, (4) supporting ongoing reflective dialogue, (5) reducing isolation, and (6) doing all of this while increasing teachers' familiarity with new technologies. (p. 14)

Research has also revealed some perceived disadvantages of networking. In a distance learning experiment which involved student teachers from a rural education program, some participants found it difficult to express and understand feelings and ideas in writing. The most commonly cited disadvantage was a lack of nonverbal feedback and the other supports that normally occur in face-to-face discussions. On a more technical level, the participants experienced trouble using the associated computers and technology (Clarcken, 1993).

McMahon (1997) similarly identified technical drawbacks to telecommunication. She used questionnaires, exit interviews, and content analysis of on-line exchanges to monitor the attitudes of 35 teachers involved in three eight-week on-line courses. McMahon concluded that "network-based professional development is far from reaching its potential" (p. 13) and listed such technical obstacles as hardware and software problems, use of technology, and competition for connection time. She observed:

While an overarching goal of many on-line initiatives is to encourage professional relationships between teachers that support reflective conversations and improved practice, not enough is known about what enhances or gets in the way of these relationships. For network-

based professional development to be a viable option, the conditions that challenge and enhance effective participation need to be understood—from the user's perspective. (1997, p. 1)

Thompson and Hamilton (1991) concluded that initially, teachers tended to use telecommunication for their own personal needs. A study of LabNet, a computer network designed for high school science teachers, supported this finding. A group researching the effectiveness of the network divided the professional discourse of LabNet participants into two categories:

Network dialogues in the teaching activities category are those directly related to classroom work—for example, a conversation between two teachers whose classes are collaborating on a project. Teachers also spend much time “talking shop”—gathering information about science activities and teaching aids, improving technological expertise, and seeking additional financial and technological resources. (Ruopp, Pfister, Drayton, & Gal, 1993, p. 12)

In a later study of the LabNet experience, Muscella and DiMauro (1995) emphasized the importance of meaningful dialogue to promote professional development via telecommunication: “Its purposeful use seems well-suited in fostering meaningful learning for teachers” (p. 1). They went on to list ways in which telecommunication can offer new vehicles for professional development: “Support substantive and reflective conversations; have a particular focus (i.e. writing, science, school change, reflection on practice); create an environment that fosters collegueship; and put teachers at the helm of their own professional development” (p. 3).

The results of studies of beginning teachers indicate that, although computer networking has been effective in providing moral support and reducing feelings of isolation, the ability of the network to offer support for teaching processes (e.g. management techniques, curriculum and lesson planning) has been less effective (Clarcken, 1993, p. 11; Merseth, 1991, p. 145). Based on her findings with beginning teacher networks, Merseth speculated that this lack of formal teaching support may be due to the predominance of beginning teachers over experienced teachers using the network. She suggested that further research on linking beginning teachers with experienced teachers would be productive, and might reveal different supportive capacities for a network (1991, p. 146).

If telecommunication is to become an essential component of teacher mentoring programs, it is important to know how teachers use the medium, particularly specific populations such as science and mathematics teachers, rural teachers, and beginning teachers. Thompson and Hamilton called for "further research . . . to address the specific uses of the system and the contributions of these experiences to the effectiveness of the classroom teacher" (1991, p. 10).

In a review of key topics for future research on the role of computer networks in rural education, Gal (1993) referred to factors that influenced rural teachers in particular: isolation; resistance to change within the school; limited resources; lack of professional development; and the need for a

community of practice. He recommended research to investigate "the purposeful use of the network in the specific rural context. . . . What are the unique features of rural teaching, and how do telecommunication networks best apply to those features?" (1993, p. 42).

Montana's Mentoring Needs

In 1992, the Montana Certification Standards and Practices Advisory Council (CSPAC) began a three-year effort to research the effects of mentoring on new teachers' performance and attitudes. The project resulted in the publication of a manual to assist school districts and administrators in setting up mentoring programs for teachers within their districts. In the CSPAC model, veteran and beginning teachers in the same district were matched without regard for content area or grade level, and no mentor training was provided. This project represented Montana's only effort to implement a mentoring program at a statewide level prior to the initiation of the Early Career Support Program by the STEP Project. The designers and researchers of the CSPAC model, which is now inactive, showed the "overwhelmingly positive effect that mentoring can have in easing the transition from college to teaching, [and] in starting the development of a competent professional" (Zetler & Spuhler, 1997, p. 1). The STEP Project carried the mentoring model in Montana several steps further, with a strong conceptual framework, formal mentor training, and a structured implementation program.

Goals of the STEP Project

The Montana STEP Project, initiated in 1993, influenced the preparation of mathematics and science teachers from their undergraduate coursework through their first years of teaching. One of the three original Collaboratives for Excellence in Teacher Preparation (CETP) funded by the National Science Foundation (NSF), STEP served as a national model for statewide collaboration between institutions spanning the K-16 spectrum. The Montana collaborative included the state's university system, the tribal college system, and numerous K-12 schools and districts, with support from professional organizations, education leaders, and other grant-funded projects.

STEP's five-year effort to reform teacher preparation in mathematics and science followed a sequence similar to that followed by a new teacher preparing for and embarking on a career in education. The first strand, which was given priority during the first three years of the project, focused on undergraduate course reform, with an emphasis on revising content and methods courses in mathematics and science for K-12 preservice teachers. A second strand initiated in Year Two of the project addressed the student teaching field experience; the focus was on identifying and promoting a number of model school sites with exemplary mathematics and science programs and teachers. In Years Three and Four, K-12 model site educators

continued to develop their programs, working in partnership with university professors and placement officers to recruit student teachers to their sites.

The third strand of the STEP Project's teacher preparation agenda sought to provide mentoring and a supportive professional environment for beginning science, mathematics, and elementary teachers, particularly those in rural areas. The Early Career Support Program was designed and implemented to meet this goal. Its focus on beginning rural teachers prompted a creative blend of program components which combined formal training for mentors, modeling of science and mathematics content and practice, productive use of telecommunication, and a sensitivity to rural education issues. Three of STEP's guiding project goals were directly related to the Early Career Support Program:

- provide early career support for mathematics and science teachers in a rural setting during their first years of service;
- use Montana's extensive telecommunications network as a key component in the development of teacher preparation models for rural schools; and
- design, implement, evaluate and disseminate new ideas in preparing mathematics and science teachers at all levels.

The fourth and final strand of the STEP Project was threaded through the other three: Recruit and retain women and minorities, particularly Native Americans, in the mathematics and science teaching fields. This

effort was evidenced in part by the choice of Indian reservations for two of the model school sites and by the creation of a scholarship program which heavily supported Native American students pursuing education degrees. In 1997-98, at least ten percent of the mentors and novice teachers in the ECS Program taught in a Native American setting.

Definition of Terms

Research in the area of rural teaching and mentorship does not call for command of a technical vocabulary; however, several familiar terms do require clarification in the context of the STEP Project's Early Career Support Program and this study.

1. *Novice teacher*: a beginning teacher in the first five years of professional experience; also referred to in the research as an early career teacher or an inductee. The term "novice" will be used from this point forward.
2. *Mentor teacher*: an experienced teacher (five or more years of classroom experience) with demonstrated qualities of educational leadership and a strong background in mathematics and science instruction. The mentor's role is that of an advisor or sponsor who offers insight, guidance, and support to his or her protege (Odell, 1990, p. 6).
3. *Rural*: in relation to more populous areas of the United States, every Montana community could be considered rural. For the purposes of this

study, a rural school is defined to mean a school serving a rural district or a community with fewer than 2,500 inhabitants.

4. *Telecommunication*: in regard to mentoring, this term refers to personal exchanges between teachers using computer conferencing and electronic mail (or *e-mail*), usually via the Montana Educational Telecommunication Network (Metnet), which is accessed using FirstClass® Client software. In the classroom sense, a curriculum activity based on telecommunication can include data-sharing with other online classrooms, downloading material from the Internet, or maintaining an exchange of ideas with another person or group via electronic mail.

Summary

Previous research has identified clear areas of need for novice rural teachers. In addition, the results of numerous studies demonstrate the positive effects of induction measures, particularly mentoring programs, on novice teachers. Most mentoring programs employ either established master teachers who serve a district or county, or same-building partner teachers. In situations where no experienced colleague working at similar grade levels or in similar subject areas is located nearby, mentoring partnerships must be differently designed.

The use of telecommunication for professional exchange and teacher interaction is a growing area of research, and recent studies indicate that

participation in a computer networking system provides benefits to novice teachers. Feelings of professional, social, and geographic isolation can be reduced by teachers who actively participate in electronic communication with peers and/or mentors.

For teachers in remote areas, or for teachers with particular needs based on their teaching assignment or school setting, distance-mediated mentoring partnerships can be set up with little regard to location or time. The STEP Project's Early Career Support Program provided such an opportunity, and supplemented it with teaching materials, workshop experiences, and occasional face-to-face interaction between mentors and novice teachers. The study reported here represents an effort to determine whether or not such distance-mediated mentoring partnerships can be adequately supportive, and to compare their impact on beginning rural teachers' mathematics and science instruction and professional growth against the proven benefits of a traditional mentoring program.

CHAPTER 2

DESIGN AND METHODOLOGY

Introduction

The study was carried out during academic years 1996-97 and 1997-98, which represented Years Two and Three of the Early Career Support Program (ECS Program) sponsored by Montana's Systemic Teacher Excellence Preparation (STEP) Project. The research goal was to characterize the ECS Program mentoring model and investigate its effectiveness for beginning rural teachers.

The need to explore the program from the perspective of its teacher participants drove the choice of a qualitative research design, which is "concerned with understanding behavior from the subject's own frame of reference" (Bogdan & Biklen, 1992, p. 2). The researcher formulated a set of questions and subgoals to facilitate the research process, but remained flexible in directing the research in accordance with Patton's view:

Qualitative inquiry designs cannot be completely specified in advance of fieldwork. While the design will specify an initial focus, plans for observations and interviews, and primary questions to be explored, the naturalistic and inductive nature of the inquiry makes it both impossible and inappropriate to specify operational variables, state

testable hypotheses, and finalize either instrumentation or sampling schemes. A qualitative design unfolds as fieldwork unfolds. (1990, p. 61)

The five-month process of initial data collection included: extensive telephone and face-to-face interviews; field observation of classrooms, schools, and communities; analysis of electronic mail exchanges; surveys comprised of demographic and descriptive questions; and participation in ECS Program workshops and seminars. Follow-up research conducted one year later employed a final set of interviews and a second survey. The essential elements of the research design and methodology, including data collection procedures and analysis techniques, are discussed in this chapter.

The use of telecommunication by mentors and novices inspired the collection of some data via electronic mail. The researcher was able to receive copies of electronic messages exchanged between selected mentor-novice pairs. This provided the opportunity not only to monitor the overall use of the communication network by mentor-novice partners, but to gain an inside view of the information exchanged between mentor partners without intruding into the conversation.

Contributions to Theory and Practice

As outlined in the review of literature, mentoring programs have proven effective in improving the experiences of novice teachers. Research on mentoring has shown that mentors facilitate the development of the

knowledge framework of their novices by reframing the novices' experiences from a more expert perspective (Odell, 1990). In addition, novice teachers with mentors have demonstrated reduced concerns and increased competency ratings over teachers without mentor support.

The STEP Project's Early Career Support Program followed a framework derived from the research literature on mentoring, with a novel component added: instead of restricting mentor-novice matches to a particular school or district, the ECS Program often paired beginning teachers with mentors who lived and taught up to two hundred miles away. Recent advances in technology and telecommunication have made this a viable prospect for rural teachers as a supplement to face-to-face professional development (McMahon, 1997). The distance-mediated mentoring model opens up potential opportunities for new teachers in isolated and rural areas to converse with colleagues who have appropriate content and grade level expertise.

Investigation of the questions posed in this study sought to broaden the current field of inquiry about mentoring programs. In particular, the researcher explored whether the benefits of mentoring and of teacher networking as cited in the previous chapter applied to distance-mediated mentoring relationships between novice teachers and experienced educators who were not in the same school or district. The results of this exploration support the extension of existing mentoring programs to include novice

teachers who do not have the luxury of immediate proximity to a mentor in their grade level or subject area.

Background and Setting for the Study

The STEP Project (1993-1998) was designed not only to affect the preparation of mathematics and science teachers, but also to provide support to those teachers in their early years of employment. STEP was instrumental in reforming content and education courses at Montana's five university campuses with teacher preparation programs. Its model school sites and field programs exposed student teachers to a broader-than-usual range of classrooms, grade levels, and teaching experiences. As a capstone to these experiences, the Early Career Support Program component was initiated in 1995 to sustain new teachers in their first years in the classroom.

The Early Career Support Program

As of July 1997, Montana had 56 counties with a total of over 475 school districts serving an estimated population of 878,810. Many of the smaller schools combine several grades in one classroom; a central Montana high school recently graduated a "senior class" of one student. Teachers in these schools often shoulder responsibility for multiple grade levels, many subject areas, and a wide range of duties outside of classroom teaching. With no state-mandated mentoring program in Montana, novice teachers have typically been left to their own devices, dealing with classroom,

administrative, and community issues through a local support system, if one exists.

STEP's Early Career Support Program (or ECS Program) was deliberately designed to explore new models for creating and sustaining distance-mediated mentor partnerships, especially those that support new teachers whose first jobs are in rural schools. The program matched mentors and novice teachers primarily based on content area and grade level; for novice teachers in rural schools, this often meant working with mentors outside their school and district. During the first two years of the program, many mentor-novice matches were intentionally made between teachers who were separated by up to 200 miles, in order to preclude regular face-to-face contact and explore the potential for mentoring over long distances.

Components of the Early Career Support Program

The Early Career Support Program offered a support structure that encompassed a wide variety of resources: (a) partnership of beginning teachers with a trained mentor teacher for mutual collegiality, professional growth and support; (b) receipt of a "survival kit" containing journals, books, hands-on manipulatives, software, and a modem; (c) support and training in telecommunication via Metnet, which provided free network access and opportunities for private electronic mail exchange as well as participation in public conferences; (d) support for participation in workshops and conferences sponsored by the ECS Program; and (e) membership in state

science and mathematics education organizations. While all aspects of the program were important, the components most valuable to this study were the establishment of partnerships between the novice teachers and their mentors, and the use of telecommunication to support and maintain those partnerships.

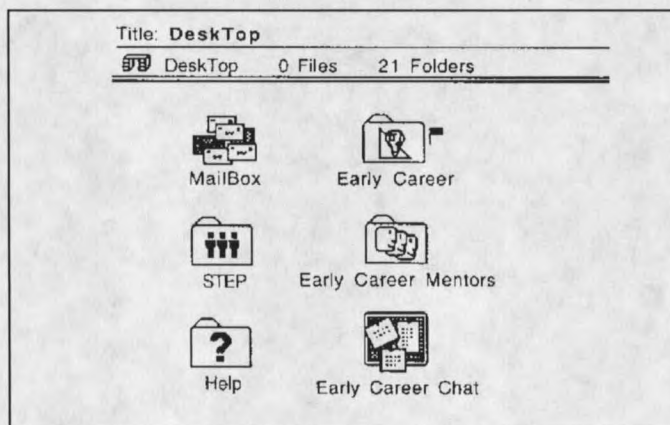
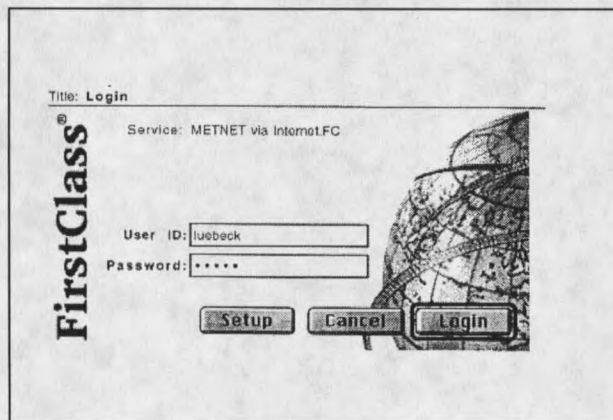
Telecommunication in the Early Career Support Program

A major design feature of the ECS Program was its reliance on telecommunication to maintain contact among the participants. For several years, Montana has been improving its statewide computer network for educators. At the beginning of the study (Fall 1996), the Montana Educational Telecommunications Network (Metnet) offered free access to any subscribed Montana educator for up to one hour per day; connection to the network within the state was available via modem using a toll-free telephone number.

The Metnet system offered private electronic mail (or e-mail), live chat opportunities, and the ability to create and maintain public or limited-access discussion sites known as conference "folders," where subscribers could post questions, comments, and responses to be viewed by all conference members. FirstClass® Client, the software used to access and operate the Metnet system, was considered a user-friendly interface. Figure 1 displays samples of the FirstClass® Client log-in window and the Metnet desktop which initially appeared upon entry to the system. Visible are a folder for private electronic mail, a STEP Project folder and the three ECS Program folders: "Early Career"

for communication between all novices and all mentors in the program; “Early Career Mentors” for exchanges between mentors only (inaccessible by novice teachers); and “Early Career Chat” for novice-only discussion which could be read, but not responded to, by the mentors. (Folders for other Montana education groups existed on the desktop, but are not shown.)

Figure 1: Metnet Window and Desktop Samples



The researcher was interested in the use of e-mail and conference folders by mentor-novice pairs and in their use by the program participants as a group. Figure 2 shows an excerpt of postings to "Early Career," the general program folder (names have been deleted).

Figure 2: Sample Postings to Early Career Folder

Title: **Early Career**
Page 1 of

Conference 33 Files 2 Folders

Early Career Chat

Lesson Ideas

☒	1K Re(4): Panel Members	4/20/98	3:59 PM
☒	1K Re(3): Panel Members	4/20/98	3:56 PM
>	>	>	>
☒ D	28K Summer Course in Math and Sc	4/16/98	3:44 PM
☒	2K Panel Members	4/16/98	8:49 AM
☒	1K Re(2): Rick's Latest Adventur	4/14/98	12:28 PM
☒	1K Re(2): Rick's Latest Adventur	4/13/98	9:53 PM
☒	1K Re: Rick's Latest Adventure	4/13/98	8:50 PM
☒	2K another one	4/13/98	11:35 AM
☒	3K MSDB Summer Program Offerings	4/11/98	4:21 PM
☒	2K	4/8/98	11:08 AM
☒	2K University Credit	4/8/98	10:57 AM
☒	1K Car Pooling	4/6/98	7:50 PM
☒	2K Re(3): Conference in Butte	4/6/98	5:33 PM
☒	1K Re(2): Conference in Butte	4/5/98	9:38 PM
☒	2K Rick's Latest Adventure	4/5/98	3:01 PM
☒	2K Re: Computerized Grade Books	4/5/98	1:41 PM

History of the Early Career Support Program

The STEP-sponsored Early Career Support Program was put in place in Spring 1995 during Year Two of the STEP Project. The program was coordinated by a team of three co-chairs: a middle school mathematics

teacher, a middle school science teacher, and a university science education professor.

During the early months of 1995, twenty mentor teacher candidates were chosen from an application pool of 49 teachers, who learned of the program through mailings, word of mouth, and announcements by professional organizations. Acceptance into the program was based on each applicant's teaching experience, leadership qualities, and strengths in mathematics and science. In the first cohort of twenty mentors, eighteen held master's degrees; eleven taught elementary school, and nine were involved in middle or high school mathematics and science. Each mentor had from five to thirty years of teaching experience.

In June 1995, the mentor candidates underwent a week-long training experience based on Beginning Educator Support Training (BEST), a highly-structured mentoring program developed by Connecticut's State Department of Education (CSDE). In a message to BEST participants, a CSDE official stated:

It is the ultimate goal of the BEST Program to support the professional growth of both beginning and experienced teachers by providing them with opportunities to strengthen their knowledge of subject matter and instructional strategies, to identify their own learning needs, and to enhance their understanding of students as learners. By becoming members of a community of learners, teachers will contribute to the quality of their colleagues' practice and to the larger educational community. (CSDE, 1997)

Although its distance-mediated model differed from the BEST Program's reliance on site-based mentor partnerships, the ECS Program set similar goals for its novice and mentor teachers. Drawing from BEST and other sources,

Montana's mentor training program emphasized trust building between mentor partners and encouraged mentors to nurture reflective thinking practices and personal autonomy in new teachers. Mentors developed their reflective thinking and decision-making skills and other mentoring skills such as *flexibility*—the ability to view the world through another's eyes, and *consciousness*—the ability to explain the reasoning behind one's actions (Colton & Sparks-Langer, 1993). The training sessions also developed listening skills and effective questioning strategies, highlighted issues faced by novice teachers, and provided practice on Metnet (Thoresen, 1997, p. 287).

As the new mentors were being screened, selected, and trained, novice teachers were also being solicited via mailings sent to administrators and superintendents across the state. As applications from novices arrived, the ECS Program co-chairs and STEP staff matched them with mentor teachers, placing priority on correlating content and grade level. By November 1995, 42 novice teachers had been accepted into the program. The response rate for novice teachers was lower than expected; the program leaders speculated that administrators had not adequately disseminated information about the program, or that by the time new teachers were aware of the opportunity, the school year was well underway and they felt too pressured to apply. No applicants were turned away as long as they had a teaching assignment involving mathematics or science at some level. These 42 novice teachers

and the twenty trained mentor teachers formed the first cohort of ECS Program participants.

The first organized opportunity for a face-to-face meeting between novice teachers and their mentors was at a two-hour seminar scheduled during the October 1995 annual conference of the Montana Education Association (MEA). Although at least thirty mentors and novices attended the seminar, relatively few matched partners were present at the same time. At the seminar, the novices received a "survival kit" containing materials and resources applicable to their grade level and subject area.

The next ECS Program-sponsored event was a Mentoring Skills Workshop in November 1995, where many mentor-novice partners met for the first time. The workshop agenda was constructed around the trust building, reflective thinking, and autonomy building themes which were the core of the June mentor training experience. Presenters at the two-day workshop also modeled science and mathematics teaching practices, and teachers received training on the use of Metnet and FirstClass® Client. The program participants then returned to their schools with a charge to strengthen their mentor-novice partnerships, emphasizing the importance of regular contact via electronic mail.

The first three years of the program (academic years 1995-96 through 1997-98), followed a consistent pattern of events. Program participants were invited to gather informally during a two-hour seminar at the October MEA

conference. A Mentoring Skills Workshop, open to all novice teachers and their mentors, was held later in the semester with activities designed to build a solid mentoring relationship. A Best Practices Workshop in late spring encouraged a professional exchange by inviting both mentor and novice teachers to share activities and content and to model mathematics and science lessons. Workshop expenses were covered by the Early Career Support Program.

A vast majority of the first cohort of program participants attended these workshops in the first year (91% in Fall 1995, 76% in Spring 1996). Attendance at the following workshops remained high, ranging from 53% to 79% of total program participants; however, mentors and novices were not required to attend with their assigned partners, which curtailed the benefits of face-to-face contact. The program leaders adjusted mentor stipends to remedy that weakness. During 1995-96, all mentors were awarded a \$1000 stipend for their participation. In the following two years, the same award was given to new mentors, but the stipend was split into two payments with requirements attached to increase accountability. Each semester, the mentors had to attend the fall or spring workshop and show proof of their efforts to communicate via Metnet in order to receive their stipend. Mentors in their second or third year received reduced stipends. The incentives provided by the ECS Program clearly affected teachers' initial motivation to use the Metnet system;

however, the ensuing applications of telecommunication to the mentoring process reflected each individual's unique preferences and usage patterns.

An essential item on the ECS Program calendar was the annual three- to five-day workshop, held in June, to train new mentors. The 1995 cohort of twenty Montana mentors was trained by experts from the Connecticut BEST Program. In June 1996, a subset of the Montana mentors studied for one week under the BEST leaders to become mentor trainers themselves; they then assisted in the training of the 1996 cohort of new mentors. The Montana mentor trainers played leadership roles in the fall Mentoring Skills Workshop; they also trained the third cohort of mentors in June 1997.

In summary, the 1995-96 program participants numbered 42 novices and 20 mentor teachers; in the following year, numbers increased to 90 novices and 54 mentors, with the inclusion of mentor trainers. After accounting for withdrawals, the 1997-98 program involved a total of 127 novices and 79 mentors and/or mentor trainers. All mentors had a minimum of five years' classroom experience. Table 1 indicates the prior teaching experience of novices upon their enrollment in the ECS Program for 1996-97 and 1997-98, the two years included in the study.

Table 1: Novice Teacher Experience Upon ECS Program Enrollment

Prior Experience	0 years	1 year	2 years	3 years	4 years	5 years	>5 years	No Resp.
1997-98 (n=50)	17	15	9	1	1	1	1	5
1996-97 (n=50)	23	13	10	3	1	0	0	0
1995-96 (n=42)	Information not available							

Results from Year One

Valuable progress was made during the initiation year of the Early Career Support Program. Evaluations of the summer mentor training and academic-year workshops were overwhelmingly positive, and self-reports by participants indicated that enthusiasm for the project ran high among both novice and mentor teachers. In the STEP Project's Year Three annual report, the project director wrote that "From the perspective of the STEP staff, MCTM (Montana Council of Teachers of Mathematics) and MSTA (Montana Science Teachers Association) representatives, the mentors, and the early career teachers, the Early Career [Support] Program was a success during its first year" (Charron, 1996, p. 18).

The telecommunication component proved to be the greatest obstacle to full implementation of the Early Career Support Program. Teachers reported a variety of technical difficulties during the first year of the ECS Program, including difficulty in accessing the Metnet telecommunication system and in obtaining telephone hookups and setting up modems where network access was not readily available. Such setbacks are not uncommon when setting up a telecommunication network; Ruopp (1993) and Spitzer (1993) each cited network startup problems which included lack of technical literacy, lack of time to learn the system, and poorly matched hardware and software, along with a general lack of funding and resistance to change.

Year One of the ECS Program, or 1995-96, provided an opportunity for the program leaders to assess and revise the processes of initiating, developing, and maintaining mentor partnerships. By Year Two, the year in which the study commenced, the program, its participants, and its supporting components were well-established and ripe for investigation.

Selection of Study Participants

The researcher adopted two data collection models in carrying out the study. In the first phase, focused research was directed at a select sample of novices and their mentors, with data collected through multiple interviews and field observation of each individual as well as examination of the Metnet correspondence between the mentor-novice pairs. In the second phase, data was gathered from surveys distributed to all mentor and novice participants in the ECS Program. Investigation of the select sample, referred to as the "core group," unearthed a wealth of information useful in characterizing the unique aspects of the program, the distance mentoring relationship, and the benefits of both for rural teachers. The survey data strengthened the findings and allowed them to be generalized to a larger population.

Core Group vs. Survey Group

To identify core group subjects, the researcher began by reviewing Year Two program applications from novice teachers throughout Fall 1996. By the end of October, these new novices had been matched with mentors by the

program leaders. The researcher then reviewed the complete list of 1996-97 ECS Program participants to select novice teachers and their mentors who fit the parameters defined for the core group. After seventeen teachers were selected, the sample was reviewed by the ECS Program co-chairs to assure that no conflict or bias was evident.

The novice and mentor teachers who completed the survey represented an effort to collect data from the entire program population. The first survey was distributed at the April 1997 Best Practices Workshop; program participants who did not attend this event were mailed surveys with return envelopes provided. Eventually 89 surveys were collected, 47 from novices and 42 from mentors. In February 1998, a second survey was administered by mail to all program participants, ultimately netting responses from 73 novices and 62 mentors. The participants who provided survey data are referred to as the "survey respondents" or the "survey group" for data reporting purposes.

Core Group Selection Procedures

Previous studies have examined peripheral issues such as the success of mentoring programs in general, the needs of rural teachers, and the obstacles to successful telecommunication. These issues were foundational to the present study's purpose: to investigate the nature and effectiveness of distance-mediated mentoring relationships for rural science and mathematics

teachers. Participants were selected in a manner that maximized the potential research findings in relation to this purpose.

Core group subjects were selected through *purposeful sampling* techniques. Purposeful sampling is an attempt to "choose particular subjects to include because they are believed to facilitate the expansion of the developing theory" (Bogdan & Biklen, 1992, pp. 71-72). The researcher used a combination of purposeful sampling techniques, agreeing with Patton that "These approaches are not mutually exclusive. . . . The sampling strategy must be selected to fit the purpose of the study, the resources available, the questions being asked, and the constraints being faced" (1990, p. 181).

One selection consideration was to identify willing participants who were able to invest time and effort in the interview, observation, and data collection process. Constraints on time and resources also required the researcher to minimize travel in connection with field observation. After considering the geographic distribution of ECS Program teachers across Montana, the researcher chose to select core group teachers from the more accessible western half of the state. It should be noted that at least five of the core group novice teachers were located within forty miles of a metropolitan area (population greater than 20,000), but they lived and worked in remote, independent school districts.

Criterion sampling was first applied to be sure that "information rich" cases were included in the study. To satisfy the purpose of the study, all core

group subjects had to be novice elementary, secondary mathematics, or secondary science teachers in rural Montana schools. "Novice" was interpreted to mean teachers with less than five years of teaching experience, whether in one school or at more than one school. Selection preference was given to teachers who were in their first or second year of teaching during 1996-97.

Critical case sampling was used to select sites or subjects that "yield the most information and have the greatest impact on the development of knowledge" (Patton, 1990, p. 174). In order to adequately study rural teachers, it was critical to select some cases where novice teachers were in extremely isolated settings. An "isolated" setting was initially defined as a school setting in which the novice teacher had sole responsibility for a subject area, or sole responsibility for a particular grade level (or multi-grade classroom). Five subjects were selected based on this criterion.

The originally proposed research was intended to focus on secondary mathematics teachers. However, later examination of ECS Program demographics revealed that it was impossible to satisfy the criteria of isolated rural settings, secondary mathematics assignments, and regional proximity simultaneously. Faced with a lack of subjects teaching secondary mathematics, the researcher instead sought a sample with *maximum variation* of grade level and subject area, following Patton's premise that:

This strategy . . . aims at capturing and describing the central themes or principal outcomes that cut across a great deal of participant or program

variation. . . . When selecting a small sample of great diversity, the data collection and analysis will yield two kinds of findings: (1) high-quality, detailed descriptions of each case, which are useful for documenting uniqueness, and (2) important shared patterns that cut across cases and derive their significance from having emerged out of heterogeneity. (Patton, 1990, p. 172)

Secondary mathematics teachers in western Montana proved to be a rarity in the ECS Program; in order to guarantee that two such teachers would be in the core group, the researcher relaxed the "isolated" and "rural" criteria to include a teacher in a community of roughly 6,125 inhabitants.

The resulting core group included nine novice educators in the western half of Montana: five elementary teachers (two in the primary grades K-3 and three in grades 4-6); one teacher of seventh and eighth grade mathematics and science; and three high school teachers (two in mathematics, one in science). All but one of the novice teachers taught in a community of less than 2,500 people. Their mentors were also considered part of the core group, bringing the sample size to seventeen (in one case two novices shared the same mentor). The varied characteristics of the sample subjects strengthened the applicability of the findings to the general population of the Early Career Support Program.

Role and Experience of the Researcher

The researcher worked as a graduate research assistant and as a full-time employee of the STEP Project throughout its five-year span. Through that experience, the researcher became well-versed in the goals and activities

of the STEP Project, and of the Early Career Support Program in particular. The researcher had prior experience with collecting interpretive data, including: field notes recorded during observations of four different classrooms on multiple occasions; interviews with six college-level instructors using a standardized interview protocol; four focus group interviews using a flexible interview guide; interviews with individuals about their views on school-related issues; and transcription and analysis of data to look for patterns and emergent questions.

The researcher entered the field more as a colleague of ECS Program participants than as a stranger; relationships between the researcher and the subjects will be defined here so that they can be considered as factors affecting replication (Goetz & LeCompte, 1984, p. 214). Through the STEP Project, the researcher had come into contact with many of the mentor teachers who were enrolled in the program by 1996-97, and was in fact acquainted with four of the core group mentors, but not to a degree that influenced the research or skewed the findings. Prior to the study period, the researcher attended a Best Practices Workshop for novices and mentors in April 1996, and observed two days of a Mentor Training Workshop in June 1996. In addition, as part of a STEP-sponsored inquiry into mathematics and science reform in 1995-96, the researcher visited, interviewed, and videotaped one of the novice teachers in the core group. After discussing that occasion with the novice, the researcher

judged that their prior acquaintanceship would not unduly affect the data collection process.

Methods and Periods of Data Collection

The purposes of the study, particularly the need to investigate and characterize subjective aspects of the mentoring relationship, lent themselves to descriptive and interpretative research. Due to conflicts with work responsibilities and other practical considerations, the researcher found it infeasible to incorporate continuous in-depth data gathering into the research design. The need to forego detailed and frequent observation motivated a design with greater scope to make up for lost depth. Summary documents outlining data collection procedures and the research time line are provided in Appendix A. Data collection for the study featured qualitative methods, including the strategies described below.

Interviews

Formal Interviews. The novices and mentors in the core group were interviewed three times during the study. The first set of interviews, which took place in January 1997, provided background and data about the teaching experience, strengths, concerns, and telecommunication knowledge of both mentors and novice teachers. Nine of these initial interviews (four with novices, five with mentors) were conducted at the January 1997 Mentoring Skills Workshop (normally held in November but postponed due to

treacherous weather). Five more interviews were conducted by telephone one week later; one mentor responded to the interview questions via electronic mail. Two of the seventeen subjects were not interviewed on schedule; their initial interviews were combined with the second interview several weeks later.

The second round of interviews was carried out during site visits to the teachers' schools from late February through mid March, 1997. The protocol for this interview was constructed around the four major study purposes listed in Chapter 1, and was designed to explore those issues with the novice and mentor teachers. Finally, a third set of eleven follow-up interviews was completed nearly a year later, in March 1998. The focus of this final interview was to gather more information pertaining to Metnet use and the mentoring relationship, and to assess the progress of the relationship over time. By that time, four of the core group subjects had left their teaching positions and only three of the five intact relationships were active.

In all three cases, the researcher followed an *interview guide*, which solicited some detailed information, outlined the issues to be explored, and guaranteed a degree of consistency in responses without restricting the flow of conversation:

The interview guide provides topics or subject areas within which the interviewer is free to explore, probe, and ask questions that will elucidate and illuminate that particular subject. Thus the interviewer remains free to build a conversation within a particular subject area. (Patton, 1990, p. 283)

A total of 45 interviews were conducted. All were audiotaped for later transcription. Samples of the interview guides are provided in Appendix B.

Informal Interviews. To supplement the three interview experiences, communication between the researcher and core group subjects was maintained via telephone, electronic mail, and serendipitous meetings. These informal exchanges occurred anywhere from once a week to once every few months through 1996-97, and served as an opportunity to further clarify the teachers' circumstances; on these occasions the researcher asked questions about the frequency and content of mentor-novice interactions, the status of telecommunication use, and the concerns of the novice teachers. Informal exchanges also provided a chance for the researcher to build trust through friendly conversation.

Review of Documents

Electronic Mail and Conference Folders. The researcher obtained permission from each of the core group participants to monitor their private electronic mail exchanges via Metnet. As an alternative to handling paper copies of their messages, the participants agreed to send electronic "carbon copies" of their exchanges to the researcher. The monitoring phase began formally in late January and continued through the end of May 1997. The three ECS Program conference folders (one for mentors only, one for novices

only, and one accessible by the entire group) were also monitored by the researcher on a daily basis during Spring 1997.

Historical Documents. Materials related to the ECS Program were collected and reviewed for any history and background they might provide. These included mentor training materials, surveys and program evaluations conducted prior to the research time frame, and conference agendas preserved from 1995-96 and accumulated during 1996-97 and 1997-98. Agendas from the November 1995 and April 1997 ECS Program workshops are provided in Appendix C.

Field Research

Patton wrote that "Validity in qualitative research depends on careful instrument construction to be sure that the instrument measures what it is supposed to measure" (1990, p. 14). In studying the core group teachers, the researcher, in a sense, served as the key instrument of data collection. Interviews, classroom and community observations, and field notes were all recorded by and filtered through one person, strengthening the internal validity of the research and broadening the researcher's understanding of each mentor-novice partnership.

Field Observations. A site visit was made to each core group teacher during the initial five-month study period, most of them occurring between late February and mid-March 1997. On these occasions, the researcher spent at

least half of a school day in the teacher's classroom, observing his or her teaching style and recording information about the classroom, students, and available resources. Second interviews with each core group teacher were conducted during the site visit, either during a free period at school or in the evenings. The researcher also recorded observations about each novice teacher's school and surrounding community.

Participant Observer Journal. The researcher kept a journal to record and summarize fieldwork, keep track of changes in the research schedule, summarize meetings and conferences, and record impressions and personal biases. The journal was useful for keeping track of data collection procedures and stimulating new questions, particularly during the initial five-month study period.

Workshop Notes and Summaries. Attendance at the Fall 1996 and Spring 1997 workshops allowed the researcher to: (a) observe the techniques used to establish mentoring relationships, (b) attend model demonstrations of mathematics and science lessons, and (c) converse informally with study subjects. The "fall" Mentoring Skills Workshop, usually held in November but cancelled due to inclement weather, was held January 17-18, 1997. The spring Best Practices Workshop was held April 18-20, 1997. The researcher also attended portions of ECS Program events in 1997-98.

Surveys

The survey instrument was designed by the researcher.

Straightforward demographic questions were combined with multiple choice and open-ended questions that related to the study purposes. Survey questions were suggested, reviewed, and edited by the researcher, the ECS Program co-chairs, and the directors and evaluator of the STEP Project, bolstering the reliability and validity of the data to be collected.

The first survey was administered by the researcher at the April 1997 Best Practices Workshop. Workshop participants were given one night to complete the surveys; a modest prize drawing helped to guarantee a high return rate. Since not all participants in the ECS Program attended the workshop, additional surveys were mailed to the remaining participants. They were provided with return envelopes and given two weeks to respond. The two efforts resulted in the return of 89 completed surveys, representing 62% of the total program population of 144 teachers.

A follow-up survey was conducted in February 1998. The second survey instrument was identical to the first except for minor updates to demographic questions and the addition of two open-ended response items directed at teachers with longevity in the program. Surveys were mailed to the 1997-98 population of 206 participants and included a drawing for a gift certificate to encourage responses. Eighty-three surveys were returned, representing a 40% return rate. A second mailing promising a cash prize

drawing boosted the return rate to 59% (122 surveys). Finally, personal contacts by the researcher brought the 1998 return rate to 66% (135 surveys).

Findings from the demographic and descriptive portions of the two surveys are reported separately, for two reasons: (a) Administration of the 1997 and 1998 surveys differed significantly; and (b) Changes in technology and in population demographics from one year to the next preclude casual grouping of the data. For reporting purposes, responses to open-ended items from both surveys have been combined.

Overlaps between interview and survey data may also exist, because no control was exercised over core group teachers completing the survey. For example, seven of the eight core group mentors and five of the nine core group novices attended the April 1997 workshop and ostensibly completed the first survey; therefore, some of the open-ended responses included in data analysis may have been authored by core group participants. Neither incident of duplication adversely affected the demographic information collected on the surveys.

A sample of the survey instrument is provided in Appendix B.

Analysis of Data

Although the researcher entered the field with a preconceived set of questions for investigation, it was expected that preliminary findings might redirect the research process. The researcher approached data analysis as "an

ongoing cyclical process integrated into all phases of qualitative research . . . a systematic process of selecting, categorizing, comparing, synthesizing, and interpreting" (McMillan & Schumacher, 1989, p. 414). For example, the realities of subject availability affected the selection criteria for the research sample. An unexpectedly low rate of Metnet use among the core group novices prompted a closer study of Metnet use by other rural novices to verify the core group finding. Comparison of mentor and novice perceptions of the mentoring experience led to new lines of inquiry. This analytical process of reflection and redirection was integral to data collection.

As interviews, community visits and classroom observations were carried out, analysis in the field helped to focus the study. Bogdan and Biklen (1992) suggested that ongoing analysis can help the researcher make decisions that narrow and define the study and develop sharper, more analytic questions (pp. 154-155). Techniques that helped to tighten the focus of this study included planning future data collection sessions based on previous observation (p. 157), trying out new ideas and themes (p. 159), and maintaining an ongoing review of the literature (p. 160). For example, after completing the first set of core group interviews and reviewing the responses, the researcher made several adjustments to the survey instrument which was later administered to all participants.

Interviews

The researcher remained immersed in the interview data by: (1) conducting the interviews; (2) transcribing all but five or six of the interviews; (3) reading each transcript at least twice; and (4) coding the data from the first and second interviews electronically with HyperRESEARCH™, a software package from Researchware, Inc. designed for that purpose. Electronically preparing the data for computer coding was a tedious task, but as the work progressed, the software proved to be efficient and valuable for highlighting, sorting, and combining data under a given code or category. Interview data were coded by how they applied to the four purposes of the study, and then subdivided into more specific categories. A sample of data which was coded using HyperRESEARCH™ is provided in Appendix A.

The third set of interviews was not coded electronically. Instead, the researcher used the new data to flesh out earlier findings and examine the metamorphosis of core group relationships over time in an effort at *process coding*, described by Bogdan and Biklen (1992) as a system to "facilitate categorizing sequences of events, changes over time, or passages from one type or kind of status to another" (pp. 168-171). In the final stages of data analysis, the researcher returned to the original transcripts of all three interviews to re-examine the context of core group statements.

Surveys and Other Data Sources

Triangulation of the data was an important component of the analytic process. The subjective nature of the study purposes (e.g. describing mentor-novice relationships, assessing novice teachers' attitudes about teaching and professional growth) made it crucial to support the novice teachers' voiced impressions through other means of data collection. As Goetz and LeCompte (1984) stated:

Acculturation, socialization, and schooling are abstract constructs most readily operationalized in natural, ongoing behavioral transactions and are most directly accessible through observation. However, as their concern for the enhancement of construct validity—the extent to which abstractions are meaningful and shared across times, settings, and populations—increases, ethnographers have become more concerned with supporting constructs through multiple data-collection strategies. (p. 59)

For example, interviews with the nine novice teachers in the core group provided a wealth of information, but visits to their schools and glimpses of their personal lives helped to confirm and enrich that information. Similarly, the Metnet exchanges shared with the researcher supported findings from the interviews regarding the typical content of Metnet messages and the nature of the mentor-novice relationship. It was also useful to compare and contrast the responses of the core group with those gleaned from the two survey samples. Similar questions were asked of the core group and the survey respondents; core group data provided depth while survey data allowed a broader picture to be painted of the program participants' beliefs and behaviors.

Throughout the study, verbal and written responses to interview and survey questions, electronic mail exchanges between teachers, and classroom and community observations were compared and contrasted to verify findings and extend or restrict generalizations. The use of a variety of data collection methods strengthened both the reliability and validity of the research findings.

Issues of Research Design and Data Reporting

In studying the Early Career Support Program, strictly defined controls and standardized measurement techniques would not have unearthed the implications that arose from a qualitative research design. The study called for the interpretation and analysis of subjective data, collected with a variety of methods from several different representative population samples. Patton observed that "for particular outcomes no acceptable, valid, and reliable quantitative measures exist" (1990, p. 130). The researcher agreed, but also felt secure that reliability and validity were not sacrificed by the manner in which research was conducted and reported.

Reliability. McMillan and Schumacher suggested that "Reliability in qualitative research refers to the consistency of the researcher's interactive style, data recording, data analysis, and interpretation of the participant meanings in the data" (1989, p. 188). Internal reliability in this study was preserved in part by the fact that only one person conducted (and in most

cases, transcribed) the 45 interviews and seventeen site observations called for by the research design. The researcher employed "low-inference descriptors" (p. 190) such as mechanical recordings, verbatim transcriptions, and precise field notes which are considered "the hallmarks of qualitative research and the principle [*sic*] method for establishing internal validity" (McMillan & Schumacher, 1989, p. 190). External reliability and future replication were supported by: (a) careful explanation of the researcher role and status; (b) thorough accounts of selection procedures; (c) detailed descriptions of data collection and analysis procedures; and (d) availability of the survey and interview instruments.

Validity. "For qualitative studies, internal validity relates to the degree to which the generalizations and conceptual categories have *mutual meanings* between the participants and the researcher" (McMillan & Schumacher, 1989, p. 192). The use of the participants' own thoughts and language when analyzing and reporting findings, coupled with two years of involvement with the ECS Program and its population, supported the researcher's claim to internal validity for this study. Goetz and LeCompte further upheld the argument for validity:

In general, the qualitative data collection process claims a high internal validity. The methods of collection and analysis that are used, the length of time involved in data collection, and the constant self-monitoring of the researcher all contribute to the certainty that observed results, when triangulated with other data, can be attributed to the treatment. (Goetz & LeCompte, 1984, p. 221)

Patton (1990) wrote that "In qualitative inquiry the researcher is the instrument. Validity in qualitative methods, therefore, hinges to a great extent on the skill, competence, and rigor of the person doing the fieldwork" (p. 14). As noted earlier, the researcher had prior experience in conducting interviews, observing and scripting in classrooms, and interpreting data from multiple sources; this experience further enhanced the validity of the study.

McMillan and Schumacher (1989) defined external validity in terms of *comparability* and *transferability*, or the degree to which research components are described and defined so that findings can be generalized to other populations or applied to similar studies and future inquiry. The concerns about external validity which arose during this study are discussed here.

Novice teachers voluntarily enrolled in the Early Career Support Program: those who applied to the program and participated in the study may have possessed similar characteristics (e.g. resourcefulness, confidence, good time management skills, and strong administrative support) that affected their behavior as novice teachers. Alternatively, it may have been that in general, only underprepared and anxious teachers applied to the program. The nine core group novice teachers were asked why they entered the program during the initial interview; their motivations were not generally attributable to any factor that would preclude generalization to rural Montana's novice teacher population.

On a larger scale, validity beyond Montana may be somewhat limited since the study and the program are specific to a very large and rural state with a reputation for its innovative mathematics and science education programs. However, at least some of the findings certainly apply to other states with similar geographic and demographic environments, and many of the recommendations for practice are applicable to mentoring programs, particularly distance-mediated programs, in any setting. Even more extended generalization may be possible, but caution should be exercised when applying the results of this study to dissimilar contexts.

Attrition. Although not anticipated, attrition in the core group during the study period was surprisingly high. No core group participant left his or her teaching position during the 1996-97 academic year, but by Fall 1997 four had changed status. One novice was informed in March 1997 that her contract would not be renewed. By the end of that spring semester, three more core group subjects had left their positions: one novice left teaching to run a local business, another moved with his family to a distant city, and one mentor took an overseas teaching opportunity. This attrition rate of nearly 25% among the seventeen core group teachers (or 33% among novices only) did not reflect attrition in the program as a whole. As of March 1998, an estimated fifteen novice teachers had withdrawn from the program, but not necessarily from teaching. Exact tallies were not available, but the researcher estimated the annual attrition of novice participants at roughly four percent.

Limitations of the Study

Although 90 novice teachers were enrolled in the Early Career Support Program in 1996-97, the group's demographics coupled with the research constraints limited the researcher's ability to focus on novice teachers of secondary mathematics. The study had to be adapted to include both mathematics and science teachers at a mixed variety of grade levels in order to select an optimal number of teachers who also reasonably met the criteria of rural isolation and regional proximity. As mentioned earlier, the researcher was restricted to a design that allowed only limited involvement with the subjects, but used a large core group and extended research period to balance this deficit.

The research design was also limited in its ability to control for the personality, natural ability, and maturity of each participant. Background data on age and life experience of the novices were not available during the selection of the core group; some of the novices were parents of teenagers and had previous career experience, while some were in their early twenties and directly out of high school and college. Age, attitude, and experience may have influenced each mentoring relationship and the corresponding novice's behavior in the classroom.

Certain research implications arising from this study may be applicable to schools and communities with large populations, or to mentoring partnerships that are carried on in different contexts. At minimum, the

findings increase the knowledge base about distance-mediated mentoring and its impact on rural science and mathematics teachers, and enable one of the foremost goals of the STEP Project's Early Career Support Program: to serve as a national model for teacher support in isolated rural areas.

CHAPTER 3

ANALYSIS OF DATA AND FINDINGS

Introduction

Initial data collection for the study of the STEP Project's distance-mediated Early Career Support Program (ECS Program or ECSP) took place over one academic semester spanning January through May of 1997. A follow-up survey and interviews were conducted in February and March 1998. Research activities were designed to: (1) characterize and document the relationships established between mentor teachers and novice teachers; (2) determine the level of use of telecommunication in initiating and maintaining these relationships; and assess the impact of mentoring relationships on (3) novice teachers' mathematics and science teaching; and (4) their attitudes and professional growth.

The process of data collection was at times directed to all participants in the ECS Program (referenced in this document as the "survey respondents" or the "survey group"), but more often focused on nine selected novice participants and their mentors (referenced as the "core group"). This chapter opens with two summary sections: an overview of the ECS Program

population as a whole based on the surveys given in 1997 and 1998; and an overview of the core group participants in particular, offering comparisons and contrasts among the core group mentor-novice partners. The next section offers more detailed accounts of the nine novices' unique teaching environments including details about the teachers' community, school, and classroom settings and a description of their professional contexts. Since the investigation focused on the novice teachers, brief situational descriptions for the mentors are provided only as needed to better understand their roles in relation to the novice teachers.

The remainder of the chapter is devoted to analysis of data and findings based on the four major study purposes. Findings which emerged from the analysis of data based on the nine core group novice teachers are blended with supporting survey data under each of the four "purpose" headings. At the core of this research is a qualitative study of selected participants in the ECS Program; therefore, the data and findings revealed through interviews and other interactions with the nine pairs in the core group are generally presented first. Those findings are then supported and clarified further by the demographic data, descriptive data, and open-ended responses gathered from the two large group surveys. The contents of the analysis sections will be outlined as each study purpose is examined.

Description of Population and Research Subjects

To support findings based on the nine novice teachers in the core group, two surveys were given to the mentor and novice teachers involved in the Early Career Support Program. Demographic information, program participation data, and open-ended responses were initially gathered through an April 1997 survey completed by 89 program participants (47 novices and 42 mentors). This return represented 62% of the total 1996-97 program enrollment of 144 (90 novices and 54 mentors). Nearly all of the surveys were completed by teachers attending a January 1997 Mentoring Skills Workshop. A few additional surveys were returned by non-attendees who received the survey by mail the following week.

A follow-up survey was conducted by mail in February 1998. The two survey protocols were nearly identical, with the addition in the 1998 version of two comparison/contrast questions: one for mentors with more than one novice teacher, and one for those who had been in the program more than one year. Two hundred six surveys were mailed to the 127 novices and 79 mentors enrolled in the program for 1997-98. One hundred thirty-five of those were eventually completed and returned, for a response rate of 66% (73 novices and 62 mentors). Pertinent data gathered from the surveys is reported as it applies to the four study purposes.

Overview of Survey Respondents

Survey #1 (Spring 1997). Only sixteen of the 89 respondents to the 1997 survey were male (seven novices and nine mentors). Twelve of the 47 novice respondents indicated that they were first-year teachers, with at least 29 of the novices in their first three years of teaching (others had more experience or did not provide this information). The twelve first-year novice respondents represent 70% of the 17 first-year teachers in the entire 1996-97 novice cohort. Fourteen of the 42 mentor respondents had sixteen to twenty years of teaching experience, and an additional fifteen had been teaching for more than twenty years. Table 2 summarizes teaching experience and ECS Program experience regarding the 1997 survey respondents.

Table 2: 1997 Survey Respondents by Teaching and Program Experience

NOVICE Experience (1997)		MENTOR Experience (1997)	
1st year teaching	12	5-10 years teaching	6
2nd-3rd year teaching	17	11-20 years teaching	17
4th-5th year teaching	9	21-30 years teaching	14
>5 years or no response	9	>30 years or no response	5
1st year in ECS Program	28	1st year in ECS Program	22
2nd year in ECS Program	18	2nd year in ECS Program	20
No response	1	No response	0

All of the respondents but one (assigned to teach Spanish at the time of the survey) were responsible for teaching mathematics, science, or a combination of the two, several with technology assignments as well. Table 3 provides information about respondents' grade level and school size.

Community data was also collected: roughly one-third of the novice respondents taught in communities of 500 to 2,000 people with a total of two-thirds in communities of less than 10,000; the remaining third were in cities with a population of over 25,000.

Table 3: 1997 Survey Respondents by Grade Level and School Size

NOVICE Grade Level (1997)		MENTOR Grade Level (1997)	
Elementary:	27	Elementary:	23
Middle school:	9	Middle school:	10
High school:	4	High school:	6
MS/HS combo:	6	MS/HS combo:	1
No response:	1	No response:	2
NOVICE School Size (1997)		MENTOR School Size (1997)	
(based on enrollment)		(based on enrollment)	
0-99 students	15	0-99 students	6
100-500 students	25	100-500 students	24
>500 students	7	>500 students	12

Survey #2 (Spring 1998). Responses to the February 1998 survey represent a similar proportion (66%) of the increased ECS Program population. Among the 73 novice respondents, thirteen were in their first year of teaching (23 of the novices in the 1997-98 cohort applied as first-year teachers). Thirty-six novice respondents were in their second or third year of teaching; the rest had more years of experience or did not respond. Forty-four of the 62 mentor respondents had eleven to 25 years of teaching experience; six had less and eleven had more (one did not respond). Teachers in both groups were equally distributed among mathematics and science teaching loads. ECS Program experience and other demographic data for 1997-98 is

reported in the following tables. Statistics describing the 1997 and 1998 survey respondents are comparable, except for a 1998 increase in secondary level teachers and a relative decrease in extremely rural teaching settings among both novices and mentors.

Table 4: 1998 Survey Respondents by Teaching and Program Experience

MENTOR Experience (1998)		MENTOR Experience (1998)	
1st year teaching	13	5-10 years teaching	6
2nd-3rd year teaching	36	11-20 years teaching	28
4th-5th year teaching	19	21-30 years teaching	24
No response	5	>32 years or no response	4
1st year in ECS Program	30	1st year in ECS Program	23
2nd year in ECS Program	29	2nd year in ECS Program	17
3rd year in ECS Program	12	3rd year in ECS Program	21
No response	2	No response	1

Table 5: 1998 Survey Respondents by Grade Level and School Size

NOVICE Grade Level (1998)		MENTOR Grade Level (1998)	
Elementary:	38	Elementary:	26
Middle school:	15	Middle school:	11
High school:	5	High school:	18
MS/HS combo:	5	MS/HS combo:	1
No response:	10	No response:	6
NOVICE School Size (1998)		MENTOR School Size (1998)	
(based on enrollment)		(based on enrollment)	
0-99 students	15	0-99 students	6
100-500 students	51	100-500 students	33
>500 students	7	>500 students	20
No response:	0	No response:	3

Overview of Core Group Subjects

Comparison/Contrast of Core Group Subjects. The matching of core group novices with their mentors was not engineered by the researcher. As

with all ECS Program participants, priority in matching core group partners was given to grade level and subject matter taught over other similarities or geographical proximity. Selection of the mentor pairs to be included in the core group was based on three parameters: (a) rural placement of the novice teacher; (b) location of each partner in the western half of Montana to assure a manageable research design; and (c) maximum variety in grade level. Seven one-to-one partnerships were studied, along with a eighth partnership involving one mentor and two novices. Several of the core group mentors were also mentoring a second or even a third novice in larger communities, but data was collected only on the rural novice partners.

A number of parallels and contrasts became evident among the nine core group partnerships. The core group included seven sets of same-gender pairs (five female, two male), and two cases where the novice was female and the mentor male. In three partnerships, the mentor's and novice's work environments were closely matched in terms of school and community size. Partners in the other six pairs were at schools which differed substantially in size. Two of the mentors and three of the novices taught on Indian reservations, but in only one partnership did both teachers work on reservations. Two mentors and one novice happened to teach (at different grade levels) in the same small community, but their partners were located elsewhere. The pair with the most similar characteristics were two male teachers, both non-Native American but teaching and living on reservations,

and both with full responsibility for their middle school and high school science programs.

Comparison/Contrast of Core Group Communities. The novice teachers selected for the core group were chosen primarily for their rural location. School enrollments (based on 1996 school board data) and community sizes (based on Montana census estimates collected in 1990 or 1997) are provided in each novice profile. The largest school used in the study was a high school of 620 students, in a community of 6,125 located near a major city. The smallest enrollment was at a three-room school which served 47 students, grades K-8, in a sparsely populated ranching community. Seven of the novices in the core group taught in schools serving rural districts or small communities with populations of 500 or less.

The researcher's field notes supplemented each teacher's description of his or her school and community. While detailed analysis of the rural settings was not considered essential to the research, it was revealing to gather impressions of each novice teacher's unique rural context and sense of isolation from both the researcher and subject points of view. Abbreviated descriptions of each community are included in the novice teacher profiles.

Anonymity and Pseudonyms. The recognizability of teachers in rural school districts created a conflict between describing the core group subjects in depth with respect to their schools and communities, and guaranteeing their

anonymity. The profiles presented for each novice teacher do include information about their schools and communities, but these descriptions are deliberately abbreviated in order to limit potential identification of the subjects. Gender-accurate pseudonyms have been assigned to all nine core group novices, and core group data will be reported in a consistent order. The eight mentors are simply identified in reference to the novices' assigned names.

Core Group Novice Teacher Profiles

The nine core group novices entered their teaching careers with different teacher preparation experiences and unique sets of strengths and weaknesses. Their entry points into the teaching profession and the ECS Program, and their prior teaching experiences, are summarized in Table 6.

Table 6: Prior Experience of Core Group Novices

Joined ECSP	Assignment	Experience at Current Site	Prior Experience
Fall 1995	3rd grade	New graduate (1995)	None
Fall 1995	9-12 math	New graduate (1995)	Substitute 0.5 yrs
Fall 1996	5th grade	1 year, same school and position	Substitute 10 yrs
Fall 1996	5th grade	1996 graduate	Bilingual tutor/instructor 5 yrs
Fall 1996	9-12 science	New graduate (1996)	Aide 1 yr
Fall 1995	6th grade	1 year, same school, 1st grade	Substitute 0.5 yrs
Fall 1995	K-2 combined	2 years, same school and position	None
Fall 1995	3-4 combined	1 year, same school, 4th grade	Substitute 5 yrs, 1st grade 2 yrs
Fall 1996	7-12 math	1 year, same school and position	Middle school 2 yrs

In the following sections, the nine novice teachers are introduced and identified through the school and community settings in which they lived and taught and the context of their professional situations. These

descriptions are based on classroom and community observations by the researcher in early 1997, on interviews in 1997 and 1998, and on information provided on ECS Program application forms.

Barb: Elementary Mathematics/Science

Barb's school was situated alongside a county road in a town (pop. 103, 1990 estimate) that supported a restaurant and a bar, but no grocery or general store. The school served local families from three communities; most of them were employed in mining or ranching. The older wing of the school complex housed fourth through twelfth grade. Every graduating class since the 1930s was honored in a series of photographs lining the high-ceilinged stairwell; they ranged in size from three to twelve students. The elementary school served 82 students; Barb's classroom was in a new addition which included the gymnasium, the coaches' area, and a conference room.

Barb had a solid background in mathematics and science which included courses in calculus, physics, and biology. She praised her student teaching cooperating teacher as a "good model" who provided a team teaching experience with plenty of variety. She cited preparing grades and dealing with small-town parent and community relations as areas of weakness in her teacher preparation program: "They made that picture seem so rosy, and teaching's great, it is, but you know there's parts that aren't so rosy you have to deal with too."

Barb applied to teach at her school two days before the application deadline and was hired within three weeks of graduating from college. "I figured 'I'll get a job somewhere,' but I knew how hard jobs were to get. It wasn't that I set out to get a job in a little town, but I'm happy with it." She was pleased that her new community was located midway between her family and her boyfriend, but was sometimes bothered by the close-knit population:

[There is] too much personal attention. . . . Like my life's a fishbowl . . . but I'm a single teacher also, and so they have, you know—their eyes are bugged out toward me. I've had great parent help if I've wanted it, and . . . they're interested in their kids' education.

Barb was the high school track coach, and also volunteered in an after-school science/mathematics program which she had initiated. In Spring 1997, her "math club" included thirteen students who met after school on Tuesdays to work on creative projects. She was capable of independent work, which was becoming more evident by her second year:

I would go to the other teachers and say "Help me with this" or "What should I do about this?" or "What would you do?" . . . but I don't do that so much this year, I'd say hardly at all. I just—I've become more independent, just dealing with stuff on my own.

Her administrator approved of her hands-on approach to science and the fact that she used multiple materials and did not rely solely on science or mathematics textbooks:

I can do anything I want, which is good, 'cause I don't like to use the book. . . . I talked about it last year with the administrator, and he was . . . "Great—you wanna do it, do it." And that's what I like about my administrator, he doesn't really care what we do.

Wendy: High School Mathematics

The 1996-97 school year was Wendy's second year of teaching and second year in the ECS Program, but she had just moved to a new mathematics position in a high school with roughly 620 students and four other mathematics teachers. Wendy, in her early twenties and recently married, had taught the year before in an eastern Montana town, but relocated so her husband could complete his education. Her personal education experience was rural; she graduated with a class of seven students, so the community of 6,125 (1997 estimate) she now taught in seemed large by comparison.

With an economy based on ranching and the railroad, Wendy's small town lay within commuting distance of a major city where her husband attended school. Her high school was relatively new and appeared to be well-supported by technology: a videodisk player was evident in one of Wendy's classrooms; the morning announcements were delivered by students over closed-circuit television; and attendance was taken via networked Macintosh computers located in each room.

Like all of the core group novices, Wendy prepared for her career at a Montana university. Student teaching in a junior high school was a "great experience" with an excellent teacher who prepared her well for the classroom. She could recall no weak spots in her student teaching experience, but was not as positive about the preparation provided by her coursework.

She felt that her pre-student teaching classroom experience, which consisted of observation during a sophomore practicum spanning a semester, was inadequate. "I don't really feel like when I came out of college that I was prepared. . . . I probably learned more in the first month of my student teaching than I had in my four years of college."

Wendy taught three different lower-division mathematics courses, each in two sections. She was also the cheerleading advisor. Two of her classes had fifteen students; the others averaged in the mid-twenties. In 1996-97, Wendy was a "roving" teacher, sharing a small office with the Title 1 teacher and an aide and moving from room to room to teach. Her classes were held in the music room, a history classroom, and in other teachers' mathematics classrooms. She sometimes shared the space with teachers who remained working at their desks or computers, and she had to carry her equipment and materials with her throughout the day. With no place to store calculators or set up computer lab stations, she found it difficult to incorporate technology.

Pamela: Elementary Mathematics/Science

Pamela's community of 1,586 (1997 estimate), a medium-sized farming center, was located on Montana's "high line," a fertile grain belt stretched along the state's northern border. The small town radiated outward from a downtown of two city blocks, crowded with traditional shops and businesses that hinted of an agriculture-based economy. Pamela had raised her children

in this community, and her family owned a local business. Her school was fairly new and located in the middle of a residential area.

Pamela had returned to college as a nontraditional student, completing her education degree after her youngest child entered high school. She had considered a minor in science and took several courses including biology, botany, and physical science, then ended up minoring in reading. She had taken a few mathematics courses as well. Labeling her mathematics and science methods course as "atrocious" and "disappointing," she noted: "I had an instructor that had never been an elementary teacher, so he didn't have a clue." Pamela student taught with a third grade teacher who "threw in" science whenever she felt so inclined, which apparently wasn't often:

Everything I did [in science], I just kind of did on my own. I probably did more in my student teaching than she does in an entire year. . . . When I actually started teaching, that's when I really started reading and experimenting. . . . I felt I really had a hole there.

Pamela was one of two fifth grade teachers in her school, and was pleased with her students. "I'm very fortunate; I have a wonderful class of kids . . . almost all on the same learning level—I don't have any real lows, I don't have any real highs." She was comfortable with her fifth grade colleague, but considered herself to be "so opposite as far as teaching that we don't do a lot of things together." She was a long-time resident of the community and a former PTA president, and felt fortunate to have found a local teaching position, which was won after student teaching and substitute teaching for several years prior to this "dream job."

In Spring 1997, Pamela was very positive about her circumstances and the way education was valued by the community:

[This] is a rural community, basically farming, ranching . . . I'd say half of my students, their parents are involved in farming and ranching. The other half are involved in businesses that support the farm. So we are very dependent on ourselves as a community and a school. I think the school is . . . the core of the entire community—everything revolves around the school. At this stage of the game the community is super supportive—you know, all the levies are passing, that sort of thing.

She also praised her administrators as "fantastic" and fellow teachers as "super supportive . . . they're good mentors too." She found no fault with her indoctrination into a teaching position: "I'm just so thankful I'm where I am. It's a great place to be."

Catie: Elementary Mathematics/Science

The community (pop. 489, 1990 census) where Catie lived and worked was 60% Native American. It was located on the southern end of a reservation that encompassed a busy travel corridor between two medium-sized cities. Catie, herself a Native American, was raised in the community and had remained there through eighteen years of marriage.

The town's elementary school and high school shared a parking lot; the newly constructed junior high school, with a football playing field and track, lay within walking distance. Catie's elementary school housed 267 students. Her fifth grade classroom, home to seventeen students, was housed behind the cafeteria in what was once a junior high wing. A well-equipped science

lab, which was originally designed by a mentor teacher in the ECS Program, was now used by upper elementary students.

Catie's experience in the school system began after her children reached school age, when she worked in the bilingual program as a teacher's assistant and a facilitator and eventually decided to pursue an education degree. Other than a microbiology class years earlier, she had previously taken no science or mathematics content courses: "I did just what I had to do to get through elementary ed." That limited background left her feeling unprepared for her upper elementary teaching position. Student teaching was a positive experience for her, but it was at the primary level and it had concerned her that the cooperating teacher did not use textbooks. "You pretty much scrounge for a lot of things to teach. . . . The resources are really important and you need to be able to find them quickly." Not yet convinced that she wanted to teach, Catie had proceeded through teacher training without a clear career goal:

I probably more thoroughly enjoyed just learning as an adult learner than I did thinking that I really [wanted] to be a teacher. And then when I finally got to where I got my certificate, and even through my student teaching, I wasn't sure I wanted to be a teacher. So—right now I feel . . . six months have been really good, and I have a . . . real good classroom, and I feel like this is a good choice for me right now.

Catie's repeated references to the "good" experience she was having reflected her initial uncertainty about becoming a teacher. She seemed surprised at her own success, despite the fact that she worked hard to perfect her teaching and to plan fitting curriculum for her students.

Catie believed that "The community really sees the school . . . as something they want to be more involved with, or have some more decision-making abilities with, and that probably comes from the smallness of it." She did not have any difficulties with her principal, but noted:

My administrator also is our superintendent, and he is part-time principal for the elementary. . . . [I've seen him] put one hat on and take another one off right in front of me. . . . It's hard for me just knowing how busy he is . . . and knowing that I don't want to interfere with that so much. And so I'm not necessarily getting a lot of support from him professionally.

She did rely on the other fifth grade teacher, a 25-year veteran who was soon retiring, for answers to her questions about curriculum planning and topic coverage and for teaching ideas. Although her school was lacking in research materials and library resources, she had turned many of her fellow teachers into resources. "They would help me get things going so that I could make a presentation . . . I think within the school there are a lot of resources . . . that I'm comfortable soliciting."

Phil: High School Science

Phil taught in a remote school which served an almost entirely Native American population representing several tribes on a small, sparsely populated Indian reservation. The community (pop. 333, 1990 census) near Phil's school consisted of little more than a grocery store, schools and churches (including a Catholic church with a mission school serving grades K-8), a post office, and a community center. The region his school served was

extremely isolated, offering few work opportunities for its residents. Phil felt that community members lacked motivation and declared that "currently we have the highest unemployment rate and the highest dropout rate in the state," although he offered no support for that claim.

The school was an attractive brick building situated on a hill between the two small communities it served. Phil, who was non-Native American, lived with his Navajo wife and toddler son in teacher housing, a row of condominium-like homes behind the school. He had chosen this school partly for the available housing, partly because he wanted to bring his family to an Indian community, and also because "I came up and saw the area and I really like it . . . the people are real friendly; it was just really nice open country."

Phil had a solid preparation in his chosen profession. He had first finished an elementary degree, then earned a science broadfield degree; this had resulted in two separate student teaching experiences. He still exchanged materials with one of his former cooperating teachers, and obtained resources from the university where he earned his degree.

Phil felt there was a severe lack of motivation among his students. His impression of his high school students was that they took pleasure in "getting rid" of teachers; they considered anyone enforcing discipline to be too hard. He spoke of drug deals and suspicious activities among students, and pointed out a bullet hole in his classroom window. Phil was resigned about the

students' lack of respect for equipment and property. "They used to have one of the better science departments from what I understand, and when I walked in there most of the equipment had been dismantled, taken, stolen or broken." There were no computers in the science room; Phil had purchased some scientific calculators at a K-Mart. He was slowly repairing microscopes and balances using spare parts.

Phil felt that his rural background helped him to fit into the community. Agriculture was of primary importance in the area; at mid-year, Phil was asked to give up some of his science courses in order to re-establish a vocational agriculture program. At the time of the study, he taught chemistry and physics along with "vo-ag" courses, a major shift from fall semester when he taught all seven of the science courses available to grades 6-12.

Phil had come to rely on assistance from the nearby community college: "The college has helped me out as far as . . . when I need microscopes and other supplies that I needed, you know, like immediately." He sensed strong support from the school board, but not from parents, whom he felt paid little attention to their children's education. His attempts to involve students in diverse science experiences were often derailed by lack of parental interest and involvement:

Parental support is very low . . . for these projects and stuff like the science fair, and I've had zero interest. The kids'll say, "Yeah, I want to do it," but the parents don't really help the kids, they don't back them I don't know if they feel ashamed because they don't have the knowledge that backs them or what the deal is.

Renée: Middle School Mathematics/Science

Renee taught middle school in a small farming and ranching community (pop. 358, 1990 census) on an Indian reservation, although in her region the majority of the residents were non-Native American. Her K-12 school complex consisted of an original building housing grades 7-12 (about 200 students), a newer elementary building, and two or three annexes, one housing a well-equipped mathematics classroom and computer lab. The older main building had just one hallway, but it generated an authentic high school atmosphere with the help of purple lockers whose slamming doors echoed under the high ceiling, students moving between classes, and showcases filled with art projects, trophies, and special displays.

Renee was glad to work in a small school where she could teach elementary grades and coach high school athletics, but she would have preferred a slightly larger community. She felt isolated in this town, which consisted of little more than a cafe (with bad food, according to Renee), a gas station, and a few shopfronts on a byway traversing a broad valley. Her sense of isolation carried into the classroom: Renee's first year was spent as the only first grade teacher, which was the grade level she had prepared to teach; she was then moved to sixth grade for a year, and in 1996-97 shared the seventh and eighth graders with another teacher. Flexible and energetic, she was coping well with the switch from primary to intermediate to middle school assignments:

Well, I did all my preparation for first grade; my student teaching was in first grade . . . as far as preparing with all my classes, I took more on the lower elementary side, and I geared all my information, collected stuff for first grade and then taught the first grade, and I like it, but . . . the lady was on pregnancy leave, so it was a one-year position only. And so I knew I either had no job or I could teach sixth grade, and so sure, I'll teach sixth grade.

Renee's preparation included microbiology and one or two other science courses, but no mathematics courses beyond the required sequence for elementary teachers. She wished that a course on "organization" had been available to prepare her for the politics of schools, parent relations, and classroom setup—she could not recall learning such topics in any college course. Her student teaching experience was "pretty bad." She did not get along well with her cooperating teacher: "Her room was like a disaster and she was like completely unorganized, and she didn't get along with my supervising teacher, who ended up quitting halfway through."

In 1996-97, Renee was teaching mathematics, science, and speech/English at the seventh and eighth grade level. She had also coached volleyball, track, and the elementary basketball program, and served at various times as spelling bee coordinator, Academic Bowl advisor, and Science Olympiad coach. Her eight-period day included one prep period, and her student load averaged around fifteen, with one class of thirty students.

Renee's mathematics program relied on the "Six Through Eight Mathematics" (STEM) curriculum, a model mathematics series integrating hands-on activities and technology. Her eighth grade mathematics class was

slow-paced, partially due to the inclusion of nine resource students and two special education students. Renee and another teacher each taught mathematics to a seventh grade class and an eighth grade class. The seventh grade classes followed the same curriculum, but Renee's colleague kept the advanced eighth graders in an algebra-based program, while Renee worked with the below-average students using the STEM curriculum.

This was the first year that Renee had taught science. Her classroom lacked basic science materials, including microscopes and balances. She did appreciate the abundance of nearby natural resources, including wildlife and bird refuges:

You know I use the outdoors a lot, it's like my biggest resource just because we live in Timbuktu. So I don't have a lot of other resources besides the outdoors, or maybe some microscopes I might borrow from the high school . . . that kind of thing.

She felt comfortable with the principal (it was his first year at the school) but was less at ease with her superintendent. She relied heavily on the experience of the other middle school teacher and high school teachers, particularly with help in determining appropriate material for middle school students:

I feel comfortable going in and borrowing books, or asking them questions . . . there's not a lot of them, there's only one science teacher and one math . . . not a lot of people to go to, but I use what I have.

With science especially, I've just kind of asked [the other teacher] which way he's gone. . . . I've looked at the book, I've just picked different routes. . . . Sometimes I follow the book, sometimes I just pick a unit, and—I'm trying to follow the curriculum, you know: "What do they have to know by the time they leave seventh grade?" . . . that's all I had when I went in there.

Paula: Elementary Mathematics/Science

Paula taught in a remote community (pop. 124, 1990 estimate) bordered on two sides by railroad tracks and a highway which climbed the nearby Continental Divide. The trains no longer stopped in the tiny town, which had no store or motel but boasted a cafe.

Paula's school had no on-site administrator; it was part of a combined district with a county superintendent. Three of the four schoolrooms served as combined classrooms for grades K-2, 3-5, and 6-8; the fourth housed a combined lunchroom, library, and media center. Books lined one wall of the all-purpose room; tables filled the room's center; computer software was shelved in a corner; and along another wall an aide prepared the day's lunch using a microwave oven.

The 1996-97 school year was Paula's fourth year at the school, making her one of the most experienced novice teachers in the ECS Program. She was currently the "supervising teacher" at her school, which in the absence of a principal gave her responsibility for school paperwork and for overseeing the other two teachers and 47 students. Paula's preparation in mathematics and science was moderate; she took the required mathematics methods and content courses, and added astronomy, geology, and zoology to her science preparation. She had enjoyed a lot of freedom and responsibility while student teaching, and still used a book of units and activities compiled by her

cooperating teachers. However, she critized what she recalled as a lack of supervision by her college mentors, and the fact that so little time was spent in schools prior to student teaching:

You could conceivably become a teacher with very little actual time spent in the schools. . . . I also sometimes felt that there was nobody really checking as we went along to see if we were truly teacher material. . . . There were some people who got to their student teaching and then really suffered because it just wasn't the thing for them.

Paula's current teaching position was not her first choice, but it had been her first solid offer of employment and was not unattractive to her:

I did attend a school a lot like this when I was a kid myself, and . . . I think part of that draws me here too. This is my fourth year. In my mind I kind of have five years as my maximum; I don't know for sure if I'm going to follow that.

In 1996-97, Paula was responsible for the education of seven half-day kindergarten students, five first graders, and three second graders. Along with the other teachers, she commuted to school from a medium-sized city about half an hour away. She wryly noted that the community probably preferred it that way:

I think people in this community want the teacher to be . . . a saint, or you know, think the teacher really shouldn't be doing anything social The board realizes we have lives, but they think it's better if we can live them without being under the microscope.

She portrayed the school as central to the life of the small community:

The majority of families have been here for fifty plus years, and the students often are second or third generation to attend the school. In many ways, the school is kind of the focal point of community involvement—that's where families get together, at school functions

... [a] very important part of the community. I think the people realize that, were it not here, they would be really missing out on something important. ... They're very aware of that.

Paula identified the county superintendent as "our direct supervisor—he's the one who does evaluations on us ... he's kind of the liaison between us and the parent." The three-member school board served a similar function. But in matters of curriculum and practice, the teachers appeared to be on their own:

But at this point [the principal is] not a person who's real helpful, so while that should be a resource, it's not always a resource. There are as I said, several other rural schools around, and sometimes ... we talk with those teachers. But I think we're almost responsible for finding our own support sometimes.

Tina: Elementary Mathematics/Science

In 1996-97, Tina was in her third year of teaching at a country school. She had first taught fourth grade for two years, and at the time of the study was in a third/fourth grade combination. She had been a first grade teacher for two years about ten years earlier, then took several years off from full-time teaching to substitute teach and raise her family. She applied for openings during that time, "but I was raising twins, and so my heart wasn't in getting a job." Her current position seemed ideal, as she lived within a mile of her school and her children would soon be attending there.

Although located in a heavily populated region of Montana, Tina's school stood alone in the countryside, over ten miles from any established community. The 100-year-old schoolhouse was a sturdy, bell-towered

building housing the kindergarten and two other classrooms; Tina taught in an annex built in the early 1990s. The buildings were perched on a hilltop against a backdrop of empty fields and tree-covered mountains.

The school district served roughly 120 students, 21 of whom were in Tina's combined third/fourth grade classroom. She noted that "we're getting a lot of out-of-district kids" and felt that the majority of the recent arrivals were low academic achievers and "needy," based on difficult economic or family circumstances. Like most of the staff members at her school, Tina held multiple roles. For instance, she had recently agreed to devote several hours a week to a new student with resource room needs: "There's a class full of children that need me, and now he will too in a different way. . . . It just kind of like got chunked my way."

The school and others like it in the region had formed a local curriculum cooperative, and Tina felt she had accessible resources through that organization, more so than on a local level:

And we try to use each other, but our school is not good at that—our staff is not good at that (I shouldn't complain). . . . It's kind of everybody just does their own thing, and if you ask they'll tell you, but it's not like share, you know.

Among the core group of novices, Tina seemed uniquely unnerved and intimidated by her responsibilities. Other than astronomy, she could not recall taking any science or mathematics courses (including methods) during her college training. Her negative self-concept fed her insecurities about teaching science and mathematics, and her intuition and behavior often

contradicted each other. "I do math book. I mean, I'm terribly dry—I mean, I'm boring. We go straight through the math book, as exactly like I'm not supposed to do. And I know that." She attempted to use the engaging activities provided by her mentor, but added, "I always worry that I'm not teaching then, 'cause we're playing and the kids act like they're crazy."

An experienced teacher in the cooperative had offered to work with her on science experiments, but Tina was fearful of having someone in her room keeping track of her actions. She felt compelled to ask her administrator's permission for virtually everything. From her perspective, his responses were evasive and challenging, yet she felt that the other teachers could simply state their plans and do what they pleased. Her self-esteem was painfully low: "I feel like I'm just drowning so much . . . it's that darn confidence thing again, but that's my own stumbling thing, really."

Daryl: High School Mathematics

Daryl's community (pop. 278, 1997 estimate) evoked a sense of abandonment. Its center consisted of a block of apparently empty row houses, a deserted city park, and a broad swath of cinders and vacant space along Main Street, which displayed a row of once-impressive empty buildings flanking the abandoned railroad yard. The signs of habitation existed solely on the periphery: one gas station, one market/general store, two bars, two churches, and one motel (which Daryl and his wife owned and operated).

Daryl's school, situated across from the post office and general store, housed elementary students in one wing; the high school wing, which dated back to 1923, held 63 students in grades 7-12. The mathematics classroom was very small, with barely enough room for eleven desks, a teacher's desk and bookshelves, and two computers. Other than a few geometric models, there were no mathematics supplies or supplementary teaching materials in sight.

Daryl grew up in a nearby community where he also attended college after many years of ranch work. He entered the teaching profession more out of necessity than desire:

I was working on ranches and there were a lot of the older folks I [saw] that were 70-80 years old still having to work and I said I didn't want to; when I get to be that old I want to be able to retire, do something else. I went back to college, really didn't know what I wanted to do. For a couple of years I went back, kind of just got into the education program.

After graduating, he spent two years in the Idaho school system, then went looking for a job in Montana. "I wanted to get into a bigger school system . . . I thought it was more prestigious to be in a bigger school. . . . [Here] it's a lot of different subjects to teach and everything, but I enjoy it."

Daryl's class sizes were small, ranging from three to twelve students, but he had a daunting schedule. He taught eight different classes: seventh and eighth grade mathematics, Business Math, Pre-Algebra, Algebra I, Geometry, Algebra II, and Advanced Math. On top of this workload, he was guiding four students through independent studies, and he coached the football team. Daryl felt that local residents were interested in the school, and

noted that parents often came by to visit. Besides offering sporting events, the school served as a community center for dinners and other activities.

Daryl's school was not far from the college campus where he was educated, and he felt comfortable returning to his professors there for resources and advice. His available technology included two IBM computers, an Apple computer, and fifteen TI-82 calculators. He planned to begin working with calculator-based laboratory activities (CBLs). "I have one CBL, and then I've ordered another one with a lot of the monitors, and I'm going to start with my juniors this spring with those." Daryl had been coordinating with the science teacher and attending workshops in an attempt to integrate their two disciplines.

As the mathematics expert in his school, Daryl had a great deal of freedom in his classes. He was trying to rearrange the curriculum so that it adequately supported his Advanced Math course; when he started at the school, he felt "they had no concepts of what they were doing and why they were doing it." Students entering courses did not have the arithmetic or algebraic skills necessary to move ahead. Along with strengthening the skills of his lower-level students, Daryl was remediating his upper-level students as they continued to struggle with advanced topics.

Reporting of Core Group Data

The nine core group novice teachers have been introduced in the following order: Barb, Wendy, Pamela, Catie, Phil, Renee, Paula, Tina, and

Daryl. This sequence will be repeated in upcoming sections wherever individualized information about the core group subjects is presented. Most of the data reported so far was collected during the 1996-97 school year. Subsequent sections will include information updated through March 1998.

The above sequence of names represents a loosely ordered progression from greatest to least in terms of involvement in the ECS Program, benefits from interaction with a mentor, and successes experienced as a teacher. In particular, the first five novices (Barb, Wendy, Pamela, Catie, and Phil) were the most confident and capable teachers in the core group; all had strong convictions about teaching mathematics and science, and all had positive mentoring experiences.

The last four novices (Renee, Paula, Tina, and Daryl) encountered turbulence in one or more aspects of their mentoring experience. Paula had trouble getting responses from her mentor; Renee and Daryl were difficult for their mentors to motivate. In addition, all four had unusual demands placed on them at school: Renee taught three different grades in three years; Paula taught three grades at once while supervising other teachers; Tina was embroiled in school politics while teaching two grade levels, and Daryl taught grades 7-12 while holding down another job and coaching duties. It is helpful to consider these similarities and differences when considering the data.

Purpose 1: The Nature of the Mentor/Novice Relationship

The first purpose of the research was to "Characterize and document the nature and development of the relationships established between mentors and beginning rural teachers in a distance-mediated mentoring program." This section opens with a sequential overview of the concerns, goals, and expectations expressed by each core group novice. Analysis of the mentor-novice relationships then begins with a discussion of first encounters between core group partners. Each core group partnership is explored in depth, and then relationship-based themes which emerge from the core group data and from analysis of the survey responses are presented.

Concerns, Goals, and Expectations of the Novice Teachers

Three sources of data revealed the core group novices' concerns and goals as new teachers, and their expectations for the mentoring experience. First, the researcher reviewed ECS Program application essays where the novices were asked to write a one-page essay explaining how they would implement one or more reform strategies for teaching mathematics and science in their classrooms. Second, additional information was gleaned during classroom visits and informal conversations. Finally, these areas were explored in structured interviews through inquiries such as:

- Recall your expectations when you first applied to the mentoring program.

What kinds of support were you hoping to receive from your mentor?

- As your first/second school year progresses, what are your greatest needs or areas of concern regarding your math/science teaching responsibilities?
- Is your mentor aware of those needs or areas of concern? Why/why not?
- Specifically, how has your mentor helped you with your needs or concerns regarding math/science teaching?

The following vignettes represent a synthesis of the data collected from each novice.

Barb. Barb attempted to make problem solving, hands-on science discovery, and computer technology part of the daily routine in her third grade classroom. Every day's mathematics lesson began with a problem solving session, and she tried to incorporate models, graphs, and technology into her science teaching.

Barb's greatest concern was her occasional uncertainty about creating her own curriculum. "I'm filling out my lesson plans and go into the science section and go 'Okay, now what do I do this week?' 'cause I don't have . . . a layout and I have to come up with everything." She preferred to work without textbooks, but worried about having a new administrator the next year who might not allow her such freedom. "You know you never know who you're going to get, especially in a small town, and I'm just scared that somebody's going to come in on this big power trip, 'You have to use the book.'" Barb's attitude was quite different from that of other novice teachers.

For instance, Tina saw her administrator as an adversary who challenged her methods, and Catie felt regret that her administrator was too busy to offer her much help; but Barb hoped that her administrator would stay out of her way. Also, Tina felt lost without a science text to follow and Catie expressed similar concerns, while Barb was determined to avoid using a text if possible.

Wendy. Wendy's ultimate goal was "to motivate my students to become lifelong learners." She stressed her regular use of cooperative learning to conquer students' fears of mathematics, to improve their communication skills, and to enhance their higher order thinking.

Wendy did not express any concerns about her new position, other than to bemoan the practical inconveniences of her roving status. She did share her hopes for participation in the ECS Program:

It sounded like something that would be really positive, that would really help me through my first few years. It would be a place where I could get ideas . . . or create ideas with other people, especially when we go to the conferences and stuff, and it just sounded like something I'd really want to be involved in.

I don't feel I'm very—a very creative person by myself, but sometimes when you brainstorm with another teacher or something, you come up with all sorts of ideas. . . . Also, not only that but a person that I could talk to about disciplinary things, maybe administrative things . . . any problems that I was dealing with at all, or that she might be dealing with. [It would] be kind of a person that I could keep in contact with, that had the same interests as I did as far as being a math teacher, and—somebody that we could relate to each other.

Pamela. Pamela's interest was in connecting subject areas such as science, mathematics, social studies, and reading/language arts. She wanted

her fifth graders to be able to "explore, experiment, and participate" as learners. Inquiry, problem-solving, and model building were the techniques she wanted to emphasize.

Pamela felt fortunate to have the backing of a cooperative administrator. "She . . . is behind me one hundred percent—may offer suggestions, recommendations, but I haven't been turned down on anything I want to do, and I've done some really unusual things, you know." She was proud of her literature-based science program, but had concerns about her mathematics teaching:

I'm not as confident as I would like to be. I try to grab every workshop . . . and opportunity that comes up, because I felt like when I went back [to school] . . . my math background was not what I want it to be.

Pamela was also initially concerned about working with a mentor: "I was really, really nervous about the mentor part of it . . . I kept thinking 'Oh dear, I'm gonna feel so inferior.' . . . So that was kind of a pleasant surprise too . . . as comfortable as it was." She felt she could learn a great deal about science from her mentor, who was responsible for the science program for an entire elementary school.

Catie. A Native American herself, Catie was making a conscious effort to "locate specific strategies to use in my classroom to effectively engage female and minority students." She wanted her curriculum to be culturally relevant and personally applicable so that students would be able to use the knowledge they already possessed to increase and extend that knowledge.

In 1996-97, Catie was teaching social studies to two fifth grade classes while the other fifth grade teacher handled science. However, she was planning ahead for the possibility of teaching science the following year, and hoped to use that summer to design a curriculum which employed the learning cycle and the scientific method. While her more experienced colleague was able to design a text-free curriculum, Catie was concerned about teaching science without a book. Revision of the school's science curriculum had been held up in favor of other subject area revisions, and she lacked guidance.

Catie was just beginning to actively pursue changes in her mathematics curriculum, although she had begun the year on a note of caution:

With the math—it was my assumption that with the textbook that we have . . . I needed to pretty much follow it. But I want to be able to break away and do some more hands-on things too, and within our math program, there are written in there several times when you can do that.

And that's kind of the way I feel about the math right now, is if I follow through with . . . the textbook . . . guiding me . . . I will know what that textbook has to offer, and I can use it more flexibly next time It kind of depends on subject level with me, and I think right now we're getting into where they're doing graphing, and so I think I can get more creative with that as far as having them do their own surveying and collecting data . . . and making graphs. But as far as hands-on things, there are some in my room, but I haven't used a lot.

Phil. Phil's initial plans for his new position were wide in scope. He was aware that he needed to be culturally sensitive among his Native American students and community. He was eager to find science applications related to local geological and mining interests. Through the Internet, he

hoped to introduce his students to researchers in major science disciplines. At the same time, Phil was very concerned about maintaining order in his classroom and spoke of letting students "know their boundaries" and keeping a "very structured and orderly room so that students feel safe in their learning environment."

Although Phil felt that his administrator was open to new ideas, he had little chance to try any "because with seven classes it was almost next to impossible to get a lot of labs going." His greatest and most pressing content concern was the low skill level of his students in science and mathematics; he felt that they lacked the familiarity with terminology and mathematical processes needed to move ahead successfully.

Renee. Renee expressed her desire to succeed in her new assignment at the sixth grade level. She hoped to get her students actively involved in mathematics and science through real world experiences and cooperative work. Renee felt she had freedom in choosing her curriculum and in using or not using a textbook. However, she did not have a grasp of science and mathematics content standards for middle school students, and hoped that they would have what they needed when they left her classroom:

I need to make sure I'm getting the students the basic math they need to be able to grow with STEM [mathematics], and am I doing it? I don't know. . . . I just don't know for sure if I'm—if the students are getting everything they need. . . . I've never done it before, so I—I just feel completely lost as far as which direction to go. . . . And I was worried that they'd know more than I did. . . . What would I do when they

asked me a question I didn't know the answer to? That was a huge fear.

Renee considered the ECS Program an opportunity to "grow in her field" and felt it would be helpful to have someone else to talk to and to support her in mathematics and science:

Well, basically I was just trying to get someone I could speak to, ask questions about my curriculum, and especially with sixth grade just the math and the science, 'cause I didn't know it all, and you have to go-home and study a lot, and make sure you know everything . . . just a friend, someone to talk to and share your day with if you had a problem . . . someone out of your school, you're struggling with maybe getting support at your school, somebody else I could talk to that might be-had taught a while that could have some helpful answers.

Paula. During her second year of teaching, Paula received a brochure about the ECS Program, and decided over the summer to apply. "I didn't feel like I was doing, especially with science, the best job I could. . . . That's part of the reason why I applied too, is-well, I've got to challenge myself a little bit in the science area." She had come to realize that she could not teach all subjects every day to three grade levels. Possible solutions she saw to that problem were the integration of mathematics and science topics, and group projects as "a wonderful way for students to learn from each other." Since many of her students remained with her for three years, she also hoped to "incorporate a variety of techniques into my teaching . . . to provide a better learning environment."

Like several of the core group novices, Paula's expectations were for a mentor partner who would share ideas and materials and work closely with her and her students:

I was probably hoping for someone who would have a lot of ideas as far as curriculum, and units they would share with me, and—especially the science—a person that would be willing to maybe do some projects in conjunction with . . . our classes corresponding with each other and things like that.

Paula felt that her years of experience had increased her academic freedom, but did not necessarily find that to be a benefit. She viewed the ECS Program as a way to challenge herself in science: "Maybe this'll be a way to hold me more accountable, because really I'm—you know, there's no one looking over my shoulder out there." She felt more comfortable with her mathematics program, but continued to look for remediation ideas and "alternative ways to teach different concepts."

Her greatest concern was her school's curriculum:

I've—maybe I feel like I have a little more freedom because I understand a little bit more what they believe and what they don't, and . . . what would be stepping on someone's toes. I sometimes feel like we don't have enough supervision in some ways.

For me personally, it's having a curriculum—our school doesn't. We just say we follow the state guidelines, but I've never seen those either. And teaching three grades at once . . . I still need some kind of framework where I can hit all the bases in three years—you know, do everything that kindergartners should do, and a first grader and a second grader, for science especially . . . that's the big one.

Unfortunately, she didn't feel that her mentor could offer much help with the issue of teaching in a multi-grade classroom. "My concerns are always time—you know, am I spending the time on math and science? . . . I'm not

sure that anybody else can really relate." Paula tended to discuss multi-grade issues with teachers in three nearby rural schools who had similar teaching assignments.

Tina. Tina felt that "children are full of a natural curiosity that needs to be challenged and channeled for more discovery to 'spark.'" She wanted to actively engage her students in mathematics and science, but after several years out of the classroom, Tina had a severe lack of confidence in those areas. She described her science teaching method as "flailing." Her biggest concern about mathematics and science was "that I don't teach them very well":

I don't have that natural curiosity. . . . Our science teacher says "Oh gosh, it's so much fun. . . . Wait 'til you do this science project," and I said "And it didn't turn out," and she goes "Wasn't it great? That's the best part about science." And I'm thinking "But I didn't know how to explain why it didn't work". . . . It bothered me I think, 'cause I felt just—I felt stupid. . . . So of course you kind of avoid those things that make you look like . . . you don't know what you're talking about. I have a different idea of what science is too, that it's dissecting and doing stuff that I'm going "Ooh". . . I don't have a science background at all.

Tina took one biology class in high school, and seemed to recall taking astronomy in college, but she had no memory of science content and methods courses taken during her training. As a classroom teacher, she felt handicapped by this serious knowledge gap and had armed herself with training in the use of innovative mathematics and science teaching packages such as Activities Integrating Math and Science (AIMS) and Marilyn Burns' mathematics programs. "There are tons of ideas in there for me to use, but

it's again figuring them out, trying them at home, making sure I have all the supplies, whatever." Her greatest concern was the uncertainty inherent in using hands-on activities, and she seemed to have a great fear of losing control of her students:

Having the group of children that I have this year, the minute I start anything—if it has to do with water, if it has to do with waste, it doesn't matter—they're eating them, they're throwing them, they're chucking them, they're breaking them. . . . I lose my patience and I think "What am I doing?" I mean, I want to get out a book and say "Now we're gonna read about science". . . . We don't have a book, so I can't anyway.

I mean, the minute that you stop doing what they're traditionally used to or seatwork, an administrator might walk in and the kids are playing around, or a parent. . . . I'm trying to jump through everybody's hoops, and as a result I'm not doing what I'm supposed to.

By Spring 1997, the school had become a high-stress environment for Tina, and she was fearful for her professional future:

Last year was the worst year of my entire life, because I had parents that wanted to run things and it . . . in particular [there] was a school board member and a parent in my class, and he came in and honest to gosh, harassed me. I mean, it was almost to the point that it was a lawsuit.

Everything I did he questioned, he commented on, he wanted it done a different way, tattled on me to the administration—it was horrible. And he made things miserable because he talked to other board members and then it ended up that another family in the class didn't think I was doing anything right, but they hated the administrator and I was the easy target.

Throughout the early months of 1997, Tina was in the midst of conflict with her principal, who wanted her to resign (she refused) and was unlikely to rehire her for the coming year. She had received several parental complaints about various classroom issues, and in recent months her principal had compiled a list of concerns about student safety, discipline and management,

and instruction. Tina admitted that she had not confided in other building teachers, although she thought they might support her struggle:

When things were going smooth I felt like everybody supported me, including the parents in that first year. Then last year all this happened, and when all this was happening, my administrator took me into his office and told me that it might be better if I resigned. So all of a sudden there-now, I don't know if he supports me.

Support to Tina meant validation of her classroom practices and assurance that she was making progress as a teacher. She sought this support from her ECS Program mentor. She also harbored the hope that somehow the ECS Program would fill in the gaps she perceived in her science and mathematics preparation:

[I entered the program] one hundred percent for support, for a mentor that would be able to give me advice—not necessarily advice, I shouldn't say that—to give me strength in math and science. I really looked at that as being a weak area and the application talked a lot about how they would be giving you ideas and ways to teach it better and I knew I needed help in there, so I looked at it more from that first, and then I also thought of just having a mentor that would help me in teaching in general terms.

I thought I would become a wonderful science teacher. I was expecting her to have a magic wand and—I mean, ideally I really hoped for tons of ideas and . . . ways to teach science because I hadn't taught it at all yet and I was really nervous, and so I thought any help that I could get first would be a really advantageous thing to do.

Tina's mentoring situation was somewhat of an anomaly: she had a warm relationship with an outstanding, proactive mentor teacher who lived near enough to allow for frequent personal visits and classroom observations, yet despite her mentor's interventions she lost professional ground during the 1996-97 school year. One obstacle to Tina's progress was her insecurity and

deep-seated certainty that she was an inadequate science and mathematics teacher. In addition, 1996-97 was her third year at her school; her first two years may have given rise to negative workplace perceptions that her mentor could not influence, and a chain of events that her mentor could not reverse.

Daryl. Daryl was very familiar with the isolation and limitations of ranching, and he wanted to use technology and teaching to expose his students to new opportunities. His interest in the ECS Program was piqued by a mailing that offered a chance for new teachers to improve themselves based on the experiences of mentors. He colorfully described his imagined mentor:

[I thought] of the Kung Fu movies [with] the little grasshopper and the master. . . . I really didn't know [what] kind of support I'd be getting. You know I was just hoping I could get a lot of new ideas how to teach the new math or things different . . . a lot of the kids in this school here are, you know, "When are we going to use this?" and they never really experience life outside . . . [I want to] try to get some of the big city ideas into a smaller community.

Daryl's "big city ideas" formed a vision for his mathematics program. In his ECS Program application, he described his recent purchases of a 486 computer and TI-82 calculators, with plans for more calculators and CBLs. He had been working with the science teacher to integrate the two disciplines through technology labs and "real world modules" calling for teamwork, research, data collection, and writing from students.

First Encounters

None of the core group participants was prepared to begin telecommunication via Metnet when mentor partners were first assigned; most of them were unfamiliar with the FirstClass® Client software or had not yet solved technical problems in connecting to the network. For all but one of the nine core group pairs, initial contact was made either by letter or by telephone. More than half listed their first face-to-face contact as occurring at a workshop or event sponsored by the ECS Program, as shown in Table 7.

Table 7: First Encounters Within the Core Group

Novice	Joined ECSP	Date/Location of Face-to-Face Contacts	
Barb	Fall 1995	May 96	Best Practices Workshop
Wendy	Fall 1995	Nov 95	Mentoring Skills Workshop
Pamela	Fall 1996	Jan 97	Mentoring Skills Workshop
Catie	Fall 1996	Jan 97	Mentoring Skills Workshop
Phil	Fall 1996	———	No face-to-face contact as of 3/97
Renee	Fall 1995	Nov 95	Mentoring Skills Workshop
		Fall 96	Formal switch to current mentor
Paula	Fall 1995	Oct 95	MEA Conference
		May 96	Best Practices Workshop
		Oct 96	Mentoring Skills Workshop
Tina	Fall 1995	Nov 95	Mentoring Skills Workshop
		Spring 96	Formal switch to current mentor
Daryl	Fall 1996	Dec 96	School site visit by mentor

Of the nine core group mentor-novice pairs, Daryl and his mentor had the most unique first meeting. After four or five telephone exchanges, Daryl's mentor traveled to his school to spend an evening getting to know him, and the next day modeled his teaching techniques in Daryl's classroom. By contrast, Phil had not yet met his mentor in Spring 1997, although they

were in regular contact by telephone. The other seven mentor partners met for the first time during an ECS Program function, but the similarities ended there, as shown in the following examples.

Three of the core group pairs (Wendy's, Catie's, and Paula's) first met at a function sponsored by the ECS Program and designed for that purpose. Paula (new in 1995) and her mentor first met at a two-hour ECS Program session at the Montana Education Association conference in October 1995. They also both attended the ECSP-sponsored Best Practices Workshop in April 1996, and saw each other again at the October 1996 education convention. Wendy (new in 1995) and her mentor both attended the Mentoring Skills Workshop in November 1995.

Catie (new in 1996) and her mentor first met at the Mentoring Skills Workshop held in January 1997; they had already conversed regularly on Metnet and by telephone for several months. Catie appreciated an early initial contact by her mentor, who telephoned her two weeks before school started. "There were things that I needed to ask her right away . . . about setting up . . . the classroom and things like that." At the January meeting, Catie's mentor had no trouble identifying her. "I spotted her right away. . . . I think just having talked to her and [having] had that communication with her, I could kind of feel that that was [her]."

Two other pairs (Barb's and Pamela's) made contact en route to an ECS Program function. Pamela (new in 1996) and her mentor shared a van with

several other teachers as they traveled to the January 1997 Mentoring Skills Workshop. Pamela was enthused about interacting with so many teachers:

I told my husband, when I got there I was absolutely exhausted because that was such a neat experience. . . . I kept thinking "Okay now, I hope I can remember all these things," because things were just bouncing off people, you know: "Have you tried this, have you done that. . . ." Where else do you get to talk to anybody if you don't go to something like that?

Barb (new in 1995), who shared a mentor with Tina, was surprised when her mentor and Tina made an impromptu visit to her classroom. As they were headed for the April 1996 Best Practices Workshop, "They stopped here at the school and they spent the afternoon in my classroom. . . . [My mentor] just came right in and I was in the middle of class . . . I don't know, I was kind of uncomfortable."

Renee and Tina met their current mentors before being formally matched. While teaching first grade in 1995, Renee had been paired with a primary grade mentor teacher who was unable to attend the Fall 1995 ECS Program functions. At both the state education convention and the November workshop, Renee participated without her mentor. A middle school-level mentor who was active in the ECS Program provided her with materials and assistance at those meetings, and remained in contact as she worked with her assigned mentor through the spring. In Fall 1996, Renee was assigned to teach sixth grade, and she was formally matched with the middle school mentor who had helped her earlier.

Tina also changed mentors midway through her experience. She knew her current mentor from a workshop they had both attended the previous summer. They lived in the same region, and drove together to the Mentoring Skills Workshop in November 1995. Tina's original assigned mentor did not attend the workshop and was not a regular communicator. By mid-year Tina had formally shifted to a partnership with her current mentor. Her new mentor, who was already working with Barb and another male novice teacher, accepted Tina as a third novice. She noted:

Tina had a mentor . . . who was not on Metnet and had a terrible time getting on. . . . Tina is a person who will try new things always, and it was very very frustrating to her. . . . When I met her the first time we went to a technology software workshop in Helena that was sponsored by STEP, and so we rode together, and she drove, and we talked all the whole time. And it was kind of interesting because when she got there . . . she had the feeling that she had already shared herself and it was real difficult to do that again with another person. And so then when it became a formal meeting with her mentor, it was just always uncomfortable. . . . It was like she never was--there was some link that wasn't there.

The first encounters between the nine mentor pairs did not follow an easily defined pattern, but in their individual ways they all spoke to the benefits of face-to-face contact. It is noteworthy that in Renee's and Tina's cases, the early proximity and presence of a surrogate mentor helped to inspire an eventual change of partners. Having shared concerns and experiences with one person, they were uncomfortable with the thought of repeating the process with another mentor.

Relationships Within the Core Group

All of the mentor teachers in the core group exhibited great flexibility in establishing and extending the mentoring relationship. Some novice teachers had a deep desire for guidance; others simply wanted a colleague with whom to share ideas. Each novice's needs varied throughout the year, and their mentors were willing to fill whatever role best suited the situation. The timing and sequence of these varied interactions did not follow any well-defined structure. Rather, they flowed freely along a continuum between professional and personal support, shifting in emphasis as needs changed. Many of the novices' positive comments about their mentors focused on their openness to questions and nonjudgmental responses—skills which were emphasized during the ECS Program mentor training. The following sections offer description and analysis of the core group relationships.

Barb and Tina. The teacher who worked with Barb and Tina had a very equitable approach to mentoring which she tried to adapt to best suit each of her novice teachers. She felt that as a mentor "You're not the know-all teacher person, you're the learner, lifelong learner right along with everybody else." She shared many lessons and activities with both novices, but claimed to receive just as many ideas from them. She felt she had experience to share, but not definitive answers: "I don't see the mentor role ever as being the expert . . . I can tell you what I think, but it might be wrong."

By March 1998, she felt that both of her novice teachers had made a "natural progression," but along very different paths. Barb had pulled back from communication but progressed quickly in her teaching; Tina had done just the opposite:

I think with Barb the frequency [of contact] is a whole lot less, depth maybe is more . . . I think she's just really become real independent and successful, and she's really a good teacher. . . . With Tina, even though she's not actually teaching this fall, we probably communicate almost as much. . . . Barb, maybe twice a month, not very often, not like it used to be. . . . I probably talk to Tina more than I talk to Barb.

The mentor was excited that Tina had recently expressed an interest in returning to teaching. She recalled that "She was basically fired from her job last spring, and I did go to the school board meetings"; in March 1998, she reported that Tina was considering a write-in candidacy to sit on that same school board.

Tina's mentor felt that she needed "to have somebody who has really unconditional support, which she doesn't necessarily have even at home." She was able to differentiate the needs and abilities of her two novices:

I think Tina's greatest concerns were wanting to do . . . her problem always was that she felt like she had really neat things that she could do, activities, but she wasn't always sure why she was doing them. . . . It's important to always have a reason why you're doing something.

I think with [Barb] in math or science it was more that she's always open to new and different ideas, and I think she's always pretty able to plug them into whatever standards or objectives she already knew.

The mentor clearly recognized Barb's strengths and capabilities:

I think that she was always capable, and always had a lot of self esteem. And I think that our relationship probably was one of reinforcing that,

which I think to me that's a lot of what a mentor does anyway, what we were kind of taught as mentors, is to help people realize what they already know, not necessarily teach them anything new. And I think that she's just become real comfortable in her role as a teacher.

However, from Barb's perspective, her mentor did not always recognize her needs. Barb's well-developed sense of autonomy gave her different expectations of the program. Where other novice teachers, including Tina, were eager for moral support and validation, Barb had more concrete needs which were not entirely satisfied. She wanted materials to renew ideas and avoid burnout in her text-free science curriculum. Her mentor had a wealth of resources and knowledge, but Barb's needs never got clearly communicated:

I was hoping to get . . . some help from my mentor 'cause I wanted to do all my science without books. So that's what I was kind of hoping for at first and it really hasn't turned into [a] . . . "get help with ideas" type thing—hasn't really turned into that. It's been more of a comradeship thing.

Barb was not by nature someone who asked for help. "When I feel like talking about something I get over it real fast. . . . I just internally deal with it." She was not nearly as interested in talking as she was in increasing her science repertoire, but this did not happen to her satisfaction:

It was helpful to a point. I guess part of me honestly was hoping to get some ideas, you know some actual ideas: "Oh, I've done this activity and it worked great." And I never was able to get any of those ideas, which was okay, but I didn't have a whole lot of resource materials at the time, and also couldn't afford to go buy resource books. . . . In some ways it wasn't [appropriate], and in some ways you know it was, but at the same she was trying to help . . . it's nice to know that someone's trying to help also, even if their help's not useful.

Barb was very forgiving, even about her mentor's clear aversion to talking on the telephone. "I can understand . . . she's definitely ready to go home [at the end of the day] . . . and I don't want to waste her . . . time." She simply forgave and forged ahead on her own; Barb preferred action to contemplation. She was impatient with the time it took to communicate and discuss problems with her mentor, preferring to "deal with it" and move on. In 1996-97, she was acutely aware that she was just one of three novices working with the same mentor, and at times had deliberately pulled back so that Tina, whose needs she sensed were greater, could have a greater share of their mentor's attention.

Tina's difficulties, and her mentor's reflective guidance, centered around the management and discipline of her classroom:

[I was] helping her to think about what she actually did, and what made it work or not work, and what she might do differently—not telling her, but helping her to think about it her own self. . . . She always wanted to do things—she would get a zillion ideas, she would go to every workshop there was, and she wanted to do things in the way that she thought was right, but she just wasn't always able to make it happen You have to solve the other problems, the problems of control and discipline and organization and content . . . before you can have a quality program or even a "best practices" lesson.

The mentor valued face to face contact and classroom time; she had invited Tina to her classroom more than once to observe how she maintained discipline and control:

She would try different things, and she would come and observe in my classroom and we would talk about it on the phone afterwards. . . . I think it made her feel really good, because I think my classroom looked

like what her classroom felt like, except that I knew what was happening in mine.

The mentor regretted that she had only seen Barb's school once. That occasion occurred en route to an ECS Program conference. The mentor found it valuable to see the "environment that I was addressing all the time . . . that I think was really essential, because I can picture her in her classroom."

By contrast, in Spring 1997 Barb recalled that "surprise" visit as an uncomfortable experience. And by March 1998, she seemed to have forgotten that the visit took place at all:

Even though it's a long distance, the whole thing is based on Metnet and long distance, there still needs to be a proximity where you can visit each other's classroom. . . . I think that if she was [nearer] I'd almost guarantee that we would have, by this time, seen each other's classrooms.

Barb felt strongly that personal contact was essential to a good mentoring relationship, and that lack of contact had played a role in her dwindling interest in the mentoring experience:

I'm sure our mentor relationship . . . would be stronger because of that. You know, there has been other teachers that I've kind of developed a friendship type mentor relationship with where I have visited the classroom, and they have seen me also, and it's super.

For me [a classroom visit] made me feel more human, 'cause I think that we [novices] look at the "master teachers" as perfect, like everything is you know the answer, like they have all the answers, they have everything, everything is perfect in their classrooms, they don't have kids that talk out of line . . . once you've seen that, just whew! I'm human. . . . It breaks down a lot of barriers.

Her mentor shared the same opinion about personal contact:

I think there's great advantages to being closer together. I was only able to visit [Barb's] classroom one time . . . there would have been more

quality if we had been in closer proximity. . . . We couldn't both even get to the same conferences lots of times, and that was real frustrating because those conferences were really neat.

By March 1998, Barb had reduced her interactions with her mentor to a casual, monthly Metnet exchange about nonspecific school and classroom updates. Tina was more communicative with her mentor, although she was no longer on teaching and not on Metnet. Her correspondence with the researcher ceased in late March 1997, coinciding with the time that she learned her contract for the following year would not be renewed and withdrew from the ECS Program.

Wendy. Wendy and her mentor first met at the Mentoring Skills Workshop in November 1995, and both valued the experience. "What was really nice is we ended up meeting the very first meeting that we were at," explained Wendy. "We found out . . . how many things we actually did have in common." She credited a guided interview exercise with helping them to become well acquainted. The two had not met again in three years, according to Wendy. "It would be nice to see each other more often, but I don't really know if it's necessary." Her mentor agreed that personal interaction "enriches it, but I don't see it as necessary."

Wendy found it very easy to ask questions and receive feedback: "Whenever I ask for help or I need help, or I just want to call to talk or whatever, she's always willing and loves to give her ideas to other people." Wendy felt that her mentor's help was timely and appropriate, and that she

followed up on materials she had sent and kept in touch about specific classes. She found both personal and professional rewards in her relationship with her mentor. "We're just so compatible and we do have a lot of things in common—I mean, when we do talk to each other it's not just about school things, it's about lots of other things too."

Along with high school mathematics, Wendy's mentor recalled discussing the "vast difference between being in the classroom and being in the university" and help with "just how to survive." She recalled that at first they talked about classroom activities and projects, but "as the time went on . . . activity kinds of things, those decreased" and they moved on to "the programmatic, like a philosophy of a department . . . [or] book selection."

The two women had strikingly similar views about the purpose and proper conduct of their relationship. Wendy was a well-prepared and capable teacher, and her mentor recognized and respected that: "From the very beginning, she felt pretty autonomous. . . . She came [to] me very strong." The mentor saw her role as "just giving her support that her strategies were good. . . . I get as many ideas from her." She felt that Wendy had already achieved a good sense of direction: "She seems so secure and solid. . . . Good mind, good training . . . it's a great career choice for her." Wendy agreed. In her larger school she already had sources of help. "If I was in a [small] school, I'm sure I would've been calling [my mentor] a lot more."

By March 1998, the women were no longer formally communicating. They had exchanged two or three monthly phone calls in Fall 1997, and had not spoken or written since. They both viewed this as a very natural maturation of Wendy's career and their relationship:

Wendy: I'm in my third year of teaching now . . . I don't have as many questions. . . . She was so easy to talk to and she was there for support . . . it has taught me to stand alone more. . . . Because now I am more independent, I don't need to talk to her about those things. In fact, usually when we talk, we talk more just as friends.

Mentor: The later conversations were just more kind of social, just touching base. . . . In my mind, she is . . . weaned from the mentoring process, and I would—our goal is not necessarily to have a lifelong mentoring, mentor relationship. . . . Someone like Wendy I can see as not too far in the future being a mentor herself.

Pamela. In her 1997 interviews, Pamela spoke of the comfort level her mentor immediately established:

Within two or three days she had called me. She was just great. . . . I immediately at that time decided I had nothing to feel inferior about or worry about. . . . She just made me feel so comfortable. She talked about what she could offer me for support, and that I should be really comfortable giving her a call any time—gave me all kinds of information on how to get hold of her, and told me quite a bit about the STEP program.

By contrast, her memory in March 1998 was one of discomfort until she was able to personally meet her mentor:

I was so uncomfortable until I finally met her. . . . I was very intimidated, never should have been because she was not at all intimidating on the phone, she was calling in support . . . but I needed to see her, just to make that connection. And I felt just a hundred times better after I had met her.

Pamela was naturally gregarious, and placed a high value on communication. She easily listed a variety of topics that she and her mentor had discussed in 1996-97: discipline, science catalogs and supplies, how to run experiments, birds in the classroom, lesson plans, books and activity sources, point systems, scheduling, and their mutual involvement in a program called Project Success. They also worked together on activities that her mentor selected out of the STEP survival kit.

By March 1998 the picture had changed. Pamela revealed that, except for a five-minute conversation in a grocery store, she had not spoken to her mentor at all during the 1997-98 school year. She was apologetic, faulting herself for the lapse: "Had I been able to go to the conference this fall, maybe it would've been different. . . . Maybe I would've had a chance to visit with her and reconnect." She had an explanation to justify the silence of her mentor, who had been shifted from a K-6 science specialty to teaching in a self-contained fifth grade classroom:

Other than [the grocery store visit], she's never called me or anything, and I haven't called her either. I just feel really bad about it, because she was so supportive and so good to me last year, but I just feel like she got thrown into a position too, of job insecurity and a big change in her job, and I don't know—I don't know what's going on. . . . It's a horrid burden, it's a lot of worry and just a really miserable situation You have to really work to spend your energy in teaching instead of the worry.

Pamela was understandably sensitive to her mentor's job crisis. On the day before the March 1998 interview, Pamela herself had learned that her job

would be reduced to half-time. She would be sharing her fifth grade classroom with the elementary principal, whose full-time position had also been curtailed due to low school enrollments. Pamela had been assured two months earlier that her job was secure, and the effects of the disappointing news were still weighing on her. "Survival in the classroom" had taken on a new depth of meaning that Pamela felt exceeded the scope of the ECS Program.

Catie. In 1996-97, Catie enjoyed a rewarding relationship with her mentor. Their conversations, via phone and Metnet, took place at least every three weeks. Their communication was "pretty steady, and she was real consistent about getting hold of me." Catie's mentor could be counted on to call regularly and ask how things were going:

Having a mentor forced me to think about how my day went, how my week went, and if I knew she would be calling then I would write things down you know, to just keep an ongoing list of what we could talk about when she called.

Although they enjoyed a cordial and trusting relationship, Catie and her mentor were not always interested in the same issues, and Catie held her ground in areas where she had differing views. Catie was curious about cognitive issues, while her mentor preferred to discuss more immediate ideas and classroom applications:

You have to spend a lot of time thinking about curriculum or extending ideas so that you're finding out if what you're actually doing is working, and so assessing those kinds of things . . . to me that's interesting and important, but the message I got from her was "Just

give me something that I can use now, and don't bog me down". . . . She said that was just too much to think about when you've got all these other things that you're doing every day. . . . She didn't discourage me so much, but she just said that that was her feeling on it.

Catie's mentor taught many topics through projects, and she integrated science and mathematics concepts throughout the day and the disciplines.

Catie felt a need for greater structure:

I think she did integrate a lot of math and science, and that isn't something that I'm able to do to the extent where I would say that I could give either time period up. It seems like I just kind of say "This is our math time, this is our science time," and when things overlap the kids are kind of freaked out too. They'll say "I think this is science we're doing now," or "Isn't this math we're doing now?" . . . It's really hard for me to do it and to feel like [integration] is getting to all of the minute pieces of what they need to know. . . . I don't get a lot of support from my coworkers in that vein.

In 1996-97, Catie was preparing to teach science the following year. Her mentor shared many ideas, but Catie frequently refrained from asking for help with science content. She didn't like to appear unprepared and wasn't comfortable talking about content topics until she felt familiar with them. "I'm more comfortable getting out of a book than I am asking another person, because then you're admitting weaknesses. . . . She was really knowledgeable about things like air pressure and stuff that you feel silly not knowing."

Despite their different views of some issues, these two women maintained a remarkable trust and openness which was partially an outgrowth of their compatible personalities and similar life circumstances. In Fall 1997, Catie's mentor left to teach overseas. She had a "good conversation" with Catie before she left: "I didn't feel abandoned or

anything." Catie had thought they might keep in touch and perhaps set up classroom penpals, but neither teacher followed through. Although she continued to participate in the ECS Program, Catie was not formally matched with a mentor in 1997-98. She became acquainted with another mentor in Fall 1997 and the two discussed forming a partnership, but nothing officially materialized.

Phil. Phil's mentor worked with him on a wide range of issues. He shared lesson plans on orienteering and other topics. He had conducted field research on wildlife in Phil's area of the state and urged him to do field-based science activities. He helped Phil set realistic expectations for his schedule, for what he could expect of his students, and for working within a Native American reservation culture. Although as of March 1997 they had not yet met in person, Phil's mentor was strongly in favor of visiting Phil at his school as he had done with his other novice teacher:

If STEP could then somehow arrange a visit of every mentor teacher to the early career teacher, early in the fall. . . . I don't have a really good feeling about his physical environment. . . . [To] just spend the weekend or a full day with him would be, I think, really worthwhile Possibly teaching one period so that he can see some of the techniques that mentor teachers use.

Phil considered his mentor to be a positive role model who was far more experienced as a teacher, yet also understood his situation:

They have some of the similar problems that you do . . . and maybe have some insight on how to handle them. . . . Having a mentor out there that's specifically for you, it gives you a feeling that . . . you're not alone in this world. . . . He knows my situation up here and all the

obstacles, and he's been very supportive of all my decisions and everything.

Phil had anticipated support with curriculum and materials, technical support in getting computer network access, and being connected to an experienced teacher. He felt he was getting the kind of support he expected from a mentor: "Curriculum materials, ideas, where to go, where to find things . . . the mental support."

Phil and his mentor, both male, taught in very similar circumstances in terms of content, grade level, school size, and community. These similarities may have influenced their positive view of each other, as well as a strong match between personality and conversational style observed by the researcher. The mentor-novice pairs which involved Wendy, Pamela, Catie, and Phil were all same-gender pairs where both partners taught and lived in well-matched circumstances; all four pairs had an active and positive mentoring relationship. However, three other same-gender pairings did not achieve the same comfort level, and of the two mixed-gender pairs, Renee was very comfortable with her mentor while Paula was not. These data did not support any firm conclusions about the role of gender in establishing a successful mentoring relationship.

Phil and his mentor had been in weekly contact during Fall 1996, but Phil's spring semester assignment to teach vocational agriculture drew him away from contact with his science mentor, and they communicated only rarely that semester. The researcher learned late in Fall 1997 that Phil had left

the school to move to a larger city where his wife had found employment. Phil's mentor did not respond to requests for a follow-up interview in 1998, and it was assumed that the partners had lost contact.

Renee. Renee recognized a growth process in her mentoring experience: "Now it's really content and curriculum. At first it was more just support, am I going in the right direction, am I doing the right thing?" Many of her conversations with her mentor were about the structure and management of the integrated mathematics curriculum that both were using. Renee was concerned about the pace of her course, how to give timely assessments, even what to assign as homework. She valued her mentor both for his knowledge of her specific curricular needs and for his ability to relate to her general teaching woes:

You come home and you try to tell people that don't teach and they don't get it . . . with things that are going on at school. . . . [Mentors] understand what's going on and how you feel, and can give you advice.

Renee's mentor thought that she "felt more comfortable with handling students, discipline" and that her needs were "more of the content and pedagogy." He also valued both the content-related and more subjective aspects of their interaction:

There are always those frustrations, you know, where someone's discouraged because a lesson didn't turn out right . . . I think that we probably talk about those things at least half the time, and the other half is just dealing with the STEM [mathematics curriculum] materials and how did this particular activity work, or this game. . . . The moral part . . . talking to someone just about how they feel is very, very important.

"I can have a really, really stupid question, I know he'll just laugh." In order to reach that level of comfort, Renee needed face-to-face time with her mentor. "I think it's important for the first time . . . that you meet them sooner [rather] than later." But after an initial encounter, she felt very comfortable interacting from a distance. "I'm not afraid to ask him anything," she noted. "With a mentor, you can get into their head about what's going on in their classroom . . . I can almost picture [my mentor's] classroom, you know—so I can compare it to my own."

Renee and her mentor had exchanged a few Metnet messages in Fall 1996, but Renee's limited access to Metnet motivated a switch to semi-monthly telephone calls in Spring 1997. Near the end of that school year, Renee's coaching duties and late-stage pregnancy were making even that a challenge. "It really didn't evolve even too much last year, because she wasn't on Metnet, and so telephone conversations were tough too because of her coaching. And you just couldn't get hold of her . . . for the most part."

In her March 1998 interview, Renee revealed that she had shifted roles once again, this time to teach middle school history, English, and speech. She had given her survival kit materials to the person assigned to teach mathematics and science. Although she still received mail from the ECS Program, Renee no longer attended conferences or participated in other ways:

I don't want them to pay for anything for me, because I'm not even teaching math or science. . . . I wish I could still be a part of it, but I'm not teaching those classes, so I'm probably just a waste of their time.

Amazingly, she had not told her mentor or ECS Program leaders about her new assignment and withdrawal from the program, and no one had inquired about her status. "I've been meaning to call him and I felt bad . . . I don't think [my mentor] knows I'm teaching other subjects. If STEP ever adds other subjects, I'd love to be a part of it again." The abrupt change in teaching assignment was not considered unusual by the researcher; the fact that no information about this change was communicated in either direction was.

For his part, Renee's mentor was mildly annoyed that his attempts to make contact with her in Fall 1997 had gone unheeded. He had given up trying to contact her, thinking that she was simply too busy to correspond and unaware that she had switched teaching assignments:

This year's just been impossible. In the fall, [I] started off and called her numerous times, probably five or six times and left messages but still didn't get responses, so that got kind of frustrating . . . I pretty much assumed she just bagged on the program, you know with her new kid and with coaching and all her other responsibilities. . . . I think she may have felt that communicating with me was probably just another thing she had to do on top of coaching and teaching. . . . When they don't return your calls when you leave messages for them to return your calls, it's kind of tough when they don't do that.

Paula. In 1996-97, her second year with the same mentor, Paula seemed to have revised her expectations for a close relationship; this attitude continued through the following year. When she communicated with her partner via Metnet, her messages were carefully written, with a polite tone which seemed to distance her from her mentor. After two years with her

mentor, Paula was aware that the relationship was missing something essential:

It's been a little bit disappointing to me. I don't feel like we really hit it off . . . our personalities don't really click. I see some of these other [novices] and their mentors and I think "Wow". . . they're really close I don't necessarily feel real bad about it, it's a little disappointing . . . he's always been very supportive. You know, sometimes it's easier just to ask a person who's maybe in the next classroom—a concrete person.

She voiced the same feelings a year later in her March 1998 interview:

It's really maintained the status quo, it's pretty much stayed the same We still communicate maybe once a month via Internet and if we happen to see each other at teachers' convention or something like that, we chat a little bit. . . . There are times when I'll bring questions and things to him, but we don't make a regular point of [it].

The mentor agreed that "We've grown away from talking to each other," but added that "she just hasn't had the need . . . I think she's doing quite well."

From Paula's viewpoint, her lack of effort was justified by the fact that she did not find her mentor's help particularly timely, nor was it always on target:

I haven't always gotten from him quite what I was looking for, or sometimes it's just easier in the interim while I'm waiting for him to respond, to go find my own answers. If I'm having a problem today, I put it on Metnet tonight, he reads it tomorrow night and responds maybe Friday at the earliest, is it any good to even put it on?

My science curriculum is all up to me, and I really asked [my mentor] to help me just plan out a sequence. . . . We talked about it more than once—now that was another time we planned to work on it over the summer a lot and we didn't. . . . When I've asked for activities I haven't had a lot of response there.

Her mentor admitted that "She had a lot of questions and a lot of needs, and I wasn't always able to give her all the answers." As he described

their situation, it was clear that Paula had often been forced to take the initiative. His descriptions of their interaction included telling phrases:

She did a good job of expressing [her needs]. . . . I didn't actively seek out anything to help her with. . . . After I sent [material] she'd write back . . . she always followed up. . . . To be a listening ear, sometimes that's all it was . . . at the bottom when she's all done, you know she'd say "You know, this just felt good being able to write it and say it out loud."

Unfortunately for Paula, her mentor's "listening ear" attitude was too passive to suit her needs. Yet despite her dissatisfaction, Paula had made only tentative moves to change her situation. She felt that even in her fifth year of teaching, she would still like a mentor; however, she seemed resigned to making the best of the ongoing situation:

[In 1996-97] I tried to say I would like to switch, but he said "Oh, let's really-let's really make this work, and let's visit each other's classrooms and let's talk over the summer". . . so I felt like I couldn't I sometimes get the impression that he feels the same way I do . . . we'd like to be more involved with it, but good intentions kind of fall by the wayside. . . . I think we've just accepted the relationship for what it is. . . . I would like it to be different, but I guess I haven't done the things I need to do to make it different either.

Paula did not dislike her mentor, and actually communicated with him more regularly than most core group novices in 1997-98. But her efforts to maintain the relationship were "more out of loyalty" than for personal benefit. In terms of her teaching she concluded, "I guess if I had not known [my mentor] I think I'd still be pretty close to where I am today."

Daryl. Like Phil's mentor, Daryl's mentor felt strongly that a personal visit was required to establish a relationship. He acted promptly on his

conviction, taking time off from school in December 1996 to spend a night and a full day with Daryl at home and school. He discovered that they had both been football coaches, and used that shared experience to launch a conversation that later branched into mathematics, integrated curriculum, and teaching philosophy. "I got to see his school and his home turf, and his classroom, and his hardware and calculators, and just found out . . . more about him, his family, and what he does." Daryl juggled the entire curriculum for grades 7-12 mathematics in an extremely rural ranching community; by contrast, his mentor and eight other teachers shared the mathematics program in one of Montana's largest high schools. But by visiting and teaching in Daryl's school and spending an evening learning about the community through Daryl's eyes, the mentor helped to bridge the gap that separated their experiences.

Daryl seemed ambivalent about the potential for his mentoring experience, despite his mentor's visit to his community and classroom. "If I needed something I could call him, and more than likely he could find it at a bigger school. . . . But then again, trying to get hold of him is going to be a problem." Although he appreciated the materials (calculators and teaching modules) his mentor demonstrated and then left with him, Daryl had made little or no attempt to use them and seemed to be continuing on his original course, which consisted largely of walking through his textbooks. Daryl and his mentor had not connected on Metnet or attended an ECS Program

conference together, although the mentor repeatedly encouraged Daryl: "I followed up both before and after [the visit] by inviting him to STEP conferences . . . I suggested that we put on a workshop together . . . or we would just attend the workshop together, visit, talk shop, but he never did follow through."

Daryl resigned his teaching position to manage his motel after 1996-97. His mentor had not made an effort to contact him after Spring 1997 other than to eventually ask for the return of his calculators, and had not pursued the relationship after Daryl left teaching:

I didn't know that he was quitting until I got the message, I don't know when it was, June or July. . . . I sort of lost interest after he you know, he didn't want to go to any conference or anything . . . It seems like it's got to be sort of a two-way street, not one-way all the time.

Summary of Core Group Attrition

Seventeen core group teachers (nine novices and eight mentors) were involved in the first year of the study in 1996-97. In the second year, three novice teachers and one mentor had relocated, for various reasons:

- Tina's contract had not been renewed by her school board;
- Phil had left his reservation school when his wife got a job elsewhere;
- Daryl had left teaching to operate his motel on a full-time basis; and
- Catie's mentor had taken a teaching position overseas.

In addition, two mentor teachers (Phil's and Pamela's) failed to respond to inquiries by mail and telephone and so were not interviewed in March

1998. In her March 1988 interview, Pamela was able to supply some information about her mentor and easily brought the relationship up to date, since virtually no interaction had taken place over the past year. The eventual fate of Phil and his mentor remained a mystery; after repeated attempts at contact, the researcher determined that the data to be gained through exit interviews did not warrant the continued pursuit of subjects who had withdrawn from teaching and the ECS Program or who were unwilling to be contacted.

"Second-Year Syndrome"

To supplement the two-year history of the nine core group pairs, the 1998 survey asked for information from mentors and novices who had been assigned to the same mentor partner for more than one year. Thirty-seven novices and twenty-seven mentors responded to this request to compare and contrast their assigned partnership from one year to the next. Six novices and three mentors indicated no change in their relationship over two years. Among the mentors, fifteen claimed a decrease and nine an increase in the level of their relationship, while twenty-two novices claimed a decrease and nine an increase.

These data did not necessarily represent a negative trend. It was true that by the second year, most of the relationships were declining or in stasis, but at least sixteen instances of "decreased" contact had positive justifications. For example:

Novice: When I first entered the STEP program, I felt like a "lost puppy" but throughout the past years I have gained valuable friends and information. . . . My mentor is there but I have, it seems, gained other mentors through the conferences. I have a nice network to help me at all times.

Novice: My mentor and I don't talk a lot . . . though it is okay because I know she is there if I need anything. I have benefited highly from my interaction with other mentor teachers [and novice] teachers.

Mentor: The relationship has developed more trust and more of a peer relationship rather than a mentor/[novice]—we are more equal now in experience and [educational philosophy].

Mentor: My [novice] told me in October that she didn't need to talk to me as much now as she did two years ago because she feels confident about her teaching. She also referred to me as "her friend," which is something colleagues hopefully become.

Frequency of Contact

The core group participants were asked to estimate the frequency of their mentoring exchanges over the time period extending from the beginning of Fall 1996 through the time of the interview in February or March 1997. They were then asked for the same information one year later. Table 8 summarizes their responses. Five of the partners claimed "No contact" in 1997-98: in three of those cases, a mentor or novice had left the program; in the other two cases the partners had simply not communicated.

Table 8: Frequency of Contact Between Core Group Partners

Novice	1996-97 Contact	Method	1997-98 Contact	Method
Barb	Twice weekly	Metnet	1-2 times monthly	Metnet
Wendy	Once monthly	Telephone	1-2 per semester	Telephone
Pamela	Twice monthly	Telephone	No contact	N/A
Catie	2-4 times monthly	Metnet	No contact	N/A
Phil	Once monthly	Telephone	No contact	N/A
Renee	Twice monthly	Both media	No contact	N/A
Paula	1-2 times monthly	Metnet	Once monthly	Metnet
Tina	Twice weekly	Metnet	2-4 times monthly	Metnet
Daryl	Once monthly	Telephone	No contact	N/A

The 1997 and 1998 survey respondents were also asked to characterize their mentoring relationship by reporting the frequency of their non-Metnet contacts. Since overlapping responses were assumed from the mentors and novices, only the data from novice respondents are recorded in Table 9.

Table 9: Frequency of Non-Metnet Contacts (Novices)

Type of Contact	No./Month	1997 (N=47)	1998 (N=73)	Type of Contact	No./Year	1997	1998
Telephone	More than 5	2	0	In person	More than 2	6	5
	3 to 5	0	0	(ECSP event)	1 to 2	35	47
	1 to 2	20	18		0	4	15
	0	21	44		No response	2	6
Faxed message	No response	4	11	In person	More than 2	7	5
	More than 5	0	1	(other event)	1 to 2	6	19
	3 to 5	1	1		0	28	35
	1 to 2	7	4		No response	6	14
Mailed message	0	30	48	In person	More than 2	4	4
	No response	9	19	(arranged mtg)	1 to 2	11	11
	More than 5	2	1		0	25	42
	3 to 5	0	4		No response	7	16
	1 to 2	19	22	School visit	More than 2	3	2
	0	19	34		1 to 2	7	11
	No response	7	12		0	29	43
					No response	8	17

Based on 1997 survey results, roughly 45% of the 47 novice respondents regularly used the telephone and/or mail to communicate, generally once or twice per month. Thirty-one of those respondents also claimed to use Metnet

for one-to-one exchanges with their assigned mentors. In 1998, far fewer of the 73 novice respondents were in monthly contact with their mentors via mail (37%) or telephone (25%), and only 42 indicated that they used Metnet to interact with their assigned mentors. General Metnet use was much higher as shown in Table 10, but the data represent participation in conference folders and contact with other novices and mentors as well as interaction with assigned mentor partners.

Table 10: All-Purpose Metnet Use by Novices

1997 Novice Metnet Use (N=47)		1998 Novice Metnet Use (N=73)	
>5 times per week	1	>5 times per week	5
3-5 times per week	9	3-5 times per week	4
1-2 times per week	12	1-2 times per week	17
2-3 times per month	4	2-3 times per month	7
Once per month	11	Once per month	16
Never	10	Never	24
<i>Used to contact assigned mentor: 31</i>		<i>Used to contact assigned mentor: 42</i>	

The relative frequency of face-to-face contacts, at STEP gatherings or on other occasions, decreased from 1997 to 1998 in all categories except for encounters at non-STEP meetings. In both years, personal encounters were infrequent and supplemented by other forms of contact.

Categories of Mentor/Novice Communication

Core group novices and their mentors were asked to describe the subject matter of their interactions. Among the seventeen core group subjects, curriculum and/or content needs were most commonly named as

the focal point of communication, followed by moral support and/or personal issues. The following categories of communication were identified by comments from core group interviews and survey responses.

Curriculum and Content. The matching of partners by grade level and teaching assignment greatly amplified their ability to benefit from each other's experiences. Among the nine core group pairs, exchanges about curriculum most often couched the mentor in the role of guide, as one who was familiar with the relevant content and curriculum and able to offer suggestions to lead the novice through unfamiliar material. This did not imply that the mentors provided ready answers or gave directive advice to the novices. As Renee's mentor recalled:

Once I went through the mentor training I realized it was more helping them to realize how things were going, let them reflect on their teaching . . . rather than just telling them, give them questions that guide them through, and hopefully they'll discover it on their own.

Renee was matched with her current mentor after she switched from teaching first grade to a middle school assignment. Both teachers had adopted the STEM integrated mathematics curriculum. Renee attended a summer institute to prepare for using STEM materials, but still relied heavily on her mentor's experiences. They discussed the pacing of the curriculum, techniques for cooperative grouping, and methods of grading assignments and assessing students. Her mentor offered suggestions for adjusting segments of the pilot curriculum that did not succeed with his students.

Renee's comfort level with her mentor was very high: "I feel . . . one hundred percent like I could just call him up and say, 'I'm totally lost, and what should I do in this situation with STEM?'. . . He's already been there."

Wendy depended on her mentor as a resource and sounding board for a high school course they both taught. "This is my first time I've ever taught consumer math, and she's been teaching it for quite awhile. I've been calling on her and she's been giving me tons of ideas of what I can do." Wendy's mentor sent materials, including a stock market game and a building activity, and suggested ways to bring probability into the course. In the realm of moral support, they shared the woes of working with juniors and seniors in a course intended for entry-level students. And Wendy's mentor also benefited from her novice's ideas. "She had just finished a credit card unit, and I was starting it. . . . She had the kids make their own credit card companies at the end. . . . I used that as the end, instead of an exam—it was a great idea."

Exchanges about curriculum took many forms. Some novice teachers had questions about how to teach from a packaged curriculum, or were searching for a worthwhile curriculum to implement. In Wendy's case, specific materials and activities were shared to supplement traditional curriculum in a particular area. Or, as shown in the following exchange between Paula and her mentor, questions sometimes focused on conceptual problems and pedagogical roadblocks.

Figure 3: Sample Metnet Exchange—Curriculum and Content

Monday, March 17, 1997 5:36:57 PM	From: Paula
Subject: Math woes	To: Mentor

I just sent you a message yesterday, but I thought of a question I've been meaning to ask for quite [awhile]. It's a problem I have had every year with my first and second graders. I hope I can put it into words to explain the problem, because I have had a dickens of a time trying to explain myself to the kids.

Every time I teach how to do two digit subtraction like this

$$\begin{array}{r} 45 \\ -32 \\ \hline \end{array}$$

it goes fine. But then when they are asked to do this kind of math problem

$$\begin{array}{r} 13 \\ -7 \\ \hline \end{array}$$

they give an answer of 14. They could do this before, but now they are all confused. I know what they are doing—they are "subtracting up" 7-3 and then 1-0. All five of my first graders did this today and we had tears (the kids and not me!) when I tried to explain. And then with the second graders, it gets even worse once they learn how to borrow. Have you ever encountered this dilemma-and what works to fix it? Or am I not explaining some concept clearly at some point—or missing a concept all together?

.....

Wednesday, March 26, 1997 9:04:11 PM	From: Paula's Mentor
Subject: Re: Math woes	To: Paula

Sorry that it took me so long to get on line. Computer problems, anyway I'm back. Let's see subtraction? First, I don't think first graders are ready for subtraction . . . maybe they can learn to do the math but they really can't understand it. I teach subtraction to 10 and then using lots of manipulatives. We even use M&Ms, you know 10-5 so eat 5 and how many do you have left. I would teach the larger numbers by using lots of manipulatives also. I would do exchanges with hands-on materials until the concept is understood. Moving from the concrete stage to the abstract level should come naturally if the children know the way subtraction works. This is probably too late but if you haven't gone back to manipulatives, I think this would help.

Curricular support was not limited to help from mentors teaching parallel content. In some cases, the mentor attempted to open up new opportunities and broaden the horizons of his or her novice partner. When Daryl's mentor planned his school visit, he brought along modules from an integrated high school mathematics curriculum, TI-82 calculators, and CBL

equipment. "I pushed a little bit from the mentor standpoint because of what I thought I could offer him . . . in terms of experience." He knew Daryl had virtually no classroom materials, dated textbooks with no integration of topics, and a very limited budget. Daryl's mentor planned simple activities that featured mathematical modeling and use of the calculators, and left the materials behind with his encouragement to continue using them.

Catie's mentor was well-versed in telecommunication and use of the World Wide Web. She felt that "a lot of times we need to be forced into technology" and often accompanied her curriculum ideas with Web site "bookmarks" which provided Internet-based materials which Catie had to seek out. Tina's mentor regularly worked with her on nontraditional classroom materials such as tangrams, polyhedral dice, manipulative fraction kits, and games. She encouraged Tina to use activities at least once a week—anything that would draw her away from an anxiety-based linear coverage of the textbook. Tina expressed surprise at the discovery that games and "those fun activities" are actually mathematics, and that "weighing and measuring and all that . . . and investigating . . . I am doing science."

Validation. Validation was another important theme in curricular discussions. Pamela was a creative teacher, easily motivated to try new approaches and quick to pick up on new ideas. "I was really interested to find that [my mentor] has many, many animals in her classroom. And it motivated me; I've ordered an ant farm, I've ordered a worm farm—I had a

bird but he died." The occasional pet mortality did not stop Pamela from experimenting, but she did appreciate her mentor's reinforcement. Pamela's teaching style was experimental and creative: she described setting up lawn chairs and a picnic table for reading time during a unit on Mexico; during another literature-based unit, plants and gardens sprouted up in her classroom. In Spring 1997, the researcher observed her room festooned with jungle plants and animals. Pamela felt that validation needed to come from outside her school, noting that her fifth grade colleague was more traditional; no one else in her school was interested in animals; and her school system was hesitant about their new, more interactive mathematics series.

Pamela's mentor reminded her that innovative teaching was hard work, but worth the rewards. "Sometimes I do things that are a little wild . . . and I'm thinking 'Am I off the wall here, or not?' and then she says 'Well I've done this, this and this,' and I thought 'Oh, good, you're not so weird.'" In similar fashion, Tina's mentor validated her efforts to enhance her curriculum with activities:

We follow a textbook but I'm jumping in and out of it. . . . Every Friday I'm making sure I do [a supplementary hands-on activity] even if it doesn't tie into what I'm doing, and I checked with [my mentor] first She said that's okay—that's, you know, the beauty of it or whatever.

Classroom and School Issues. Tina was effusive in her gratitude for her mentor's classroom management ideas and moral support. She taught third and fourth grade simultaneously, and covered over a dozen subject

areas in a week. She felt the most out of control during science activities. Her mentor provided her with management suggestions such as a discipline log, and ideas for engaging the students with activities. She introduced Tina to "happygrams," complimentary notes to send home with the children as a way to stress positive behavior. Tina's mentor also helped her learn to "manage" overeager parents who wanted to help in the classroom by suggesting roles for them that allowed Tina to keep her mind on her students.

Other novices emphasized that sharing their struggles with their mentors reassured and encouraged them, particularly when they dealt with other adults and had difficult decisions to make:

Catie: We've talked about peer relations and . . . the observation time from the administrators, and we've gone through what the parent-teacher conferences are like, and she's told me one of the biggest things to remember is to try to get them comfortable and make them laugh and . . . enjoy their children.

Barb: I retained a boy this year . . . he came back, and that was really hard for me . . . for some reason I'd always thought "I'm never going to retain a kid". . . I really felt like it was the right thing to do, but I was just all "Ah, what should I do?" so you know, I asked her about it and she helped out a lot.

Moral Support. For many of the core group teachers, the mentor was not only a source of materials and information, but an outlet for pressures that built up with no professional release. For example, Tina's struggles with curriculum and other aspects of teaching were overwhelming. During the time of the study, she was also battling for professional survival and was

sorely in need of her mentor's support: "[She] hasn't sat down and said 'You know what you should be doing in math and science,' because I think she thinks I need just to be able to breathe." Although she got off to a rocky start with her original mentor, Tina regarded her current mentor as "a little bit like a mother figure" and relied on her for both moral support and injections of enthusiasm.

Her mentor became not only a facilitator of Tina's professional development but a champion of her cause and an emotional anchor. She channeled Tina's frequent and lengthy phone calls into Metnet communication, and encouraged her to document her fears, feelings, and conversations with school personnel. Tina faced combative parents, nonsupportive colleagues, a disapproving school board, and a fence-sitting administrator; she narrowly avoided dismissal the year before she entered the ECS Program, and the battle continued throughout the 1996-97 school year.

Tina's mentor provided as much support as she could in both concrete and abstract ways: she wrote a letter to Tina's school board in support of her teaching, attended a school board meeting where Tina's contract was under discussion, and offered a steady stream of encouragement and coping strategies. Tina withdrew from the ECS Program, but offered thanks for her assigned mentor and others who helped her survive "all the headaches and heartaches" that she endured in relation to her job.

Phil eloquently expressed his appreciation for his mentor's support and for his ability to relate to Phil's circumstances:

He's very understanding of the situation I'm in—he can sympathize with me. He's been very supportive that way. That really put me at ease, too, when I first started here 'cause I was like "Oh my God, I'm never going to do this". . . . [I] told him about my class load when I first got here and he says "Hey, you know, you can only do so much and don't, don't get too excited . . . you're only human." [I appreciate] the constant positive feedback . . . like a pat on the back, keep going, don't stop. . . . You're put in a bad situation . . . don't let that discourage you from teaching.

Paula was a thoughtful teacher who listened carefully to the parents and supervisors who operated her school, but she had virtually no colleagues with whom to share her frustrations and uncertainties. Her relationship with her mentor, who was male and many years her senior, was not particularly close. Yet she still felt comfortable sharing her concerns with him and took comfort in his responses (although he often did not directly address her questions).

Figure 4: Sample Metnet Exchange—Moral Support

Thursday, January 23, 1997 10:32:48 AM
Subject: Looking for some advice

From: Paula
To: Mentor

Hello [Mentor]—Sounds like the conference was a great one.

I went to an interesting meeting yesterday, but left with some pretty mixed feelings. It was sponsored by a foundation that is looking for really good rural schools, with the goal of making them even better and truly a part of the community. Our school clearly did not qualify for many reasons, but I still took away a lot of great ideas. One of my school board members and a parent also attended with me and at lunch we talked about what they would like to see in relation to the meeting we were attending.

The mother with us has very interesting ideas—and so many of them, great projects that she would like to see us doing but of such high expectations that I'm not sure we could even undertake them. Our school board member has the goal of adding on to the school and getting a computer lab, as well as just dealing with some of the difficult parents who are always challenging school policy. Anyway, I felt that they

Figure 4: Continued

were simply talking "at" each other, not "to" each other and are really miles apart on what they want.

I was left feeling a little lost about my role in all this, and wondering about all these "wonderful, model site" schools out there. It's a great goal to strive for, but sometimes it seems that I'm doing all I can just to get through all I need to. Sometimes I teach a good lesson or unit (like a body unit we are doing right now) and I feel really proud of it, but somehow I'm not sure I measure up.

In your experience, are there teachers out there that really [excel] at everything or does something—maybe a personal life—fall by the wayside? Do you ever feel that you aren't doing everything you should be for your kids—or am I just wanting to be a perfectionist again? And what do you do about the different expectations that parents, school board and community members have? I never realized just how different they were—sometimes even from my own.

Maybe you have faced some similar feelings. This year has been going so well, but now I'm wondering if we are doing enough for our students. Any thoughts? Just writing this all down has made me feel better.

.....
 Sunday, January 26, 1997 6:53:37 PM
 Subject: Re: Looking for some advice

From: Paula's Mentor
 To: Paula

Hi Paula,

Missed you at the conference. It was a lot of fun. Some great ideas were shared and I'll get you off one of those ideas on the body that I picked up at a session. It is from the science curriculum FLOSS. Have you heard about this curriculum? We're looking at a new science curriculum for next year and I'd like to look at this one closely.

To answer some of your questions...

First of all, You're A Great Teacher!! Believe in yourself and what you're doing. Any teacher who feels that they have all the answers and can't get better has been in teaching too long. I don't know any really good teacher who doesn't evaluate each lesson, each day, each school year, and feel that they could-of, should-of, done something different to make it better for the kids they teach. I know that personally I know that I don't do some things as well as other teachers. But I also tell myself that I do some things much better. It's a trade-off. And I'm always trying to improve myself, professionally, by attending conferences, workshops, classes at the U, and consulting with my peers.

Second, Different expectations for you. I believe that I know my students better than anyone. That I am the professional. The school board should be made up from [people] in the community and some should also be parents. Teachers should work with school board members to create expectations that are achievable. I know this is idealistic so until that happens just trust yourself.

I probably haven't solved anything for you. That's really up to you. I can only say that I believe in you and I'll bet 99% of your parents do too. Trust us!! You're GREAT!!

It is noteworthy that, despite Paula's rather specific questions, her mentor often provided vague and unsatisfactory answers, as shown in the previous examples. In the Metnet exchange shown in Figure 4, Paula's question about how to handle the different expectations of parents, school board and community was not directly addressed; instead, her mentor made a vague reference to the structure of a school board. His response to her very precise subtraction question from the previous excerpt (Figure 3) was to provide an example using manipulatives rather than discussing the algorithmic example she gave him.

Social Talk. Interspersed with communications about classrooms, curricula, and administrators were threads of everyday conversation: reports of trips taken and conferences attended; talk about family, health, and home; and occasions to "blow off steam." Such exchanges frequently appeared on the Metnet conference folders, and they also appeared in one-to-one conversations between mentor partners. The excerpts of Metnet messages between Catie and her mentor located in Figure 5 at the end of this section demonstrate several examples of such social talk.

Survey Results

On the 1997 and 1998 surveys, respondents reported the frequency ("often," "occasionally," or "never") with which they discussed a selected list of topics with their mentors. The results for novices from the 1997 survey are

shown in Table 11. (Results from 1998 are comparable.) On both surveys, the topics most frequently ranked as "often" discussed were mathematics and science curriculum, classroom management, and personal/moral support issues. These choices echoed the types of interaction most frequently described by the core group partners.

Table 11: Topics Discussed by Mentor Partners (1997 Survey)

Topics Discussed With Mentor (N=47)	Often	Occas.	Never	No Resp.
Preparing math/science classroom activities or curriculum	13	23	9	2
Preparing other classroom activities or curriculum	8	20	16	3
Locating teaching resources, materials, and/or activities	8	28	9	2
Interacting with students/classroom management/discipline	12	20	13	2
Interacting with administration	7	17	21	2
Interacting with parents and/or community	7	17	21	2
Personal issues, moral support, or friendly conversation	16	19	10	2

Shifting Balances in Communication

When prompted to estimate the time allotted to moral support as opposed to curriculum and content, seven of the core group mentor pairs claimed a "fifty-fifty" balance. In most cases, this equal distribution was an average over time; on a day-to-day basis, the balance shifted as needs arose. Excerpts of an ongoing Metnet conversation between Catie and her mentor provide a view of the unorchestrated flow from professional, to casual, to very personal communication, as well as the trust and intimacy which developed between two teachers in different districts and communities.

Figure 5: Catie's Conversations--Metnet Excerpts

February 4 (Catie): Our school is starting a school wide/curricular wide revision of curriculum that will run for two summers and also during the regular school year. The worry I have is it's so compartmentalized that ASSESSMENT is the very last thing planned for, I'd like to see more integration but am not sure how this could [logistically] happen.

I'm missing a lot of school lately, a death in the family, jury duty, workshops. . . . I've learned to appreciate being with my students much more as a result.

February 10 (Mentor): Sorry to hear of your loss. . . . I hope that things lighten up. . . .

Tonight, I was driving home and I went by a flower shop. We are starting our unit on plants. (This is a new one for me, so I have very little to go on.) Anyway, I turned around and went back. Just stepping in the door brought fresh new ideas to teach this unit and I got fired up. I don't know if the owner really got what I was doing. But, not my problem! I was having a ball!

Thinking of you and your family.

February 17 (Catie): I liked your description of the flower shop. I agree, ideas come from the least expected places. I can really see where your experience helps though; I have to be more open and watchful for all kinds of ways to include freshness into my teaching.

March 23 (Catie): I'm getting eyestrain from being on this machine too much. Our spring break is in four days and I plan to [do] a lot of "planning" during this time.

I'm using my math text closely this year, but am sort of frustrated that there is one quarter left to teach. I'm just finishing Chapter 8. There are thirteen chapters in all. I thought I would take a closer look at what is review and what needs to be introduced before sixth grade. I really like teaching!!! There's never a time when I don't have something to do.

I'm really excited about our conference in April. The agenda looks great. . . . Do you plan to go? . . . If you do come this way, would you like to think about me riding with you again?

April 23 (Mentor): How's the week going? I came back [from ESCP conference] completely worn out, but excited about the enthusiasm [shared] this weekend.

April 27 (Catie): I was also tired last week from the conference. . . . I need to study up on polymers so I can decide which concepts to emphasize when I use the demonstrations I got. I also need to start using the conference page more. I was really impressed by everyone working as mentors and [novices]. We are fortunate to be involved in such a great program.

April 28 (Mentor): I think I ran across some stuff on polymers last week. I'll see if I can remember where it was. I did find an article in AIMS about lesson objectives. You said your principal wanted you to let your kids know what the objective of the lesson is. Maybe this article will give you some ideas. I'll send it out this week to you.

Figure 5: Continued

May 1 (Mentor): Sitting here practicing Chinese (writing!) for our unit on China. . . . The class and I are going through the Spring Forward phase of the year. We'd all like to spring forward to June! So, sometimes its a little hairy in the room!

I'm sorry, I haven't sent that info yet. I will. It can be something to look at when everything is close to done. I used an AIMS lesson on cohesion, adhesion, and gravity. A real short, quick one. Before we actually did the demo, we looked up the words a day before. Then, I called for the words after the discussion. I didn't give any reasons why things did what they were doing, just asked lots of questions about what would happen if we changed the variables. They wrote about how the words they looked up the day before had [been used] in relation to the demo. Then, we did it again after clarifying the concepts. The kids liked it because they got to go outside and when we did it in the classroom, it made a mess!

May 6 (Catie): Thank you for the info you sent. I'm going to take it with me tomorrow. I'm on my third day of jury duty. . . . I was the first drawn for this trial and was selected on Monday to sit on this trial all week. I keep saying I should buy a lottery ticket.

May 13 (Mentor): Jury duty! Lucky you! I was at the job fair in Missoula last week and stopped by your school on Tuesday on my way back. They said you had jury duty all week. . . . Take it easy and don't stress much . . . it's almost over and we never cover all we want to in a year!

May 20 (Catie): I was really happy to see your note in my mail box at school. . . . I was thrilled again to know it was you! Anyway, my kids are totally bonkers from my leave of absence. It's like they are possessed by the wandering-do-nothing-but-visit monster. I'm trying not to get stressed, the end seems to have that effect on a lot of folks though. I'll try hard not to catch it.

I think our kids take their report cards home with them on the last day, so I better get started on them soon. I plan to do my own science next year. Mostly because I felt too disjointed this year, working with the other class. I was wondering if you could send me a sample of your lesson plans for a day-in-the-life of Ms. [Mentor]. [I'm curious] because I want to be a more Whole Language teacher, but I seem to have everything compartmentalized this year. . . . I plan to work every day at school doing curriculum review until June 25.

May 21 (Mentor): Sounds like you'll have a long but interesting June. I think that your interest in curriculum is to be commended. . . . I'll look back and see where I was using something for the first time. Like RAFT from Project Success. Role Audience Format Topic. It's a good structure and still lets the writer have control of what the project says. Language arts . . . you've taken CRISS: And Project Success? Anyway, those two come to mind right away. I'll see what else. Oh, all of the Projects: Wet, Wild and there's a lower level one I can't remember.

Well, as usual, I can't seem to make these any shorter than 1,000 words.

In summary, core group mentor-novice partners exhibited discourse patterns in the areas of curriculum and content, validation, classroom and school issues, moral support, and social talk. These categories were also valid for the survey group. Mentor-novice partners tended to balance discourse centered around curriculum and content with equal quantities of interaction on a more personal level of social exchange and moral support. They indicated that the more personal components provided a necessary foundation for successful discourse about mathematics and science.

Purpose 2: Influence on Mathematics and Science Teaching

The second purpose of the research was to "Describe how discourse between mentors and beginning rural teachers in a distance-mediated mentoring program influenced the beginning teachers' perceptions about mathematics and science teaching." Portions of this description are woven throughout other sections of the chapter. This section summarizes the prevalent categories of discourse about mathematics and science as discovered through interviews and surveys.

Mentor Impact on Mathematics and Science Teaching

In their 1997 and 1998 interviews, the core group novices were asked to provide specific examples of when and how their mentors had enabled their science or mathematics teaching. The majority of their responses involved the provision of teaching materials. The most common medium for

mathematics and science content support was an exchange of materials, usually from mentor to novice (although not always). This often occurred when a novice's request for specific help or mention of an upcoming unit gave the mentor an opportunity to mail activities and examples that he or she had used successfully in the past.

In addition, respondents to both surveys were asked to describe occasions when their mentor influenced their mathematics or science teaching. Forty-two novices responded to the 1997 survey request. Sixteen provided specific examples; twenty-one referred in more general terms to ongoing support, help in locating resources, day-to-day encouragement, and help with parents, administrators, and classroom management. Among the 73 novices who completed the survey in 1998, thirty-three provided specific examples and seventeen offered general but positive responses. A total of seventeen novices (five in 1997 and twelve in 1998) indicated that their mathematics and science teaching was not influenced due to insufficient contact with their mentors. The survey data, coupled with the core group responses, revealed distinctive categories of mathematics and science support.

Materials and Activities. Wendy described games, posters, and simulation activities which her mentor shared to motivate students in her consumer mathematics class. Daryl received technology assistance: his mentor loaned him eighteen calculators to use with his lower division students for several months, along with curriculum modules for integrated

mathematics. Another novice "needed help with a lesson. I couldn't come up with a concrete activity. My mentor had at least three great ideas off the top of his head. It was great and easily useful in my curriculum."

Other shared materials included hands-on materials and activities for probability and geometry units, and physics and chemistry labs and projects.

Special Units and Projects. Phil's mentor shared materials for orienteering and plant identification units. Paula's mention of an upcoming unit on the human body prompted her mentor to send her several anatomy activities. Other examples of special topics included:

- materials for a weather unit, a penguin unit, and a rock unit;
- a collection of mixture-making projects;
- mathematics and science holiday activities;
- resources and planning ideas for a science fair; and
- activities related to Dental Health Month.

Resources. Pamela and her mentor discussed possible Internet applications for science, and her mentor's extensive use of animals in the classroom inspired Pamela to order several species. Daryl's high school mentor and Renee's middle school mentor both provided textbooks for their novices to use as resources. Like many novices, Renee also highly valued the survival kit materials that were provided by the ECS Program:

Those books in the beginning were an unbelievable help. . . . Right after that year I got those books, I had to teach math and science in the junior high, and I can tell you I needed those books.

Based on their own experiences, mentors directed novices to proven materials:

We discussed alternative suggestions for helping Title 1 first grade students with math learning. [My] mentor suggested possible resources and offered to mail a copy if I was unable to find [them] at my school.

I was considering ordering a certain math program but I wasn't sure about it. [My mentor] suggested investigations instead. She helped me figure out where to order it and told me I could use some of her materials to pilot the program.

Mentors also recommended local teachers to help with special topics:

I needed information on chemistry. My mentor directed me to someone in my community for help.

She has provided names of excellent resources in my town. These leads have given me a lot of help in preparing lessons for my gifted students.

Classroom and Student Concerns. Wendy's mentor shared concrete ways to make her low-level mathematics classes more engaging (for example, structuring review sessions as games). They also discussed how to reach students at different achievement levels who learned at different rates. Phil talked to his mentor about ways to handle students who refused to participate in science labs. Also, because they taught in very similar environments, Phil relied on his mentor's reassurances about how he managed his many science courses and unruly students.

Survey respondents also provided classroom-related examples:

During my first year I asked my mentor about how far [first] graders should be in math by the end of the year. My mentor helped me by explaining where his class was at that point.

My mentor often gives advice on discipline problems and management. My mentor also gave me some very helpful advice about assessment and weighting of grades.

Curriculum Design. Renee received a steady stream of supplements from her mentor in the form of books, lesson plans, and advice. Many of their conversations centered on pedagogy, assessment, and classroom management related to STEM, the integrated mathematics curriculum which they both used. A survey respondent reported that "I wrote to my mentor about how to structure a year-long science plan. She encouraged me to use lots of hands-on things."

Paula's attempts to work with her mentor on a long-term curriculum left her feeling mildly disappointed:

I wanted to work this summer on a . . . kind of a three-year curriculum for science. . . . I did sort of come up with one, and I sent it to him this summer, and I asked for his feedback, and I never really got much back from him, I was a little disappointed about that. But we have talked, you know, about how I just feel like I'm kind of lost as far as that goes.

It is possible that Paula's mentor did not register the importance she placed on creating her plan and her request for feedback. She clearly would have preferred concrete help to the knowledge that she was "kind of lost" in curriculum planning.

Teaching Practices. Mentoring in the mathematics and science content areas extended far beyond a routine exchange of ideas or daily activities. For instance, because of her mentor's support, Tina found the courage to reach beyond the security of her textbooks:

And every Friday I'm making sure that I do an AIMS activity or a Marilyn Burns or something . . . even if it doesn't tie into what I'm doing. [My mentor is] trying to convince me that I am doing more science than [I realize] I'm doing.

Catie's mentor influenced her to move beyond a traditional textbook approach. In 1997 Catie was asked about her mathematics teaching: "With the math I found also that I was able to use the textbook and not worry so much about deviating from that." In 1998 she replied differently to the same question: "This year I've set aside Fridays as a day to do hands-on things in math—that was one of the ways that forced me to use hands-on more."

One novice mentioned an ECS Program workshop where her mentor discussed how "She used manipulatives to teach fractions in fourth grade. I had not seen fourth graders doing that before!" Another recalled, "My mentor teacher assisted me in the introduction of multiplication and division. She took a lot of the fear and anxiety away." A third noted: "She also told me how to extend lessons using more application activities following the exploration activities." Two novice respondents were especially appreciative:

I have been trying to incorporate more technological activities into my lessons but have limited experience with high-tech calculators. My mentor does workshops on TI-92s that I have attended and plan on

attending more in the future. . . . I could not have asked for a more appropriate match with a mentor.

My mentor shares insights on [a] weekly basis which I can add into my curriculum immediately. The biggest help has been her thoughts and assistance in rewriting my curriculum! Wow! What time this has saved. She was able to offer a model for me to follow so I was not working blind on something I'd never done before.

Models of Instruction. Barb and Tina both had an opportunity to

present with their mentor at an ECS Program workshop, which they felt was a great confidence builder. Other novices were able to attend workshops taught by their mentors:

I am in a unique situation where I am taking a math class that my mentor [is] teaching. I often go back to my class and try the activities and concepts we have talked about in class.

I attended a STEM [mathematics] workshop taught by my mentor teacher. The activities were enjoyable and time went by [quickly]. It reinforced my belief that working in groups is beneficial, and that there are many ways to teach concepts in math.

Daryl's mentor spent a day at his school demonstrating instruction with mathematical modeling and technology. Several mentors made similar school visits to personally model good teaching practices and appropriate strategies:

My mentor shared many lesson plans with me which influenced my teaching. He sent me lesson plans [and] discussed ideas over Metnet. My mentor also came into my classroom [and] did a presentation. His presentation was a great experience for the [students and] had a positive impact.

My mentor has visited my classroom and offered suggestions that influenced my teaching. [My mentor] made suggestions that helped me to make sure my students were understanding the science concepts

that I was teaching. I've also learned a lot [of] science information and teaching tips through conversations with my mentor.

She spent a week in my classroom. I was able to watch her teaching methodologies, rapport with students, etc. She did a great job.

My mentor told me about Marilyn Burns' materials and then came to my class to teach a lesson on geometry to demonstrate the materials. . . . I watched my mentor do the activity and do an [evaluation] of the students' knowledge.

"None of the Above." Seventeen novice survey respondents (five in 1997, twelve in 1998) responded that they had not interacted enough with their mentors to provide an example of mentor influence on their mathematics or science teaching. While there may have been justifiable circumstances in some cases, it was cause for alarm that this group of novices could identify no help received by the spring of their first or second year in the program. One novice said that "I have met my mentor once at an [ECS Program] workshop. We have not communicated since then," but went on to explain that other mentors in the same school were filling in the gap. Another simply said "My mentor has not contacted me this year. This is my second year. I suppose I should contact him/her." Such lapses in communication precluded any improvement in mathematics and science instruction, and these cases illuminated a weakness in the distance mentoring model.

ECS Program Impact on Mathematics and Science Teaching

The examples in the previous section describe the influence of individual mentors on their assigned novice teachers. Novices also had a great deal to say about the positive influences of participation in the ECS Program in general and the resulting exposure to a large cadre of expert teachers. Survey respondents were asked to give examples or explain how participation in the mentoring program had influenced their teaching experience in four areas: (a) confidence in teaching mathematics and science; (b) beliefs about teaching and learning mathematics and science; (c) mathematics and science teaching practices; and (d) professional growth as a mathematics and/or science teacher. These issues lay at the heart of the ECS Program, and at the heart of the research study.

Of the 36 novices who responded to the request in 1997, 28 responded positively. Three of the novice respondents felt they had not yet communicated with their mentors enough to answer the query; three other novices claimed "no effect" regarding all or some of the issues, and two responses were negative based on lack of contact with the mentor. In 1998, fifty-one novices responded positively; fourteen claimed "no effect" or were negative about their mentoring situation. The following excerpts are indicative of the majority of novice responses. Mentors also documented positive changes in attitudes, beliefs, and behaviors, but their responses are not reported here.

On confidence in teaching:

I have found confidence through knowing other teachers with lots of experience who have seen that teaching math and science this way does work!

I can't tell you how much it helps just knowing my mentor is there and available. I think to myself "Well, I can try it and if I have any problems I can call [my mentor]."

Discussing lesson plans with others and learning lesson plans made me see that some lesson plans are very good. That gave me confidence in using those lessons.

I have discovered that a lot of people have the same or similar problems in teaching that I have. Students everywhere have a lot of the same problems.

On beliefs about teaching and learning:

It was good to hear others' beliefs and then compare and contrast with my own. Caused me to be more open-minded.

My beliefs have been strengthened by the examples given by "top notch" educators. They believe in the importance and show the importance.

My mentor is very enthusiastic and creative in her approach to teaching mathematics and science. She does many "hands-on" activities [and] involves her students in "doing." This approach is in direct contrast to the current teaching approach at my school.

I'm starting to teach math as a problem solving/understanding concepts-based program rather than a . . . step-by-step process.

I'm learning that having students do many math problems doesn't necessarily reinforce learning.

Manipulatives are a part of "real" math and science. Learning should be fun and I am doing a good job striving for higher expectations and implementing the risky activities rather than just giving text book learning.

STEP conferences, as well as other math workshops I've attended, helped to expand beliefs and to know I was teaching in a manner to allow children to learn.

I am learning about the process of learning, discovery, and teaching a new and effective way. I hated science in school, my belief was it was boring and unimportant—I've turned around!

On mathematics and science practices:

I am trying more and more hands-on lessons all the time. What is great is having a chance to try them out and work out the bugs (at a conference, for example) before I try them in the classroom.

I want to use more active lessons so my students are involved both at their level and as I push them higher.

Best practices, why and how-tos, help to give a better understanding of reasons why we teach in particular ways, how children learn, and build a broader foundation that can be passed on to parents to help expand thinking also.

She encouraged me to incorporate my reading into math/science. Most of my focus is on reading at the grade level I have and she encouraged me to integrate so I could get the most from my teaching and the students.

My practices have become more directed because of the information I've obtained about science/math standards. I am more aware of meeting and enriching the national standards.

My practices have become [more] hands-on rather than just books—kids learn so much from doing.

On attitude and professional growth:

It has given me confidence to try new teaching techniques and to realize that I don't have to follow the book.

I am gaining the confidence to change my approach when one thing is not working. . . . I want to keep learning and growing in my profession so my students are always getting the best and most current math and technology skills I can pass on to them. When I can share ideas and especially failures with someone who has worked those things out

already, I have time advantages. I can fix what is wrong faster than I would have been able to on my own.

I find myself wanting to reach out and find out what is going on in other parts of Montana, the U.S. and even other countries. I am seeking more what the research shows about things.

A personal goal of mine was to broaden my mathematical knowledge, thinking and understanding. [The ECS Program] has helped through contact, newsletter, and workshop sessions.

[My mentor] has encouraged me to participate in such projects as March for Parks, the Jason Project and presenting at Montana Education Association Convention.

I'm ecstatic to be a part of this program since it really helps us to be more interactive, inventive teachers. This program helps me stay on top of teaching while learning new techniques. I'm a bigger believer in my profession each day.

Many more positive responses were documented through the two surveys and through postings to the program's Metnet conference folders. Both novices and mentors reported increased confidence, improvement of teaching practices, and changes in beliefs and attitudes regarding mathematics and science education. Mathematics and science discourse dominated their interactions as partners and in group settings, focusing on: materials and activities, special units and projects, resources, classroom and student concerns, curriculum design, teaching practices, and models of instruction.

Purpose 3: Mentoring via Telecommunication

The third purpose of the research was to "Determine whether telecommunication effectively supported a distance-mediated mentoring

relationship for beginning rural teachers." The next section briefly reviews data collection procedures, analysis, and results related to the use (or non-use) of Metnet by the core group partners; following that is an examination of Metnet use by other rural teachers in the ECS Program. The Metnet experiences and attitudes of the core group novices are then sequentially presented. Finally, telecommunication via Metnet is summarized in terms of its benefits and disadvantages.

Metnet Documentation

As participants in the research study, the seventeen novices and mentors in the core group were asked to provide documentation of their Metnet exchanges to the researcher. The method prescribed was for subjects to forward "carbon copies" of all messages to the researcher's e-mail address, which they all readily agreed to do. Subjects were advised that any sensitive material which they felt uncomfortable sharing could be blocked from the carbon copy process.

The subjects began providing copies of their messages following their first telephone interviews, over roughly a four-month period from January through May, 1997. A few early messages included references to the researcher, but no further intrusion was evident. The core group was periodically reminded via Metnet of the researcher's desire for message copies. Because the subjects could exercise license to censor selected exchanges, the data may not include every message sent. However, based on

informal questioning and follow-up interviews, it appeared that only one mentor-novice pair exchanged sensitive information, and copies of those messages were provided.

The exchanges provided insight into typical use of the Metnet system as well as the nature of on-line discussion between mentors and novices.

Table 12 depicts the documentation of messages between one pair of mentor partners over the four-month period.

Table 12: Sample Tally of Metnet Exchanges (Paula and Mentor)

Date	1/23/97	1/26/97	1/27/97	3/17/97	3/17/97	3/26/97
Author	Paula	Mentor	Paula	Paula	Paula	Mentor
Re: Content		x		x	x	x
Re: Students						x
Re: Adults	x	x				
Re: Morale	x	x				
Re: Social				x		x
Ask Q	x			x	x	
Answer Q		x				x
Acknowledge			x			

In this example, six messages were exchanged during the four months. Paula's first message was an inquiry to her mentor regarding her school board along with an outburst of despondency. Her mentor responded within a few days to both concerns; Paula then sent a brief note acknowledging the response. Several weeks later, Paula sent two consecutive messages; the first contained an inquiry about materials for a weather unit and adoption of a new science series, along with news of her recently broken foot; the second questioned her mentor regarding subtraction. This time the mentor did not

respond for nearly two weeks, when he listed the science series being used at his school and offered his suggestions regarding Paula's subtraction difficulties. Social talk was also an element of several messages.

A similar analysis was performed on correspondence between Catie and her mentor. From February through May, the partners exchanged eighteen messages, eight from Catie and ten from her mentor. The messages consisted largely of sharing about professional development activities (e.g. music classes, Internet classes, workshops, NCTM presentations, inservice topics) and sharing about school events (report cards, parent-teacher conferences, curriculum reviews, standardized tests, special units). These mentor partners had developed a stronger personal relationship than Paula and her mentor, and they communicated on a less formal level. Still, the purpose of at least half of their correspondence was to inform each other of science and mathematics opportunities.

The three-way partnership of Barb, Tina, and their mentor provided the most Metnet data in Spring 1997. Between January 21 and May 9, Barb sent thirteen messages to her mentor; she also posted several messages to the two Metnet conference folders she could access. Tina sent eleven messages to her mentor between January 30 and March 24, along with several queries to program co-chairs and to the researcher, and questions to other teachers regarding carpool arrangements. The mentor for both teachers sent a combined total of 33 messages between January 4 and May 19, 1997.

None of the other five core group pairs exchanged e-mail messages during the five-month period from late January to the end of the 1996-97 school year. Interviews late in Spring 1997 revealed that most were still experiencing technical difficulty. Pamela and her mentor were close to solving their hardware problems and were excited about the potential of using telecommunication. Renee and her mentor had reverted to the telephone after Metnet proved too inconvenient for Renee. Wendy and her mentor both preferred to avoid Metnet and also used the telephone for their exchanges. Daryl had difficulty finding time to access the one on-line computer in his small school, and Phil was unable to secure a reliable network connection through his rural telephone cooperative.

Follow-up interviews in February 1998 revealed that none of the five non-user pairs had ever made contact via Metnet. In addition, among the four Metnet user pairs, only one pair continued to correspond through that medium. Table 13 summarizes the degree of all-purpose Metnet use by core group novices, keyed as follows:

- Frequent = multiple use several times per week or month;
- Regular = predictable check-ins on a weekly or monthly schedule;
- Rare = occasional use over a semester;
- M? = use for one-to-one contact with the assigned mentor; and
- N/A = subjects who were no longer in the ECS Program.

Table 13: History of Metnet Use Within Core Group

Novice	Fall 1996	M ?	Spring 1997	M ?	1997-98	M ?
Barb	Frequent	Y	Frequent	Y	Regular	N
Wendy	Regular	Y	Rare	N	Never	N
Pamela	Regular	N	Regular	N	Never	N
Catie	Frequent	Y	Frequent	Y	Rare	N/A
Phil	Never	N	Never	N	N/A	N/A
Renee	Regular	Y	Rare	N	Never	N
Paula	Regular	Y	Regular	Y	Rare	Y
Tina	Frequent	Y	Frequent	Y	Never	N/A
Daryl	Rare	N	Never	N	N/A	N/A

The 1997 survey showed regular use of Metnet among mentors, with less use among novices. Of the 42 mentor respondents, 35 reported using Metnet once per week or more, compared to 22 of the 47 novices. A closer examination of only the rural novice teachers revealed very low Metnet use, as shown in Table 14. (Note: a population division of 2,000 was mistakenly used on the survey, as opposed to the 2,500 population criterion used to define "rural" elsewhere in the study.)

Table 14: Metnet Use by Rural Novice Teachers (1997)

Community Size	>5/week	3-5/week	1-2/week	2-3/month	1/month	Never
1-499	1	2	1	1	1	3
500-1999	0	3	3	1	3	3
2000-5000	0	3	1	0	1	0

Of the 22 novices in communities of less than 2,000 people in 1996-97, only ten used Metnet once a week or more. Increasing the definition of "rural" to include communities of up to 5,000 people showed that only fourteen of 27

novices used Metnet once a week or more. Analysis of 1998 survey results were similar:

Table 15: Metnet Use by Rural Novice Teachers (1998)

Community Size	>5/week	3-5/week	1-2/week	2-3/month	1/month	Never	No Resp.
1-499	0	1	3	0	1	2	2
500-1999	2	2	3	2	3	2	3
2000-5000	2	0	3	1	4	3	1

On the 1998 survey, 26 of 73 novice teacher respondents reported living in communities with populations smaller than 2,000; eleven of those reported using Metnet once a week or more. Of the 40 who lived in communities of less than 5,000 people, sixteen reported using Metnet once a week or more.

The four scenarios described above indicate regular Metnet use (once a week or more) by rural novice teachers ranging from 40% to 52%. By far the most common roadblocks to telecommunication among rural teachers were dependable access to an on-line computer and difficulty in getting an open telephone line when dialing into the system via modem.

Core Group: Metnet Experiences

Each of the nine novices expressed some degree of frustration regarding the technical use of Metnet, the electronic messaging system which was provided for them. The most frequently noted complaints had to do with difficulty in accessing a computer and getting linked to the Metnet system. "If I could ever get it set up correctly, it would work." "I feel more confident all the time, but it's a frustrating thing, too . . . technology is never

really working when you want it to." "We have it, but I don't have time to go down to the library and actually use it." "I've got on a couple of times, then I get cut off because of the phone system up here. . . . I still can't get an e-mail message typed out because it says I'm not allowed to perform that function." The following sections provide a view of the various levels of Metnet use by the core group novices over two years.

Sophisticated Users: Barb, Tina, and Catie. Barb had trouble fitting her on-line time into her weekly prep periods during 1996-97, but she managed to be on Metnet several times per week to e-mail her assigned mentor, talk with other teachers, and access folders. She had used the ECS Program conference to ask for help on at least two occasions; for example, a request for ideas to teach a unit on simple machines netted her four or five replies. Barb had also been asked to moderate the new "Early Career Chat" folder created specifically for the novice teachers. She had made several attempts to motivate conversation among her peers, but found them slow to respond. Through the following year she continued to post puzzles, questions, and samples from her classroom to the folder.

By Spring 1998, Barb had decreased her interaction with her assigned mentor to generic monthly inquiries about "how things are going." Her use of Metnet for other purposes had not diminished: "I get on every day usually, and I communicate regularly with a few people in the STEP program that

have been like mentors to me." She searched the conference folders and continued to add to the "Early Career Chat" folder to "spice it up a little bit."

Tina, an avid Metnet user, was originally paired with a mentor who did not use Metnet, but Tina still accessed the conference folders and participated in public exchanges. After being assigned a new mentor in 1996-97, she sent messages frequently, as discussed earlier. Under her stressful circumstances of employment, Tina appreciated the opportunity to document her concerns and activities as she shared her administrative struggles with her mentor:

It's like therapy because writing is like therapy to me—I really like to write things down. And then I can reread it and look at it again and change it or whatever. . . . The good part about it too is that she doesn't get to respond to it. I get to get everything out . . . she has to listen completely . . . it's wonderful that way.

Catie connected to Metnet about twice a week in 1996-97, mostly to talk with her mentor. She had responded to one conference question where teachers were asked to share their students' answers about why the seasons change. She expressed some hesitation about participating in the "Early Career" conference: "Sometimes it's confusing to know whether they're talking to us as early career or if they're talking to the mentors. . . . And so I was kind of shy as whether I should be responding to some of it."

In 1997-98, she was logging on to Metnet only once a month, to check her mail ("there hasn't been anything forever") and conference folders in the ECS Program areas and elsewhere. She had several questions she felt would

be worth posting, such as asking what time of day was best to teach science, but "I didn't get around to that yet." Catie was still frustrated by unexpected disconnects (she blamed her computer, not the Metnet system).

Optimistic: Pamela and Paula. Pamela had just received her first e-mail from her mentor at the time she was interviewed in Spring 1997. She was eager to continue, but in the March 1998 interview she stated that she had never again reached her mentor through Metnet.

In Spring 1997, Pamela had attended a STEP Project-sponsored Metnet training session in her region, but her initial enthusiasm quickly waned:

It was so much fun and I was so pumped to come home, and I couldn't figure it out when I got home. . . . The thing is I really believe that you almost have to have someone come in that can spend an hour or two with somebody to get it really going on their own computer . . . he showed us on computers that I wasn't familiar with, and so then I got home and we got it all set up on ours, and it just—it's never been that easy for me to use it.

In Spring 1997 she had been accessing and reading the ECS Program conference folders daily (she noted that she had the greatest success getting connected at 5:00 a.m.). While she had not yet participated in a public forum, Pamela read other people's postings and felt quite proud of her "inside knowledge" of statewide issues and events. By March 1998, she was regularly using Internet with her students during her allotted half hour of computer lab time, but reported logging onto Metnet only two or three times per month to look through the folders. She was still using a home modem to access Metnet and "waiting to get on it just drives me nuts."

Like Pamela, Paula had attended an ECS Program-sponsored Metnet workshop in her region and was full of enthusiasm for what she'd learned. In 1996-97, she was on line two or three times a week; she regularly read the "Early Career" conference folder and other folders, and had responded to at least one posted question. She wryly recalled, "They wanted us to ask two of our students where seasons come from. . . . I remember my kids, they all kind of figured it was God . . . and that was the end of that."

Paula continued to telecommunicate in 1997-98. She checked messages once a week, wrote to her mentor monthly, and continued to read the ECS Program conference folders. "I did at the beginning of this school year . . . put a couple things on the ["Early Career" folder] and tried to get some discussion started there, but you know there wasn't a lot of response."

Disenchanted: Wendy and Renee. Wendy had used Metnet more frequently during 1995-96, her first year of teaching in another community. She wondered if her name change (following her marriage) caused a problem in 1996-97 because "I can get mail, but it won't let me send anything out." Although aware that there was a problem, she had not made an effort to solve it since her move to her new school. She occasionally browsed through the ECS Program conference folders ("I really didn't find much") but did not actively participate during the Spring 1997 study period.

In March 1998 she reported that she had not logged onto Metnet in a year. She noted that "I'm just not much of a technology person in the first

place . . . even though I know it's free on Metnet, I'd rather pay the five or ten dollars to speak to somebody." Her mentor shared her feelings; she had experienced a series of modem complications and also had not been on Metnet in over a year. "Even if they did have it hooked up, I'd probably still be using the phone more. . . . I know that the Internet and Metnet is the technology of the future, but I like the personal aspect."

Renee felt comfortable using Metnet, but only logged on about once a month during 1996-97. She scanned the ECS Program conference postings and sometimes browsed other STEP Project folders. She recalled asking or responding to a science question early in the year, but otherwise had not participated in conferencing. Renee was rarely on line; after several of his messages went unanswered, her mentor realized that it would be nearly impossible to have timely exchanges via Metnet, and shifted modes to telephoning every two weeks.

At the time of the study, Renee and her mentor had exchanged only two or three Metnet messages. The mentor was an avid Metnet user, connected through both his home and his classroom computers. He set aside time each day for on-line communication, preferring this mode to "telephone tag" or spontaneous drop-in visits by colleagues. "If I've got messages, I know I'm going to deal with all of that right then and there. . . . I just know all my ducks are kind of in a row." By contrast, Renee had to find spare time in her hectic schedule to access the school's only on-line computer in order to read

her mail. "I had to go over to a different building, you know, and try to get [time] in another person's classroom." Renee's mentor used telecommunication to make his school day more streamlined and effective; due to her limited access, Renee found it to be an impediment.

After the Spring 1997 interview, Renee used Metnet only a few times to correspond with another new teacher whom she knew from college. She did not use Metnet at all the following year. She felt she might have done better had a connection been available in her own classroom. "You kind of start putting it off, not because you don't want to talk . . . you have so many other things going on. . . . Especially when you don't have a computer."

Uninitiated: Phil and Daryl. Daryl's explanation of his Metnet experience was short and to the point. "They have it in the library—it's only on one computer, and I haven't used it yet. . . . I don't 'cause the librarian has her little reign in there, and if you don't have to go there . . . most teachers don't." Daryl's mentor had also never been able to get on line despite several determined efforts by expert colleagues. Phil had used Metnet in the past to access an astronomy conference folder for resources, but he had experienced a string of complications in getting hooked up with his mentor. In fact, most of his Spring 1997 telephone conversations with his mentor had been centered around trying to get connected on Metnet.

Summary of Metnet Use

Among the nine novices in the core group, only Tina, Barb, and Catie could be said to converse extensively with their mentors via electronic mail. Paula and Pamela could be characterized as regular Metnet users in 1996-97, although Pamela was unable to converse with her mentor on line. Wendy and Renee had been on line several times in 1996-97, but their use dropped drastically the following year. The remaining two novices, Phil and Daryl, were enthused about the prospects of using Metnet but were never able to establish an on-line connection with their mentors.

When asked about their preferred mode of communication with their mentors, four of the novices named Metnet, but for different reasons. Tina felt it was valuable to document her conversations, and both Barb and Tina stated that their mentor preferred writing to telephoning. Catie recognized the efficiency of using Metnet over trying to make telephone contact, but added, "I miss hearing her voice." Phil, who was not yet on line, expressed enthusiasm for the ease and minimal expense of telecommunication and the potential for sending attached documents and files.

The other novices preferred telephone contact. Pamela also stressed the importance of face-to-face contact, at least to initiate the relationship. She spoke of the encouragement and ideas she received from her mentor at the January 1997 Best Practices Workshop and added, "I don't care, you can't do that on Metnet, you can't do it over the phone—you just have to have that

contact with each other." Catie's mentor expressed similar views. She felt that, without face-to-face contact, Catie might have misinterpreted her tendency toward sarcasm and humor:

It's like writing letters; it's not quite the same as talking to somebody. I like the idea of phone contact first and then getting on line because I got a feel for her personality on the phone and she got a feel for mine.

Even though she was a regular Metnet user, Paula expressed a preference for more personal contact:

I think it's really good in theory, and for someone like me in a school where I'm at right now, it makes a lot of sense. But there's something that's missing from it—that face-to-face, or that voice . . . it's not quite as personal or something.

Wendy's mentor spoke for both of them when she said, "I don't mind the phone bill. [Wendy and I] both have the same problem on Metnet . . . the phone is spontaneous, and was easy, and Metnet was like one more thing on the to-do list."

Survey respondents voiced the sentiment that Metnet was a valuable tool despite its complications. When asked to name their preferred form of contact, both mentors and novices indicated a preference for telecommunication. Of 57 total responses in 1997, 36 ranked Metnet as "most effective"; the next most effective modes of communication were the telephone (15 votes) and face to face contact (11 votes). In 1998, Metnet was again ranked highest, by 48 of 113 respondents who answered the question, followed by face-to-face contact (23 votes) and the telephone (18 votes).

In both 1997 and 1998, the most popular uses of Metnet for novices were for "exchanges with assigned mentor" and to "read information in conference folders," although only one-third of those respondents reported ever posting or responding to a question in a folder. Even those who were not yet on line indicated that they were "eager to use Metnet"; they blamed their lack of telecommunication on a combination of hardware problems, software difficulties, unreliable connections, and inconvenient access to an on-line computer. The participants who had resolved such problems were actively using and enjoying electronic communication.

Use of ECS Program Conference Folders

Overall, the mentors made better use of Metnet than the novice teachers. Mentors dominated the exchanges on the public "Early Career" folder as well as using their private "Early Career Mentors" folder. Much of the information was related to ECS Program activities and workshops, but the mentors also took opportunities to access the resources and talents of their peers: for example, one teacher asked other mentors to collect rock specimens from across Montana; another solicited lab ideas for a sixth grade geology unit.

The mentor teachers also used both folders to send congratulations, share humor, and demonstrate their skills with Metnet design features such as varied icons, colors and fonts. At least two core group mentors expressed dislike for this behavior, concerned that it caused the more timid to avoid the

on-line forum. Wendy's mentor criticized what she saw as poor etiquette and said she had minimized her Metnet use because "I don't have time for mindless chatter." Paula's mentor also felt that the time needed to download and read lengthy and vacuous exchanges affected his willingness to communicate with Paula via Metnet. Other mentors noted that they had limited computer access time and preferred to use it searching the World Wide Web for new ideas and materials, rather than searching for meaningful material in the ECS Program Metnet folders.

Barb and her mentor, both active Metnet users, shared suggestions for improving the effectiveness of the telecommunication component:

Barb: I think the mentors should have to put something on [Metnet] . . . say they all take turns and throughout the year they have to put one thing on, like their favorite activity of all time or their favorite lesson of all time . . . if they all put one thing on there, which isn't too much over a whole year, you're still getting tons of stuff because there's so many mentors. And then people will want to get on because they'll want to see those ideas.

If a conversation does go on in the mentor folder that we think "Oh, I might want—I might want to say something about that," we're not allowed that privilege because it's the mentor folder. . . . I don't think that even some of the mentors are aware that there's two folders.

Mentor: Get everybody on Metnet immediately. So many of us had to wait so long, they were so discouraged. . . . I think they needed to get right on Metnet, they needed to have the equipment, and they needed to have the expertise.

Maybe requiring an in-depth question a month or something. . . . What interests me is discussions about teaching. I think that was . . . one of the things that really attracted me, and still does, to conferences with other STEP people, is the fact that it's the only time in my life I get to talk about teaching.

Other core group novices also wished for greater structure in the program to motivate more frequent exchanges, especially via Metnet. Paula knew that the mentors had been given training, but wondered why the ECS Program did not go further to support communication:

I've always wished that they had given us—maybe the first year only—but given us maybe a monthly assignment . . . a guideline for "Okay, it's September, discuss your year plan" or [something]. . . . I just felt like we were put together and that was it . . . there were no guidelines to get us started. I feel like if we had had some assignments to do early on, or it had been a pattern established that you know, "On the third Tuesday of every month". . . that maybe we would have gotten off to a better start . . . and I would've had some more concrete ideas about how to use the program. . . . It's almost like building a relationship and being expected to have that relationship immediately without any kind of work on it.

Advantages of Telecommunication

Despite the setbacks caused by technical problems and an overcrowded network, almost everyone in the core group (seven of the nine novices and six of the eight mentors) was enthusiastic about the present or potential benefits of telecommunication in his or her situation. They named numerous practical benefits of telecommunication: cost savings in comparison to telephone calls; the ability to easily document exchanges; technology that allowed the transfer of files back and forth; ready access to announcements of workshops and special events; and the convenience of leaving a lengthy and meaningful message on line to be read and answered later during a quiet time, rather than playing telephone tag with other busy

teachers. Of course, these advantages could only be realized if both mentor and novice were connected to Metnet and comfortable with its operation.

The mentors also listed ways in which telecommunication uniquely supported their novices and themselves. Paula's mentor felt that he served as a "sounding board" outside of her school environment and that the distance between them allowed her the freedom to talk about pressure from parents and other sources. Pamela's mentor found the greatest benefit to be the larger forum of conference folders. Renee's mentor felt that the medium challenged his own thinking:

One of the real benefits of Metnet is, it really forces you to sit down and write exactly what you want to say. I mean, you really have to look at it carefully, because if it goes across the line and it was done quickly, you hurried it through, it might not sound like you want it to sound. . . . That's a thing that I've liked about Metnet, I've had to sit back, think about it a little bit, and make sure that what goes across is exactly what I want to say.

The 1997 and 1998 survey respondents listed similar benefits. They were asked to respond to the question: Summarize the advantages you have found to using telecommunication in the mentoring program—or elaborate on why you feel there are no advantages. Combining both surveys resulted in over 200 responses, which were overwhelmingly positive. Many similar responses could be grouped and categorized and are reported in Table 16. The total number of entries in the table exceeds the sample size because several responses encompassed two or more of the identified categories.

Table 16: Advantages of Telecommunication

Advantages of Telecommunication (summary of open-ended responses)	1997 Responses		1998 Responses	
	Novices	Mentors	Novices	Mentors
Inexpensive	2	10	7	5
Easy, quick, convenient	7	12	22	19
Time-efficient; available at leisure	3	8	6	9
Access to resources of large group	5	7	11	8
Allows reflection time	4	10	1	6
Novices are not on line yet	1	4	6	6
Other positive comments	10	5	12	7
Other negative comments	15	0	10	7

The following quotes represent some of the responses from the 1997 and 1998 surveys in support of the categories identified in Table 16:

Novice: One advantage is the ease and speed of communication. It is very difficult to travel and meet face-to-face on a regular basis. With telecommunication, you receive almost all the advantages of face-to-face communication without the travel.

Novice: I guess the main advantage I have found is that it gives me a [kind] of global view of education in [Montana]. Sometimes in my little school I have a tendency to think I am the only one with questions, the only one who doesn't have it together.

Novice: I have had a very difficult time getting on line. I believe Metnet will be very useful. I am able to contact my [mentor] and other teachers and I have already gotten lesson plans from Metnet. I'm looking forward to exploring further.

Novice: I think that the use of Metnet has allowed me to communicate with my mentor more often. I find that I look forward to getting mail from her, and so, I type to her.

Novice: This is a wonderful way to talk with one another and not leave your room. When I have a short break I can contact a multitude of resources.

Novice: I am able to sit down and type out a problem I have, or an area of activities I want to find, and send it to many people

and within [minutes] to hours I'll have a response. It doesn't cost a lot like the phone and isn't real slow like the mail service.

Mentor: You are able to send messages at any time day or night. In the Mentor or [Early Career] folders, you can obtain many responses to a question or concern versus just a single response in a one-on-one.

Mentor: It's quick. It's easy. There's no playing "telephone tag." A phone conversation is between two people but with the bulletin board the conversations are with groups!

Mentor: The ability to communicate weekly when we are miles apart is the best. We can both do it at our convenience. Also—putting our thoughts into words makes a deeper level of commitment.

Mentor: Writing makes you become more thoughtful [and] reflective about what you're trying to say. After you write you can reread what you've written [and] make sure you've said what you want to do. When you talk you can't take back what you've said.

Disadvantages of Telecommunication

Because the Metnet software was not always simple to install, and because gaining access to the Metnet system was often tedious, the majority of mentors and novices in the core group were not benefiting from the full capabilities and convenience of telecommunication. The core group teachers' difficulties with Metnet fell into four categories:

- inability to load and/or run the Metnet software on a personal or school computer;

- inability to maintain an active connection (the Metnet central computer disconnected the user, or the telephone connection was cut off);
- inability to open a connection due to tied-up telephone lines at the teacher's site or on the toll-free Metnet number; and
- lack of convenient access to an on-line computer (often located in a school library or computer lab and unavailable during the teacher's free time).

In 1996-97, one or more of these complications made access to Metnet so complicated that the core group partners were, in most cases, unable to develop a satisfying telecommunication routine. This was not entirely the fault of technology and poor system maintenance; probing questions revealed that many of those who had "technical difficulties" had made no substantial effort to repair the problems. Instead, they relied on the telephone and other means of contact to fill the breach.

In separate Spring 1997 interviews, Barb and her mentor revealed very similar feelings about communicating via Metnet. Barb observed that she often required more immediate feedback than Metnet could provide:

"There's once in a while that I just need to just say 'Ahhhh, what should I do?' or something, and if I can't get on then that feeling goes away." In a later interview, her mentor explained why that feedback was often delayed even when Barb did ask questions on line:

My problems with Metnet are that I have a really hard time getting on . . . we have to use the 800 number and so . . . I try at noon, I try in the morning. Friday night I can always get on because everybody else has a

life but me. And so then sometimes . . . I'll see that like Barb messaged me on Tuesday and I feel really bad, you know . . . that it's been a couple days 'til I get to her.

Like many ECS Program participants, the mentor's access problems disappeared in 1997-98 after software for Internet-based connections to Metnet became available. Modem-based Metnet connections were still necessary for participants who did not have easy access to an Internet server from their schools or homes. But for many others, busy signals and unreliable connections were no longer a concern by Fall 1997.

Negative survey responses from 1997 and 1998 included repeated comments about missing "the personal touch that voice to voice can bring" and technical difficulties with connections, settings, and software. On the 1998 survey, at least six mentors expressed frustration that their novices were not yet on line. For novices who had trouble, the loss of precious time became an issue: "It will take a lot of time and energy for me to get proficient with Metnet." "It was way more work than I was willing to put out." "The Metnet system has been a frustrating experience that takes up time I don't have to spare." In fact, most of the negative comments centered around issues of time and access:

Mentor: It has not been convenient for my early career teacher. For a new teacher anything that adds to the demand is just one more thing on the "to do" list.

Novice: Metnet is hard to access and even harder to stay on line. I finally gave up trying to use it because of the difficulty trying to get access.

Novice: I have found Metnet to be very frustrating. It has been difficult finding people to answer questions and to find the line not busy. I haven't given up yet though.

Mentor: We use Metnet for messages and for quick communication but this is not sufficient for counseling or idea/curriculum discussion.

Simply put, telecommunication through Metnet was highly rated by those teachers who had easy access and the necessary technical skills and support to use it. They cited practical advantages as well as more subjective benefits such as the ability to reflect while writing, reading, and responding to messages and freedom to express themselves to someone outside their school. Teachers not on line had trouble installing or using the software, establishing the hardware connection, or gaining access to a computer and/or the Metnet system. In the majority of these cases, the teachers were aware of the benefits of telecommunication and eager to get on the system.

Purpose 4: Effects of Mentoring on Attitude and Professional Growth

The fourth and final purpose of the research was to "Investigate the overall effects of the distance-mediated mentoring relationship on beginning rural teachers' attitudes and concerns about teaching, as well as their professional growth and development." Before findings in this area are reported, two points must be clarified. First, it is clear that many mentor partners in the ECS Program did not correspond via telecommunication; therefore, the findings related to this purpose will be discussed in terms of all

mentoring relationships without attempting to single out Metnet users. Second, those findings cannot be neatly packaged under a subheading; many of these effects have been discussed in previous sections. However, broad categories of professional growth among novices in the program were identified and are presented in the following sections.

Areas Supporting Professional Growth

Confidence. Wendy felt that her mentor's positive and supportive attitude gave her confidence in her new school. Catie and Barb both gained a sense of confidence through giving presentations with their mentors at ECS Program workshops and at the state education conference. Barb found it reassuring that her teaching ideas met the approval of experienced mentors:

Once in a while over Metnet I'll write "I'm doing this right now, any ideas?". . . People will write back with—four, you know four people write back and I'll have ideas. I think a big part of it is just confidence . . . that you go to these conferences and people are presenting. . . . And it's all hands-on and it's all things that they've . . . done in their classroom and it's been really successful. . . . Then we do it and we bring the stuff back, and it's like confidence, "Okay, I can do this too" and I think that's the biggest thing, is just confidence . . . in math and science.

Encouragement. A recurring theme was the positive role mentors played in reminding novice teachers that they did not have to be perfect or successful in everything at once. Catie's mentor suggested "that I need to probably just go through the book and see what's there . . . that to me has helped me relax a little bit about trying to do everything at once." Barb's

mentor added her perspective; she felt her novice partners were encouraged by her own experience:

People who have been teaching as long as we all had were still so excited about teaching. . . . I think that's really important because in these dark dreary days when you get discouraged and nothing is going right, you know you can look at people who have survived.

Indeed, many of the novices felt that their mentors, both individually and as a group of professionals, provided an example for them to follow. Paula felt that her mentor and his colleagues were both a comfort and an inspiration. "You know, I feel like okay, I'm only in my first few years, it's okay that I'm where I am now, but it can get better, you know—it's kind of a goal to shoot for." And Tina credited the mentor program with her own survival:

It's kept me afloat without a doubt . . . because I have a support group and I've felt like I'm important or like I'm . . . I am somebody. I mean because at school itself I have not felt support at all. Or in times when I haven't felt any . . . it's been wonderful to be able to go to a group of people that say "Yes, you do, and this is why" . . . it has kept me afloat, period.

Enthusiasm. Renee gave the ECS Program credit for building her personal appreciation for mathematics. In the past, she said, she was not very "pro-math." Then she attended a Marilyn Burns workshop and met a number of teachers from the STEP Project who were willing to support her. "Every time I went to a STEP workshop I continued talking with them about math, and so I feel like it's strengthened my whole outlook on math and the way I teach math." Paula, Tina, and Pamela all stated that the program

improved their attitudes about both mathematics and science. Pamela spoke of traveling to an ECSP Mentoring Skills Workshop with a vanload of mentors and novices from her region, including her own mentor:

I kept thinking, "Okay now, I hope I can remember all these things" because things were just bouncing off people. . . . It was great, it was really, really great to be able to bounce those ideas off of other people and get new-new things. . . . You know, that part of the mentoring is gonna be great, because it isn't just necessarily her that I consider a mentor . . . I think the others are in a way, too.

Sense of Community. In explaining the curricular and moral support they had received through mentoring, the core group novices frequently referenced the entire community of mentors and other novices as well as their individual assigned mentors. In every case where novices had attended one or more workshops or were adept at using Metnet, they praised the atmosphere of mutual support and the wealth of shared resources that existed in the larger group. Tina noted that this positive dynamic demonstrated the "strength of the program too . . . that other mentors could just—you know, be with other [novices] and help them, and it didn't have to be 'Nope, I can't talk to you because you're not my [assigned novice].'" Renee voiced similar thoughts:

When we had our first meeting of the year with all the STEP people . . . that really helped a lot. . . . It's really helpful just to hear other people's stories, you know, being a first year teacher that I was, hearing everybody else's situations in classrooms, and how they handled the situations, whether it was math or science or just behavior and that kind of thing.

Wendy also appreciated "going to those conferences and talking with other teachers, and knowing that sometimes they're having the same difficulties that you are, you're not the only one." She felt the same sense of membership in a larger group when using e-mail to ask questions or gather information. "All of that just really helps, and I think it really brings back a lot of energy into your teaching."

Validation. Tina's self-esteem was strengthened by her mentor's validation of her classroom practices: "In math it's just given me tons of enthusiasm because . . . I am doing things that are okay . . . it's validating me in the one sense that I'm . . . doing okay." Barb observed that sharing her experiences and having a sounding board helped put her teaching trials in perspective:

Last year I wanted everything to be so perfect and I guess the first few months of teaching . . . you know, I won't say that they were terrible, they weren't. But they're really stressful and I get headaches all the time and because every little thing that went wrong I was accentuating it, making it this big deal. . . . On Metnet it was like I was listening on the bulletin board to other people's problems and—not really problems, but comments—and then my mentor, and I'd say "Am I human, is this okay?" And she'd say "Oh, yeah." So I guess just that it's okay to goof.

Catie had written down her thoughts in advance of the interview, and clearly expressed what having a mentor represented to her:

Having a mentor helps me to confirm what I'm doing in the classroom as being in line with quality teaching. It makes me be a reflective teacher, to question how my class is progressing. I like to share what I'm doing to spark ideas in my mentor . . . on what she has done, or is doing, or would like to do in the future. I like to hear my mentor comment on how I seem to seek information from others, and not act

as if I know everything—and this was something that I thought was surprising. . . . I hear what my mentor is doing professionally, and I strive to seek development opportunities that are beneficial both academically and financially. And I guess I need to know and believe that I have something to share with others . . . and that's something that she helps me develop also.

Parallel Thoughts from Mentors

Interviews with the eight core group mentors revealed the same kinds of professional growth and program benefits that were described by the novices. It was clear that the mentors had experienced both personal and professional gain after involvement in the ECS Program.

Paula's mentor:

You come to these little workshops, and the enthusiasm for math and science is so high, and you go back and you go "I'm going to get my math and science done this week". . . . I know having her as a mentor has been good for me. . . . I think I've gained more than probably my [novice] has. It gives you a kick in the math and science where I needed it, and I knew I did—that's one reason why I applied. I guess another reason why I went after it was because, just being around . . . those people is such a high for me, you know, to see people excited. People around here are great teachers, but to be with a group of people who are really excited about teaching . . . it's fantastic. There's a lot for the mentors to learn here too, and there's a lot to be offered to them as well as the early career people and I think it's an excellent program—I love it.

Pamela's mentor:

The biggest strength of the [ECS Program] is all of a sudden you have a wealth of people to work with. I mean I have met an incredible number of people that I probably would've never been in contact with, had I not been involved in that program. At a conference—you might go to a workshop, or something this summer, and have . . . brief contact with people, but this has been over almost a two-year span now, and I think . . . anything that I want to do in math and science,

reading or anything else . . . there's somebody out there that can answer my questions, and I don't think that I've felt that before the program.

Phil's mentor:

Mentoring is a natural thing for me and what I really liked about it that I learned, I guess that first year . . . it's not that we know everything and the [novice] teachers know nothing—you know, it's a sharing and a helping and sometimes advising, and what you get out of it is so much more than what you ever put into it. It's the heavyweight kind of people who are in [the ECS Program]—dynamic . . . at a conference how you can get really jacked up and enthused and ready to go back in . . . and fight the battle again, you know, with new ideas and new ways of doing things. It's just sort of a shot in the arm when I get with groups like that—it's a renewal of the spirit.

Program Satisfaction

Two survey questions sought to estimate the overall impact of the ECS Program on novices and mentors. The first question asked respondents to rank several components of the ECS Program in terms of which have been of most benefit. Among the novice teachers, "providing help with math/science resources, materials, and activities" was ranked first by a wide margin (25 of 43 who answered the question in 1997 and 33 of 60 who answered in 1998). The next most helpful program component was "providing help with presenting and expanding math/science curriculum" (ranked first by ten novice respondents in 1997 and seventeen in 1998). The next two categories, "providing help with students and classroom management" and "providing help in working with administrators, parents, and community" were perceived as useful but less influential aspects of the program.

The survey also asked participants to assign values to several components of the ECS Program, with "1" denoting "very useful," "2" denoting "somewhat useful," and "3" denoting "not useful." The results for the novice teachers are displayed in Table 17.

Table 17: Most Beneficial Components of ECS Program

	Very Useful	Somewhat Useful	Not Useful	No Resp.
ECS Program Components 1997 (N=47)				
Survival kit resources and materials	38	6	0	3
ECSP conferences and workshops	28	16	1	2
Interaction with assigned mentor partner(s)	29	14	1	3
Interaction with other mentors	20	14	6	7
Interaction with other novices	21	19	4	3
Membership in professional organizations	13	21	9	4
ECS Program Components 1998 (N=73)				
Survival kit resources and materials	56	17	0	0
ECSP conferences and workshops	45	20	1	7
Interaction with assigned mentor partner(s)	28	30	8	7
Interaction with other mentors	32	21	9	11
Interaction with other novices	37	20	8	8
Membership in professional organizations	18	30	13	12

Related Findings: Surrogate Mentors

Despite the already broad scope of this study, related issues and new avenues of inquiry revealed themselves throughout the research period. The researcher continued to focus on the purposes which initiated the study, but the data collected were rich enough to indicate a number of worthwhile related investigations. For example, the issue of "surrogate mentoring" is a phenomenon that deserves further study.

In the case of two core group novices, a secondary mentor emerged at a time when the original mentor was preoccupied with personal demands and the novices were in need of support. Coincidentally, this circumstance occurred with both Barb and Tina, who were paired with the same mentor.

The researcher did not attribute this phenomenon to the event of a single mentor working with more than one novice; many of the mentors in the study corresponded successfully with two or more novice teachers.

Interviews with Barb and Tina revealed that, during a period of time in late Fall 1996, both novices felt the need to give their mentor some breathing room and sought support elsewhere. Tina explained that once they both revealed these shared feelings, the two novices formed their own bond:

She had a lot going on in her life and I didn't really feel like I was getting mentored . . . I don't know, things just didn't seem like we were . . . as close, and so Barb and I decided that we should be, and we both were wondering if there was something one or the other of us had said or done. We were kind of concerned about whether we had offended [our mentor] or whether something was going on or whatever, and we both concluded that she [was] busy and that it was good that we had each other.

Barb expressed similar feelings of uncertainty and withdrawal: "I'd write and [my mentor] wouldn't respond for . . . a couple weeks; I know she was really busy. . . . I would just quit writing her then. . . . I didn't know if she was still out there or what." By Spring 1997, she had begun to bond with a second mentor teacher in the ECS Program whom she met at another STEP Project event. At the time of the interview, Barb was planning a visit to her surrogate mentor's classroom. The surrogate had already provided her with

teaching ideas and materials, and was very willing to continue working with her in an unofficial capacity. "We communicate a lot," added Barb. "She's not my mentor, but. . . . We've just kind of connected with each other."

Tina "adopted" her surrogate mentor after they shared a long drive to the ECSP Mentoring Skills Workshop held in January 1997:

[My mentor] wasn't there, and I felt very close to [the teacher whom] I rode with. . . . We talked for those five hours or whatever and I felt it started very much like it had with [my mentor]. . . . It was really a comfortable situation and then she—her [novice] wasn't there, so we were together at that conference . . . I felt like I was branching in a sense. . . . It felt first like I was being unfaithful to [my mentor]; it was the weirdest feeling, like . . . "I'm sorry—I didn't mean to mentor with you."

These incidents reflect the importance of personal choice in establishing a successful mentoring relationship. Research findings support the notion that the partners in a successful mentoring relationship must exhibit a willingness to participate, similar professional responsibilities, and personal compatibility (Christensen & Conway, 1990; Tennessee Education Association, 1988; Wilkinson, 1994). In her study of 200 novice teachers, Wilkinson found that 84% "wanted to select the assistance they received" and cautioned against "simply assigning a mentor who may or may not provide the desired assistance" (p. 59). Bower and Yarger recommended a "provision . . . for either the mentor or the intern to opt out of a particular relationship after a certain amount of time" (1989, p. 64). Even if initial pairings had to be made by ECS Program staff, the benefits to novices would have been enhanced by

the existence of a controlled process by which dissatisfied mentors and novices could rearrange themselves into comfortable relationships.

Summary

This research study sought, through a variety of methods and using two different population samples, to investigate the nature and effectiveness of a statewide, distance-mediated mentoring program focusing on rural mathematics and science teachers. The results gleaned from two surveys of program participants tended to support the data collected through more extensive investigation of a core group of seventeen research subjects. The survey respondents and core group participants were predominantly positive in their descriptions of the program and its benefits. Although the research focused on novice teachers, the researcher found that both mentors and novices experienced positive effects from participation in the program. The data translated into a number of findings, particularly regarding the telecommunication component of the program. Implications and recommendations based on these findings are discussed in the following chapter.

CHAPTER 4

IMPLICATIONS, DISCUSSION, AND RECOMMENDATIONS

Introduction

Rural mathematics and science teachers throughout the K-12 system carry demanding and diverse teaching loads while facing isolation from peers and from professional development opportunities. Rural science teachers are often asked to teach subjects outside their area of expertise, where minimal preparation is compounded by a scarcity of human and classroom resources (Huling-Austin, 1992; Shroyer & Enochs, 1992). Mathematics teachers also suffer in the absence of resources; in its *Professional Standards for Teaching Mathematics*, The National Council of Teachers of Mathematics noted that "mathematics has its own content and pedagogy" and that only those teachers "experienced in the field should serve as mentors" (1991, p. 161). Providing isolated rural teachers with mentors who can help them develop in these content areas may mean reaching outside the boundaries of their schools or districts.

The Montana STEP Project's Early Career Support Program was designed to ameliorate the multiplied consequences of teaching in a complex

discipline, often in several subject areas and at several grade levels, in an isolated setting with limited resources and no content-area colleagues. In this study, qualitative research methods were used to investigate the defining characteristics and effectiveness of distance-mediated mentoring relationships established and supported by the ECS Program. The investigative task was subdivided into the four purposes summarized below:

- 1) Characterize and document the nature and development of the mentor-novice relationships;
- 2) Describe how discourse influenced the novice teachers' perceptions about mathematics and science teaching;
- 3) Determine whether telecommunication effectively supported a mentoring relationship for novice rural teachers; and
- 4) Investigate program effects on novice teachers' attitudes and concerns about teaching and professional growth.

This chapter examines research findings based on a study of the STEP Project's Early Career Support Program and suggests how they might be used to design and/or improve future distance-mediated mentoring programs, especially those developed for rural mathematics and science teachers.

Summary Framework and Implications

Every component of the Early Career Support Program was valued by some subset of teachers. Not all components were exploited by all novices,

but each played a role in supporting and mentoring a substantial group of novice teachers depending on their circumstances, their school settings, and their level of access and ability regarding technology. Novices benefited from the presence of a large community of mentors as well as in their one-to-one mentoring relationships. Both mentors and novices highly praised the semi-annual ECS Program workshops as opportunities for face-to-face interaction, exposure to model instruction, and professional renewal.

Telecommunication did not achieve its expected potential as a mentoring tool and Metnet, the medium selected to support electronic mail and conference folders, was underused. However, those mentor-novice pairs who mastered the on-line technology made good use of it and reported excellent benefits, including access to a large group of teachers and time to reflect during one-to-one interactions. Facility in using Metnet was not an indicator of a successful partnership; in the core group, those partners not on line found ways to compensate for technological obstacles and established successful relationships by other means.

A Framework for Broad-Based Distance Mentoring

The study findings suggest that in theory, the ECS Program embodied an ideal model for a statewide or regional distance-mediated mentoring program which services rural teachers. Not all components of the ECS Program were used to their full potential, and the findings implicate a need for improvement in the coordination and management of key elements of

the program. (These implications and related recommendations are outlined later in the chapter.) Nevertheless, the data collected from program participants suggest that the conceptual framework behind the ECS Program is an effective one if all of its components are carefully constructed and maintained.

In this context, an *effective* distance-mediated mentoring program can be interpreted as one which:

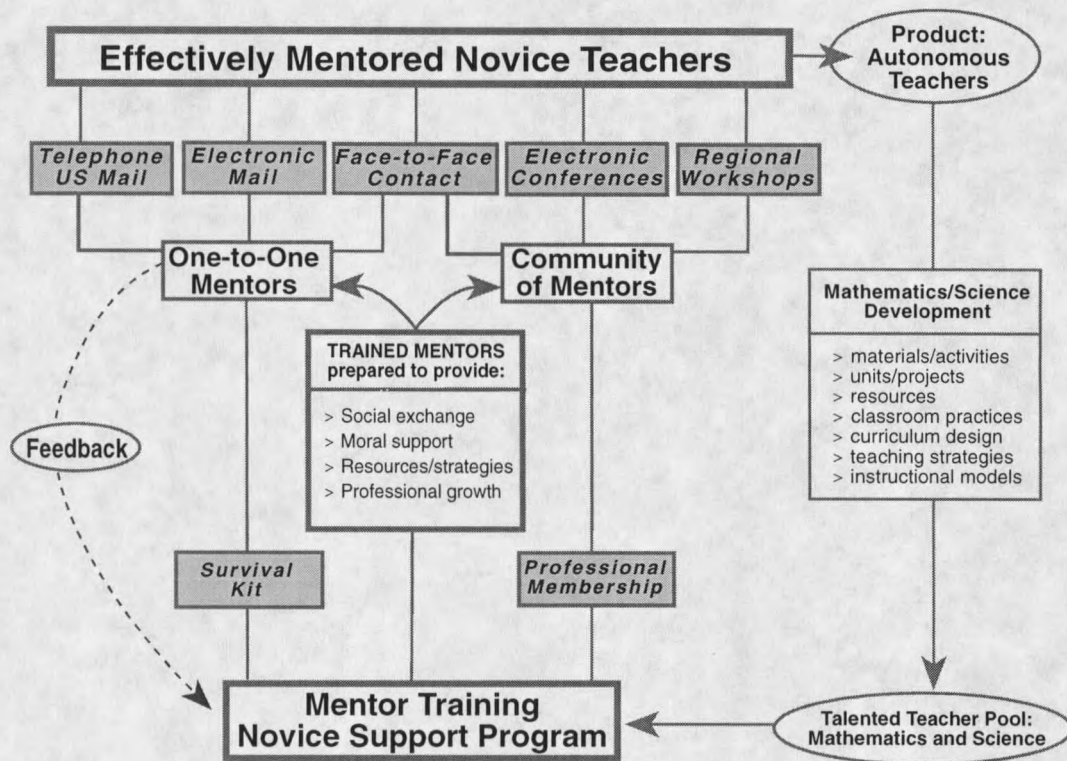
- promotes successful mathematics and science teaching and learning strategies;
- diminishes apprehension related to school, classroom, students, and subject matter; and
- results in professional growth and retention.

The components of such a program can be visualized as a framework supporting mathematics and science teachers, as shown in Figure 6. "Internal framework" is used in the title to indicate that these components are program-controlled design elements. Other external components, such as support from school administrators, are equally essential, but were not examined in this study.

The upper support level of the framework is composed of the various communication modes used by novices and mentors. The diagram in Figure 6 reflects the fact that one or two components at the upper level can be weakened or removed without noticeably affecting the support structure. At

the middle level, both one-to-one and community mentoring must be present to ensure a stable framework, although one component could possibly be removed without drastic consequences. The foundation is not so expendable; ultimately, the parent program is the basis for individual and community mentor experiences as well as the provider of mentor training.

Figure 6: Internal Framework for an Effective Distance-Based Mentoring Program in Mathematics and Science



The feedback loop on the left indicates the need to regularly assess the progress of individual mentor-novice partnerships. The feedback path to the right represents the professional growth of novice teachers, leading them to

become expert mathematics and science educators themselves. As the novices establish personal autonomy and engage in professional development, they augment their own mathematics and science materials, strategies, practices, and programs. Eventually, they become future mentor candidates for the program.

The three levels of the internal framework for effectively supporting novice teachers are described in more detail below.

Level One: Mentor Preparation. To be accepted into the ECS Program, mentors had to possess experience and ability in mathematics and/or science teaching. They also received formal training during three- to five-day summer workshops. The training process not only developed teachers' mentoring skills and increased their awareness of the needs and concerns of novice teachers; it also coalesced an assortment of talented and experienced mathematics and science teachers into a cadre of trained experts with shared interests and objectives. The experience produced mentors who were "able to analyze their own beliefs about learning to teach and to articulate their practical knowledge of teaching" (Feiman-Nemser, 1996, P-12) as they attempted to establish trust, encourage reflection, and develop autonomy in their novice teachers. In addition, it nurtured a group dynamic which sustained the community aspects of the program.

Level Two: The Many and the One. The research demonstrated that novices benefited both from one-to-one exchanges with their assigned mentors and from broader experiences within the full community of mentors. Both assigned and associated mentors inspired confidence, offered validation, and provoked enthusiasm in novice teachers, especially when they modeled mathematics and science instruction in various settings. Assigned mentors were foremost in providing moral support, serving as outlets for frustration, and working closely with novices on day-to-day management details as well as extended curriculum projects. Through the on-line conference folders and workshop experiences, the mentor community enabled novices to "fill in gaps" in the one-to-one experience by sharing multiple ideas and resources.

Tellez (1992) implied that ideally, novices are better off "self-selecting" their mentors, and should be allowed to explore relationships with several teachers before choosing a mentor. Self-selection was not feasible in the Early Career Support Program, but the existence of a community of mentors introduced a degree of flexibility in mentor-novice matches. The majority of novices and mentors in the ECS Program were suitably matched through the application process; in the few contradictory cases, novices who were dissatisfied with their assigned mentors developed ongoing relationships with other mentors whom they met at workshops and similar functions.

Level Three: Support Mechanisms. Novice mathematics and science teachers work in unique settings and contexts. No one vehicle of mentor support can be expected to supply their needs. Therefore, multiple means of support from multiple sources are required to assure success in mentoring. Ideally, both individual and community mentoring will be available to the novice teacher. Multiple delivery systems (e.g. telephone, U.S. mail, face-to-face contact, electronic mail, and computer conferencing) should be used in each case. If one mode of communication is inadequate, the findings indicate that mentors and novices will seek out and apply another on their own. This process could be formalized within a mentoring program; mentor-novice pairs could be encouraged to "shop around" for personally effective modes of communication, then make a commitment to regularly use those modes. Ultimately, the communication itself is more important than the means by which it is carried out.

In the ECS Program, the one-to-one interaction of novice teachers and their assigned mentors was supported by both electronic (Metnet e-mail) and more traditional (telephone, mail, and face-to-face) modes. The support of the community of mentors was also delivered via electronic (Metnet conference folders) and traditional (workshop) modes. In most cases, both modes were used successfully. Mentor-novice pairs like Wendy's and Renee's used the mail and telephone to supplement deficiencies in electronic

communication. Others, like Catie and her mentor, found Metnet preferable to playing "telephone tag" and interrupting their busy colleagues.

Novices indicated that face-to-face conversation helped them to build trust in their mentors, and that opportunities to observe model mathematics and science teaching and to interact with many teachers at workshops were important to their professional growth. Such opportunities are particularly important for isolated rural teachers who have minimal interaction with experienced colleagues in their subject areas.

In short, all components of the framework need to be present to adequately facilitate communication and ensure a successful distance-mediated mentoring program. The remainder of this chapter elaborates on implications of the research for developing and improving such programs. Following the order of the study purposes, the first sections include findings and their application relative to the establishment, development, and maintenance of the mentor-novice relationship and to supporting mathematics and science instruction. Next, conceptual and practical implications for mentoring via telecommunication are presented. Finally, the impact on professional growth of a distance-mediated mentoring program is examined along with its implications for both novice and experienced teachers. The final sections offer a set of recommendations for future practice in initiating or adapting similar mentoring programs, and recommendations for future research.

The Novice-Mentor Relationship

Mode and Frequency of Contact. Mentors tried to adjust modes of communication to suit their novices' specific situations. Five of the core group relationships were maintained (although not all thrived) by telephone because the novice or mentor could not resolve Metnet complications. Others in the program paid personal visits to provide mentoring assistance that could not be duplicated via computer or telephone lines.

No universal patterns regulated mentor-novice communication. Contacts ranged from several per week to one or two per year. Well over half of the core group partners reported that they communicated on a weekly or monthly basis, but at least two were unable to provide a history of consistent contact. Levels of interaction were satisfactory in most instances, but in at least four core group cases a novice or mentor was left wanting. Novices were told by their mentors to "call any time when you need help" and then left alone; on the other hand, mentors were often frustrated by their novice's failure to return messages. In a few cases the lack of communication was severe, as when Daryl's mentor didn't know that he planned to quit teaching until after he resigned, and when the researcher learned before Renee's mentor did that she wasn't teaching mathematics or science in 1997-98.

Predictors of Compatibility. Six of the eight core group novices expressed satisfaction with their original mentor partners. Paula tolerated her

situation although not entirely satisfied, and Tina changed mentors before making a good match. Gender and age were not indicated as predictors of a successful match: same-gender and mixed-gender pairings resulted in both successful and ineffective matches.

Two indicators of compatibility did emerge. The first was similarity of teaching assignments regarding subject matter and grade level. Teaching parallel content with their mentors gave Renee and Wendy a great deal to share and discuss. Those, even at or near the same grade level, who did not teach similar material were less interactive with their mentor partners. The second indicator was similarity of community, school, and classroom setting. Partnerships (Phil's and Pamela's, for example) were rewarding when the novice and mentor faced similar responsibilities, demands, and tribulations. Two of the less productive matches (Daryl's and Paula's) were with mentors who had markedly different school environments and responsibilities. Even though Daryl's mentor spent a day at his school, their differences in rurality and teaching load still erected a barrier to successful communication.

Importance of Personal Contact. The ECS Program demonstrated that telecommunication is an effective communication tool for a rural setting; however, personal contact still played a key role in mentor-novice communication, especially in the early stages of the relationship. Face-to-face meetings did not have to be frequent (teachers suggested once or twice yearly), but a personal encounter was needed to establish a foundation on which to

build a relationship. Even core group subjects who became avid Metnet users valued establishing an initial relationship on a face-to-face level. On surveys, novice and mentor teachers indicated a desire to hold the fall workshops earlier in the semester and expressed dismay when they could not attend the same meetings as their partners; they viewed such events as opportunities to launch and/or revitalize their mentoring relationships.

When solicited for suggestions to improve the program, eight core group teachers expressed a desire for increased proximity and/or personal contact. Six of them stressed the importance of early face-to-face encounters; only two mentioned a preference for having a mentor partner in the same school or building. Overall, mentors and novices did not protest having a partner teacher in another community, but they preferred a manageable distance that allowed them occasional visits.

Need for Mentor Flexibility. Novice teachers entered the program with entirely different sets of goals, concerns, and mentoring needs. Teachers like Barb "hit the road running"; they experienced very few adjustment problems and expected mentoring to enhance their already strong practices. Others, like Tina, were in constant "survival mode" and depended on their mentors as friend, counselor, and touchstone. Both Tina and Barb taught elementary science without a text: Barb was eager to exercise her independence and hoped her principal would not intervene, while Tina found herself "flailing" and eagerly sought help from her principal and other sources. Nothing on

the two novice's ECS Program applications hinted at the extreme contrasts in their instructional concerns.

Tina and Barb's mentor felt that she could adjust her focus and adapt her approach depending on each novice's circumstances; even so, she did not recognize and respond to Barb's desire for resources and innovative teaching ideas. Other mentors were far less cognizant of their novices' needs. Perceptive mentors recognized and addressed their novices' areas of greatest concern; those mentors who didn't offered inappropriate help and missed important opportunities for their novices' professional growth. Recall Paula, who wanted help in planning a three-year curriculum but instead received unsolicited short-term activities, and Daryl, who was so overwhelmed with his impossible schedule that the calculators and experimental modules provided by his mentor remained in their box throughout the year. An early discussion between the novice and mentor teachers to prioritize needs and set mutual goals could help to maximize the benefits of mentor assistance.

Partnerships in Stasis. In cases where an original mentor was obviously uncommunicative, new assignments were made. But frequently when mentoring relationships suffered because of compatibility problems or misinterpretation of novice needs, the novices did not initiate a change of mentors. Instead, they found support from other sources: at least two core group novices and several survey respondents referenced another mentor with whom they corresponded regularly (sometimes more frequently than

with their assigned mentor). These "surrogate mentors" were encountered through Metnet, at meetings and conferences, or even in the novice's own building. Most of them were ECS Program mentors who were willing to work with the novices without being specifically assigned to them. Meanwhile, relationships with the assigned mentors languished.

Benefits of Group Dynamics. On surveys, a majority of novices indicated that the ability to interact with many mentors and other novices was a valuable complement to the one-to-one mentoring experience. They appreciated being able to question the group at large and draw upon the resources of dozens of experienced teachers. Novice teachers' enthusiasm and pride in their profession grew when they interacted with the community of mentors, as did their self-esteem when their ideas were valued by veteran teachers. Metnet conferencing and ECS Program workshops fostered a group dynamic that was difficult to duplicate within a two-person partnership, no matter how successful it might be.

Duration of the Relationship. The experiences of the core group indicated two academic years as an effective time period for a formally supported mentoring relationship. Five of the nine core group pairs were intact as a mentor-novice team at the end of the two-year study period. Of those, two had not communicated during the second year; the other three were receiving minimal benefits from occasional nonspecific contacts.

Survey responses also revealed that by the second or third year of a mentor relationship, most partners had either established a relationship that would continue without external support, or diminished the relationship to a point of ineffectiveness; a few had never gotten off the ground at all.

Mathematics and Science Teaching

Modeling Good Practice. Information was exchanged across a variety of media in the pursuit of improved mathematics and science teaching.

Materials were shared through the mail, suggestions and ideas were exchanged via Metnet, and lessons were modeled by visiting mentor teachers. In addition, mentors referred novices to human and written resources, and the annual Best Practices Workshops provided two days' worth of mathematics- and science-related activities, lessons, and teaching examples.

Among the various methods of supporting mathematics and science teaching, the modeling of instruction was highly regarded by novice teachers. Novices named at least four modes by which they were able to learn from experienced teachers in action: (a) mentor teachers visited novice classrooms to teach lessons, lead activities, and demonstrate nontraditional methods; (b) novice teachers observed mentors in their own classrooms; (c) novices attended presentations by mentors; and (d) mentor-novice teams gave joint presentations. Novices who had such experiences reported gains in confidence, expertise, and motivation. They valued the opportunity to

experience good mathematics and science teaching rather than merely to discuss it.

Knowledge vs. Implementation. Often, novice teachers possessed an adequate background in mathematics and/or science content and an awareness of classroom techniques such as group work, inquiry, and hands-on learning, but they did not know how to implement their knowledge. The teaching goals expressed on core group novices' program applications were compromised by their undeveloped management skills and tentative classroom techniques. Mentors needed not only to share ideas and provide supplementary materials, but to help novice teachers implement them.

Long-Term vs. Day-to-Day Needs. A surprising number of novices plunged into major curricular projects in mathematics or science during their first years of teaching. Renee implemented a pilot-level reform curriculum in her middle school mathematics classroom. Daryl made an effort to integrate science with his mathematics courses. Paula attempted to map out a three-year curriculum for her multi-grade classroom. Two novices taught science without texts, and a third was preparing to do the same the following year. Four core group mentors failed in specific ways to guide their novices through complex tasks, or perhaps did not recognize the need. They tended toward a "Band-Aid" approach to mentoring, ready to solve smaller and more immediate problems on a day-to-day basis but unresponsive to long-

term curricular needs. Closely matching the strengths of a mentor with the needs of a novice could help to ensure a rewarding partnership.

Limited Follow-Up by Mentors. Mentors in the core group made only cursory attempts to follow up on the help they provided, and no structured feedback loops existed to facilitate such follow-up. Only Renee and her mentor agreed that they regularly discussed her application of the materials and suggestions that her mentor shared. Four mentors communicated with their novices at a level that allowed them to monitor their novices' successes and failures with shared resources. The others had no idea whether their help was appropriate, much less effective (for example, Daryl's mentor couldn't confirm whether the materials he left after his visit were ever used). Much of the mathematics and science material mentors sent to their novices was uninvited. For example, Paula quietly shelved her mentor's unsolicited materials, while he failed to recognize that curriculum planning was far more important to her than increasing her library of activities.

Overall, mentors in the ECS Program demonstrated that, with tenacity, mathematics and science instruction by novice teachers could be successfully assessed, discussed, supplemented, and improved over distance. A significant few did not expend the energy and initiative necessary to uncover and remediate their novice's real needs. In defense of the mentors, novices were also culpable for not initiating useful discussions; at least three core group

novices divulged more concerns-based information to the researcher than they apparently had shared with their mentors.

Telecommunication as a Mentoring Tool

Ineffective Use Patterns. As of Spring 1998, telecommunication within the ECS Program had not met original expectations. Interview and survey data revealed that relatively few participants in the program had realized the full potential of telecommunication; a few had not even made first steps toward using the medium. Of the nine pairs in the intact 1996-97 core group, only four effectively used Metnet; two pairs anticipated solving their connection problems and getting on line; the remaining three pairs had all but given up on the medium as a practical mode of communication. By 1997-98, only two of the remaining five pairs were using Metnet to communicate.

"Gateway" Obstacles. Participants experienced technical difficulty in several areas: installing the Metnet software on their computer equipment; understanding how to manage the software; accessing a networked computer at convenient locations and times; and connecting to the Metnet modem server. Time conflicts and unreliable Metnet connections led four of the core group partners to give up use of the computer in favor of the telephone. Two core group pairs disliked the "idle chat" that filled the conference folders; they reduced their Metnet conferencing efforts to an occasional survey for important messages, or ceased scanning the folders altogether.

Minimal Conferencing. None of the three folders available to ECS Program participants developed into a true "conference" where issues of mathematics, science, teaching methods, or classroom management were consistently discussed. The "Early Career Chat" folder for novices received very low use, typically displaying a half-dozen perfunctory responses to the conference moderator's latest effort to stimulate discussion. The restricted "Early Career Mentors" folder served mainly as a bulletin board for announcements, congratulations, humorous stories, and occasional resource requests. Comments and queries often led to multiple responses, most vacuous, which took time to open, read, and delete. The public "Early Career" folder generally duplicated the mentor folder, with an occasional added inquiry by a novice teacher.

Two factors contributed to these deficiencies. First, the conference folder audiences were inappropriate. Mentors used their own folder more often than the public forum. Novice teachers were hesitant to share their concerns on the public folder; they also knew that mentors could read (although not respond to) their messages on the "Early Career Chat" folder. Second, except for limited moderation of the "Early Career Chat" folder and sporadic attempts to initiate discussion on the other folders, there was no organized structure for introducing conference topics or motivating participation in on-line discussions. The insubstantial nature of most

conference items, coupled with a lack of guidelines for on-line discussion, discouraged potential users.

High User Satisfaction. Those mentors and novices who mastered the use of Metnet expressed great satisfaction with the medium. They praised the opportunity to interact with other teachers in the ECS Program through electronic mail and conference folders. Even teachers who had suffered setbacks regarding Metnet use were still enthused about the system's potential and envisioned positive applications of telecommunication. An example of this contradictory attitude was the novice comment: "I have had a very difficult time getting on line. I believe Metnet will be very useful." The same results were found by McMahon, who noted that "In spite of their own personal ambivalence with the [on-line] experience, participants felt that network-based professional development had strong potential" (1997, p. 21). Teachers were not opposed to the use of technology, merely frustrated by technical setbacks and the difficulties of gaining access to the Metnet system.

Telecommunication Promotes Reflection. The time that Metnet allowed to fully express thoughts and contemplate responses was considered a benefit by novices and mentors. Novices liked the idea of communicating their thoughts to a "captive audience"; others felt that the act of writing was itself a form of therapy. Mentors were able to read and respond to their novices' concerns at times when they could give full attention to their

mentoring responsibilities. Teachers from both groups emphasized that writing out their thoughts in a concise manner encouraged them to reflect on what they wanted to convey.

Mentoring Benefits to Professional Growth

Self-Assurance in Teaching. Overall, novices indicated that their attitudes about teaching, particularly in terms of mathematics and science, had been favorably affected by involvement in the Early Career Support Program. Novice teachers stated that they received encouragement from their mentors, who helped them through difficult periods and gave them reasonable expectations for the first months of their careers. They recognized and embraced their mentors' own enthusiasm for teaching mathematics and science. Mentors validated their novices' teaching practices and choice of materials, and urged them to be creative in applying reform strategies. Finally, novices gained confidence through co-presenting at workshops with their mentors and through witnessing their mentors in action during classroom visits.

The Community of Practitioners. Novices indicated that one-to-one interactions with their mentor partners were a source of strength and encouragement; most also reported that interactions within the larger group, both on Metnet and at workshops, had strongly influenced their attitudes. The semi-annual ECS Program workshops and the conference folders on

Metnet allowed program participants to interact not only with their assigned partners, but also with dozens of other experienced and beginning teachers. Those who attended ECS Program workshops and participated in Metnet conferences overwhelmingly expressed a sense of belonging to a community of professionals who loved teaching mathematics and science, enjoyed their colleagues, and continually assessed and adapted their classroom experiences.

Effects on Mentors. Not only the novice teachers benefited from participation in the ECS Program. Mentor teachers attributed a renewed enthusiasm and energy for teaching mathematics and science to their interactions with novice and mentor colleagues. The Early Career Support Program was a model which not only helped to smooth and stabilize the early years of a new teacher, but challenged and recharged experienced teachers as well.

Recommendations for Practice

The distance-mediated mentoring program featured in this study was framed around reform in mathematics and science education. Improving the relationships formed between mentors and novices in the mathematics and science arenas is integral to improving instruction and to nurturing confident and effective new teachers in these areas. Recommendations related to the mentor-novice relationship, improved mathematics and science teaching,

and teacher beliefs and attitudes are therefore integrated under one heading. Recommendations regarding telecommunication are reported separately.

Generalizability of Recommendations

The following recommendations are provided to strengthen and adapt the Montana STEP Project's Early Career Support Program and other distance-mediated mentoring programs in ways that will permit and encourage mentor-novice partners to participate more fully. Although the ECS Program is unique in its overall design, it embodies many components which figure prominently in the development of other mentoring programs involving mathematics and science, rural teachers, individual and group mentoring strategies, and/or distance technology. Various components of this study can therefore be used to inform the design of mentoring programs which serve other geographic areas and populations. At minimum, these implications are applicable to any similar distance-mediated mentoring program servicing rural teachers of mathematics and science.

Recommendations: Mentoring Relationships

Facilitate Earlier Matches. *Improve the application process so novice teachers are placed with mentors in the summer or early fall and make immediate contact.* Too often, mentors relied on the fall Mentoring Skills Workshop as a jumping-off point for the mentoring process. This left little time for first semester activities, and if the conference had to be rescheduled

(as it was due to a blizzard in November 1996), holiday and end-of-semester events discouraged any hope of regular communication in the novice's first several months of teaching. By contrast, novices who were contacted early had the benefit of help in setting up their classrooms and launching the school year.

It is difficult to identify, contact, and recruit newly hired teachers prior to the beginning of the school year, as evidenced by the relatively low number of entry-level teachers applying for the ECS Program. For example, 23 of the fifty novice teachers accepted in 1997-98 enrolled as first-year teachers; the 1996-97 cohort of 50 novices included only 17 first-year teachers. With a majority of already-employed teachers entering the program each year, it would be feasible to solicit, evaluate, match, and inform a majority of novice applicants during their first year of employment, and begin the mentoring process the following year. It may even be that novice teachers will realize greater benefits from a mentoring program if they wait to apply until after they complete their first "survival" year of teaching with its inherent stresses and time constraints.

Match Content and Grade Level. *Carefully consider current teaching assignments when matching novices with mentors.* Given differences in personality and background, it may be impossible to know in advance whether a given mentor-novice team will be compatible; however, the data indicate that matching content and grade level promotes the best interaction.

In their 1992 study of optimum conditions for teacher mentoring, Wildman & Magliaro et al. found that "similar grade level and content area assignments enabled the teachers to share knowledge of curricula and instructional issues" (p. 210) and helped to "ensure that mentors will have the knowledge and tools to fulfill their role" (p. 210). Among the core group subjects, mentor-novice pairs who shared common curricular ground were also more comfortable and open in their communication.

Encourage Personal Encounters. *Plan for face-to-face encounters to occur at least once per year, and as early as possible; incorporate classroom visits.* Both mentors and novices indicated that they highly valued face-to-face contact; a few expressed a desire to have their partner located within a range that facilitated more frequent meetings. Mentors and novices should be encouraged to meet as frequently as possible, perhaps by placing stricter requirements on both groups to attend program workshops with their partners. If a novice and mentor cannot both attend, an alternative face-to-face interaction could be required. Early contact was found to be most effective; mentors could be required by contract to arrange meetings with their novice teachers within one month of being matched. The study also revealed that classroom visits were regarded by novice teachers as highly beneficial; such visits should be encouraged.

Strengthen Mentor Involvement. *Train mentors to (a) perceive novices' true needs, (b) help novices implement shared materials and ideas, and (c) follow up on action taken.* Mentors must be discerning listeners in order to comprehend their novices' needs; they must not simply provide resources, but help the novice implement those resources and regularly check their progress. Current research on mentoring has illuminated a need for ongoing mentor training. "Mentors are more likely to develop their practice as mentors if they also have opportunities to discuss questions and problems that arise in the course of their work with novices" (Feiman-Nemser, 1996, P-12). Discernment and implementation skills may be introduced during mentor training, but they must be nurtured and reinforced once mentors are in practice.

Remain Flexible Regarding Mismatches. *Identify mentor-novice mismatches early, and remedy them quickly.* Tina's difficulties with her original mentor were quickly identified and remedied by shifting her to a more comfortable and productive situation. In Paula's case, no overt problems existed in the relationship she developed with her mentor, yet it was unrewarding. Lawson (1992) noted that "Forced mentor-novice relationships amount to a kind of contrived collegiality" (p. 167) that can undermine trust and support. Designers of mentoring programs need to develop a means of encouraging, assessing, and responding to feedback from both mentors and novices. Simply saying "Let us know if you have a

problem" is too vague; without a formalized procedure, novice teachers may be timid and unwilling to invite conflict. A solution might include the implementation of scheduled feedback loops which require mentor partners to regularly assess and report the progress of their relationship and, less frequently, call for assessment of their participation and progress by program peers or supervisors.

Support the Community of Practitioners. *Support statewide or regional seminars and workshops as essential elements of a successful distance-mediated mentoring program.* Well over half of the mentor-novice partners surveyed had their first face-to-face meeting at an ECS Program event. The Mentoring Skills Workshop provided an opportunity to develop a solid foundation for the mentoring relationship; the Best Practices Workshop offered a venue for sharing ideas and demonstrating good teaching practices. All such gatherings helped to quickly build a sense of community and motivate teachers to actively participate throughout the academic year.

Consider "Second Year Syndrome." *Limit structured support of a mentoring relationship to two years and/or design a system of increasing expectations for mentor partners.* The term "second year syndrome" is used to reference length of time in a mentoring program, rather than years of classroom experience. Findings from the study demonstrated that by the

second year of most mentoring relationships, communication had (a) dropped off to an ineffective level, or (b) evolved to a level of collegial and/or friendly exchange with a minimal mentoring component. In either case, there was little justification for continued structured support of the relationship; those of type (a) were generally destined for dissolution, while those of type (b) were vested enough to be self-supporting.

Strategies can be devised to help remedy "second year syndrome."

Mentor partnerships are as unique as the teachers who form them; therefore, the useful life of a mentoring relationship may easily vary from one to three years. The results of this study confirm earlier research findings that initial novice teacher concerns focus on self-survival, teaching tasks, discipline, and classroom management issues; as time passes, they increasingly encompass instructional issues and impact on students (Kerrins, Cushing, Grant & Veitch, 1990; Olsen & Heyse, 1990). These progressive levels of concern can be exploited to design a hierarchy of mentoring goals and activities that will continue to engage and motivate novice teachers and their mentors. As an example, the following structure could be used to support a mentoring relationship over three years:

- Year One—focus on moral support, discipline and classroom management, scheduling, working within school culture, content-related teaching strategies.

- Year Two—focus on curriculum planning, expanding and extending content, innovative instructional skills and strategies.
- Year Three—focus on broader issues of mathematics and science teaching; novices assume a coaching role with new program initiates.

A confident first-year teacher might be immediately prepared to step into a collegial mentoring partnership based on curriculum and content planning. On the other hand, a struggling second-year teacher might be in need of “parenting” in areas of classroom management and moral support. The structure presented here is subject to modification depending on the needs and strengths of each mentor-novice pair.

It is helpful to develop a sequence of expectations assuming a lengthy relationship, but it may be equally valuable to design an evaluation rubric which includes periodic (perhaps quarterly) assessment of partnerships and a series of decision checkpoints. For example, a quarterly assessment (written or verbal) by program staff or a mentor colleague would prompt mentor-novice partners to periodically reflect on the nature of their relationship, resulting in: (a) redirection of efforts to meet unresolved needs; (b) setting of new goals as a step up the mentorship “ladder”; (c) a change in mentor partners; (d) removal of nonparticipatory teachers from the program; or (e) “honorable discharge” of a novice who has achieved professional autonomy.

Recommendations: Telecommunication

Encourage and Support Use. *Promote telecommunication as a component of any mentoring program for teachers who are not in the same building. The telecommunication system used in the ECS Program did not achieve its expected potential, and the electronic mail and conference folder functions were underused. However, for those mentor-novice pairs who mastered the software, overcame technical difficulties, and devoted time to regular on-line activity, Metnet became an irreplaceable asset. Asynchronous convenience, benefits to reflective thinking, and access to scores of experienced teachers made on-line communication a valuable mentoring tool.*

Provide Timely Training. *Offer training to inexperienced telecommunication users as early as possible; make it repeatedly available; and arrange for expert set-up and maintenance service. Teachers' difficulties with Metnet often stemmed from simple misunderstandings which were quickly resolved. Those with more serious deficiencies, such as lack of access to a networked computer or inability to install software, needed an expert to resolve their problems. Priority should be given to investigating and removing the obstacles to telecommunication use.*

Structure Conference Folders by Topic. *Structure the on-line conference folders to provide venues for multiple levels of interaction. In*

particular, minimize or redirect the number of trivial messages posted to the conference folders. The ECS Program conference folders were originally intended to promote three lines of communication:

- mentors were expected to use the "Early Career Mentors" folder for discussion of issues related to the guidance of their novice teachers and the mentor training they received;
- novice teachers were expected to share experiences (with mentors able to "listen" but not respond) in the "Early Career Chat" folder; and
- all participants were expected to engage in ongoing discussion of mathematics, science and teaching issues in the "Early Career" folder.

Although valuable curriculum- and classroom-related exchange took place via on-line conferencing, no conference folder was used to its full potential during the two-year study period.

Rather than attempting to dictate appropriate and inappropriate use of the current conferencing structure, an alternative scheme should be developed. Metnet usage patterns and conference postings observed during the study period suggest that a hierarchy of folders based on content rather than audience would be more effective. For example, designating a folder solely for social exchange would reduce the need for participants to repeatedly open and discard trivial messages in order to locate content-related discussion items. A configuration of four conference folders might include:

- *The Kiosk*—a “coffee shop” venue for general announcements, special instructions, program schedules and assignments, and exchanges of participant news, humor, congratulation, and kudos;
- *The Trauma Center*—a venue for “first aid” in areas of need (e.g. classroom, school, administrative, and community issues) and for voicing teaching-related frustrations;
- *The Library*—a venue for seeking and sharing activities, lessons, topical materials, teaching strategies and other instructional aids related to mathematics and science education; and
- *The Ivory Tower*—a venue for moderated conversations about theory, beliefs, and practices related to mathematics and science content and education.

Motivate Meaningful Discussion. *Design on-line activities to increase the participatory responsibilities of both novices and mentors.* At least three core group teachers suggested that program leaders create on-line “assignments” for individual mentor-novice pairs. For example, partners could be required to explore a classroom exercise or activity together on a monthly basis (or more frequently). The mentor would share an idea with his or her novice; the novice would try the activity in the classroom, then report the results to the mentor, initiating a discussion of the purpose, success, and potential adaptations of the activity. In the particular case of the

ECS Program, the novice teachers' survival kits would provide an excellent source for such ideas and would encourage them to try out the materials.

On a larger scale, mentors (and perhaps novices) could volunteer to moderate a conference discussion on a topic of their choice. Topics (and moderators) would change on a monthly or weekly basis; moderators would be assigned in advance and encouraged to relate their discussion to previous topics. The moderator's role would be to introduce a mathematics-, science-, or education-related topic and to motivate discussion; the moderator could also recruit mentor and novice colleagues to produce questions related to the topic in a "round robin" fashion, ensuring that the conversation continued.

Summary of Recommendations

1. Improve the application process so novice teachers are placed with mentors in the summer or early fall and make immediate contact.
2. Carefully consider current teaching assignments when matching novices with mentors.
3. Plan for face-to-face encounters to occur at least once per year, and as early as possible; incorporate classroom visits.
4. Train mentors to (a) perceive novices' true needs, (b) help novices implement shared materials and ideas, and (c) follow up on action taken.
5. Identify mentor-novice mismatches early, and remedy them quickly.
6. Support statewide or regional seminars and workshops as essential elements of a successful distance-mediated mentoring program.

7. Limit structured support of a mentoring relationship to two years and/or design a system of increasing expectations for mentor partners.
8. Promote telecommunication as a component of any mentoring program for teachers who are not in the same building.
9. Offer training to inexperienced telecommunication users as early as possible; make it repeatedly available; and arrange for expert set-up and maintenance service.
10. Structure the on-line conference folders to provide venues for multiple levels of interaction. In particular, minimize or redirect the number of trivial messages posted to the conference folders.
11. Design on-line activities to increase the participatory responsibilities of both novices and mentors.

Mid-Study Technology Improvements

In the time that elapsed between the beginning and ending of the research period, the Early Career Support Program already demonstrated improvement in several areas; Metnet access is the primary example. Two major categories of complaint about Metnet had to do with initiating and then maintaining an on-line connection via telephone modem. This problem at least partially resolved itself in 1997-98, as Metnet became accessible via the Internet and more and more schools obtained direct Internet connections. As the complications thwarting on-line access continue to decrease, it will become easier to focus on those teachers who still must

struggle with the original modem-based system. Another area of technological advancement is the proliferation of interactive World Wide Web applications. Another state or region could feasibly replace Montana's Metnet system with a well-managed Web site.

Recommendations for Research

The following sections suggest areas of related research which were illuminated by this study. Telecommunication, mentoring, rural mathematics and science teaching, and combinations of these three topics remain rich subjects for future investigation.

Focus on Telecommunication

The telecommunication component of the Early Career Support Program provides a springboard for a more focused study of content-related on-line mentoring. Research should be aimed at determining how mathematics and science content, curriculum, and issues are shared and discussed between mentor partners via telecommunication, and how telecommunication can be used to optimize such exchanges. Subjects should be selected based on their consistent use of electronic mail and conference folders to assure a rich data source and to avoid repetitive investigation of the roadblocks to successful on-line communication.

Investigate the Surrogate Mentor

The introduction of substitute or "surrogate" mentors is another avenue of research potential. Within the core group of nine novices, at least three (all female) developed a bond with teachers in the ECS Program who were not their assigned mentors. In all three cases, the competing relationship developed at a meeting or workshop which invited prolonged face-to-face interaction with the surrogate. Questions to be answered could include: What factors compel novices in a structured mentoring program to cultivate a surrogate mentor? What characteristics (gender, for example) or circumstances are shared by novice teachers who gravitate toward a surrogate? How does surrogate mentorship affect the relationship with an assigned mentor? Further study could also shed light on the role played by trained mentors who work with assigned novices from a distance as opposed to the available support people in a novice teacher's immediate domain.

Compare Mentor Training to Mentor Practice

ECS Program mentors participated in a series of training sessions which repeatedly emphasized the importance of leading novice teachers to become reflective practitioners and helping them establish increasing degrees of personal autonomy. Yet the study revealed that mentoring relationships were most often characterized by the mentor providing materials, demonstrating methods, and offering advice. This study did not exhaustively explore the training of mentors; it would be worthwhile in the future to

examine the degree to which the philosophy set forth in mentor training is applied in actual mentor-novice relationships. It would also be valuable to examine, through a comparative study, how formal mentor training influences the mentoring relationship. If the element of one-to-one assignment with an experienced mathematics and/or science teacher is unchanged, how do novices' experiences differ when the experienced teacher does or does not receive formal mentor training? Finally, are mentoring skills innate or teachable? Can a mentor be "trained" to be more perceptive and aware of novice needs?

Include Performance Assessment and External Reporting

The data collected in this study were largely self-reported and focused on novice and mentor teachers' personal assessment of their relationships, their professional growth, and the benefits of mentoring. A case study model involving intensive observation of, and interaction with, a limited set of mentor partners could clarify and extend the findings from this study. Future studies of similar mentoring programs should include a method of external data collection; for instance, school administrators could be asked to evaluate novice teacher performance in terms of the goals of the mentoring program. It is also important to collect comparative information on rural novice teachers who receive structured mentoring and those who begin their careers without mentoring.

Consider the Time Factor

First-year teachers often reported feeling overwhelmed with the practical aspects of working with their new students, classrooms, schools, and communities. Their new responsibilities, including those outside of teaching, left them with little time or energy to invest in a mentoring relationship. It would be worthwhile to compare novices who are initially mentored in their first year of teaching with those who receive mentoring in their second year, to determine which experience greater benefits. Another time-conscious investigation could compare mentor partnerships where time is specifically set aside for the mentoring process to partnerships that are expected to work around teachers' normal schedules. Mentoring "release time" might range from an hour per week set aside for communication, to a release day scheduled every semester for observation and collaboration in a mentor partner's classroom. How does dedicated time for mentoring affect the relationship, and which model is most effective?

Examine What Novices Bring to the Setting

Among the nine novice teachers in the core group, three began their teaching careers as adults, having already raised children or worked in other fields. How does prior life experience serve new teachers in their classrooms, schools, and communities? How do their early teaching experiences differ from those of recent high school and college graduates? What other factors affect a novice teacher's confidence, comfort level, and success? Future

research could be designed to categorize novice teachers in terms of their needs, priorities, and personal styles. If the same data is gathered for mentors, it would then be useful to examine whether a deliberate category match in these three areas produces a more effective mentor-novice partnership than matching based solely on grade level and content area.

Study Effects of Setting and Attitude on Novice Success

The researcher entered the field with the notion that new teachers in isolated rural schools were most likely there by default and would prefer positions in larger, better-paying districts. However, interviews revealed that more than half of the core group novices were in their rural positions by choice. What factors motivate rural teachers to seek positions in small schools? What differences in attitude or practice exist between teachers who are in struggling rural districts by choice and those who are there by necessity? Finally, what are the differing needs of rural vs. urban novice teachers, or novices in small schools vs. those in large schools?

Concluding Statement

The study investigated the effectiveness of a distance-mediated mentoring program for novice mathematics and science teachers, particularly those in isolated rural areas. Data from interviews, observation, surveys, and documentation allowed an appraisal of the relationships developed among novice and mentor teachers, the support provided by various program

components, and the impact of those relationships on mathematics and science teaching.

The findings demonstrated that an organized and sustainable program for mentoring widely dispersed teachers in a rural setting calls for the following components: development of a cadre of trained mentors; opportunities for mentoring by individual assigned mentors as well as a larger community of mentor teachers; and multiple modes of communication to support those opportunities, including traditional modes as well as a well-managed telecommunication platform.

The Early Career Support Program model developed by the Montana STEP Project demonstrated the potential of distance-mediated mentoring programs; however, a few key components of the ECS Program were not well developed. In particular, the telecommunication system was underused at both the individual and community level. In addition, despite their training a significant number of mentors were not sufficiently perceptive or proactive regarding their novice partners' needs and concerns.

A framework for an effective mentoring program was presented at the beginning of this chapter; to some extent, each component of that framework existed in the Early Career Support Program. Based on the implications of the study findings, eleven recommendations for the improvement of certain components and, ultimately, the overall effectiveness of a distance-mediated mentoring program have been offered. Many of the framework components

are transferable to programs in more highly populated regions or involving other disciplines.

The study indicated that a distance-mediated mentoring program which effectively enhances mathematics and science teaching requires ongoing support at several levels. First, mentors require initial training and continued support as they conduct their relationships with novice teachers, including skills to help them perceptively assess and address their novice teachers' needs and concerns. Second, a complete mentoring experience requires individual interaction as well as access to a community of experts who can provide ideas, resources and answers supplementing those of the assigned mentor. Finally, more than one mode of support is necessary to service the needs of novice teachers in rural settings. On-line discourse, verbal exchange, and sharing of materials can and should be incorporated into a distance-mediated mentoring program. Face-to-face encounters and opportunities to observe good mathematics and science instructional models, both highly valued by novice teachers, should also be encouraged.

The unique circumstances, wide-ranging responsibilities, and broad teaching assignments of rural mathematics and science teachers require a complex mentoring framework. Fortunately, the time and resources required to design, initiate, and maintain such a network are justly compensated by the multiple benefits experienced by teachers on both sides of the relationship. Those benefits are best expressed by the novice and mentor teachers

themselves. When asked about her own professional rewards, one mentor teacher spoke from the heart: "I am not the same teacher I was five years ago—before my involvement with STEP. It has been the greatest stimulant for growth I've had in 23 years of teaching." Finally, no statement could summarize the value of effective mentoring for novice teachers more eloquently than Catie's own words:

Having a mentor helps me—

- to confirm what I'm doing in the classroom . . .
- to question how my class is progressing . . .
- to share what I'm doing to spark ideas . . .
- to seek information from others . . .
- to seek development opportunities . . .
- to know and believe that I have something to share with others.

REFERENCES CITED

- Bogdan, R. C. & Biklen, S.K. (1992). *Qualitative research for education*. Boston, MA: Allyn and Bacon.
- Bower, A. & Yarger, G. (1989). Mentor-intern relationships in New York State's formal program: Beginnings. Action in Teacher Education, 11 (2), 60-65.
- Cadigan, J. (1993). Report from Alaska. Journal of Research in Rural Education, 9 (1), 32-34.
- Carlsen, W. S. & Monk, D. H. (1992, April). Rural/nonrural differences among secondary science teachers: Evidence from the Longitudinal Study of American Youth. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA. (ERIC Document Reproduction Service No. ED 350 133)
- Christensen, J. E. & Conway, D. F. (1990-91, Winter). The use of self-selected mentors by beginning and new-to-district teachers. Action in Teacher Education, 12 (4), 21-28.
- Clarcken, R. H. (1993, April). Computer mediated support for student teaching and first year teaching. Paper presented at the annual meeting of the American Educational Research Association, Atlanta, GA.
- Colton, A. B. & Sparks-Langer, G. M. (1993). A conceptual framework to guide the development of teacher reflection and decision making. Journal of Teacher Education, 44 (1), 21-29.
- Connecticut State Department of Education Bureau of Research and Teacher Assessment. (1997). A guide to the BEST Program for beginning teachers and mentors. Hartford, CN: Author.
- Davis, J. (1987). Rurality and isolation in education. The Rural Educator, 9 (1), 11-14.
- Enochs, L. G. (1988, July). Toward improving rural schools with implications for the teaching of science. Paper presented at the Conference on Improving Rural Science, Mathematics, and Technology Education, New York, NY.
- Feiman-Nemser, S. (1996). Teacher mentoring: A critical review (Report No. EDO-SP-95-2). Washington, DC: ERIC Clearinghouse on Teaching and Teacher Education. (ERIC Document Reproduction Service No. ED 397 060)

- Gal, S. (1993, Spring). Teachers and teaching. Journal of Research in Rural Education, 9 (1), 38-42.
- Gibson, I. W. (1994). Policy, practice, and need in the professional preparation of teachers for rural teaching. Journal of Research in Rural Education, 10 (1), 68-77.
- Goetz, J.P. & LeCompte, M.D. (1984). *Ethnography and qualitative design in educational research*. Orlando, FL: Academic Press.
- Hersh, S. B., Snyder, M., & Stroot, S. (1993, April). Mentoring entry-year teachers in rural communities: A model program. Paper presented at the annual meeting of the American Educational Research Association, Atlanta, GA. (ERIC Document Reproduction Service No. ED 362 352)
- Hofmann, J.M. & Feldlaufer, H. (1992). Involving veteran teachers in a state induction program. The Clearing House, 66 (2), 101-103.
- Huling-Austin, L. (1992). Research on learning to teach: Implications for teacher induction and mentoring programs. Journal of Teacher Education, 43 (3), 173-180.
- Kellogg, D. (1996, March). Getting rural teachers on-line with SLIP. Paper presented at the University of Texas at Austin International Conference on Technology and Education, New Orleans, LA. (ERIC Document Reproduction Service No. ED 396 870)
- Kerrins, J. A., Cushing, K. S., Grant, B. A., & Veitch, W. (1990, November). A seminar experience: Effects of teacher talk on professional development. Paper presented at the annual conference of the National Council of States on Inservice Education, Orlando, FL.
- Lawson, H. A. (1992). Beyond the new conception of teacher induction. Journal of Teacher Education, 43 (3), 163-172.
- Lemke, J. C. (1994). Teacher induction in rural and small school districts. In D. Montgomery (Ed.), Rural partnerships: Working together. Proceedings of the annual National Conference of the American Council on Rural Special Education, Austin, TX.
- McMahon, T. A. (1997, March). From isolation to interaction? Network-based professional development and teacher professional communication. Paper presented at the annual meeting of the American Educational

Research Association, Chicago, IL. (ERIC Document Reproduction Service No. ED 408 257)

McMillan, J. H. & Schumacher, S. (1989). Research in education: A conceptual introduction (2nd ed.). Glenview, IL: Scott, Foresman and Co.

Merseth, K. K. (1991). Supporting beginning teachers with computer networks. Journal of Teacher Education, 42 (2), 140-147.

Merseth, K. K. (1992, May). First aid for first-year teachers. Phi Delta Kappan, 678-683.

Miller, B. & Hull, J. L. (1991). Overcoming professional isolation in small, rural school (DOE Contract No. RP91002001). Portland, OR: Northwest Regional Educational Laboratory.

Montana STEP Project (1996). Montana STEP Project: Year Three Annual Report. Bozeman, MT: Montana State University, Office of the Provost.

Murphy, D. S., Merseth, K. K. & Morey, A. I. (1990). Content and strategies for assisting new teachers. In A. I. Morey & D. S. Murphy (Eds.), Designing programs for new teachers: The California experience (pp. 26-39). San Francisco, CA: Far West Laboratory for Educational Research and Development and Eugene, OR: ERIC Clearinghouse on Educational Management.

Muscella, D. & DiMauro, V. (1995). Talking about science: The case of an electronic conversation. Cambridge, MA: TERC. (ERIC Document Reproduction Service No. ED 395 765)

National Council of Teacher of Mathematics. (1991). Professional Standards for Teaching Mathematics. Reston, VA: Author.

Odell, S.J. (1990). Mentor teacher programs: What research says to the teacher. (ERIC Document Reproduction Service No. ED 323 185)

Odell, S.J. & Ferraro, D. P. (1992). Teacher mentoring and teacher retention. Journal of Teacher Education, 43 (3), 200-204.

Ogden, W. R., Chao, Z., Horn, J. G. (1994-95). The needs of science teachers of northeast Texas: Rural vs. nonrural. Rural Educator, 16 (2), 21-27.

Olsen, D. G. & Heyse, K. L. (1990, April). Development and concerns of first-year and reentry teachers with and without mentors. Paper presented at

the annual meeting of the American Educational Research Association, Boston, MA.

Patton, M.Q. (1990). *Qualitative evaluation and research methods*. Newbury Park, CA: Sage Publications, Inc.

Reed, D. F. & Seyfarth, J. T. (1984). Assessing teacher needs in rural schools. The Rural Educator, 6 (1), 12-17.

Rogan, J. M. (1997). Online mentoring: Reflections and suggestions. Journal of Computing in Teacher Education (13) (3), 5-13.

Ruopp, R. (1993). A Concluding Reflection. Journal of Research in Rural Education, 9 (1), 51-55.

Ruopp, R., Pfister, M., Drayton, B., & Gal, S. (1993). Supporting teachers with telecommunication: The LabNetwork. Journal of Research in Rural Education, 9 (1), 2-19.

Schatzman, S. (1995). Science and mathematics initiatives in education: A model distance learning program building telecommunications bridges to rural schools. Washington, DC: ERIC Clearinghouse on Rural Education and Small Schools. (ERIC Document Reproduction Service No. ED 395-722)

Shroyer, G. & Enochs, L. (1987). Strategies for assessing the unique strengths, needs, and visions of rural science teachers. Research in Rural Education, 4 (1), 39-43.

Shulman, J. (1989). Blue freeways: Traveling the alternate route with big-city teacher trainees. Journal of Teacher Education, 40 (5), 2-8.

Spitzer, W. (1993). Environmental Barriers to Networking. Journal of Research in Rural Education, 9 (1), 47-50.

Stern, J. (1994). The Condition of Education in Rural Schools. U.S. Dept. of Education/Office of Educational Research and Improvement. Washington, DC: GPO.

Stone, D. (1990). Recruiting and retaining teachers in rural schools (Knowledge Brief No. 4). San Francisco, CA: Far West Laboratory for Educational Research and Development.

- Sunal, D. W. (1991). Rural school science teaching: What affects achievement. School Science and Mathematics, 91 (5), 1991.
- Tellez, K. (1992). Mentors by choice, not design: Help-seeking by beginning teachers. Journal of Teacher Education, 43 (3), 214-221.
- Tennessee Education Association and Appalachia Educational Laboratory (1988). Bridges to strength: Establishing a mentoring program for beginning teachers, an administrator's guide. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement.
- Thompson, A. D. & Hamilton, J. (1991). Patterns of use of an electronic communication network for student teachers and first year teachers. (ERIC Document Reproduction Service No. ED 334 180)
- Thoresen, C. (1997). Early Career Support Program: Telecommunication mentoring for rural teachers. Journal of Science Teacher Education, 8 (4), 283-293.
- Veenman, S. (1984). Perceived problems of beginning teachers. Review of Educational Research, 54 (2), 143-178.
- Westerman, D. A. (1991). Expert and novice teacher decision making. Journal of Teacher Education, 42 (4), 292-305.
- Wildman, T. M., Magliaro, S. G., Niles, J. A., & Niles, R. A. (1992). Teacher mentoring: An analysis of roles, activities, and conditions. Journal of Teacher Education, 43 (3), 205-213.
- Wildman, T., Niles, J., Magliaro, S., McLaughlin, R., & Drill, L. (1987, April). Virginia's Colleague Teacher Project: Focus on beginning teachers' adaptation to teaching. Paper presented at the meeting of the American Educational Research Association, Washington, DC.
- Wilkinson, G. A. (1994, Summer). Support for individualizing teacher induction. Action in Teacher Education, 16 (2), 52-61.
- Zetler, A. & Spuhler, L. (1997). The single best thing: Mentoring beginning teachers. Helena, MT: Certification Standards and Practices Advisory Council and Montana Board of Public Education.

APPENDICES

APPENDIX A
DESIGN AND ANALYSIS DOCUMENTS

RESEARCH TIME LINE

<u>Date</u>	<u>Procedure</u>
Sept. 1996	Contact and <u>select core group mentors</u> for study Review novice teacher <u>applications</u> Meet with co-chairs to <u>match partners</u>
Oct. 1996	Contact and <u>select core group novices</u> for study Mentor/novice partnerships announced
Nov. 1996	ECS Program "Mentoring Skills" <u>conference</u> (canceled) <u>Establish protocol</u> for informal contact with core group
Jan. 1997	Rescheduled ECS Program <u>conference</u> <u>First interview</u> ; focus on relationship Begin monitoring <u>Metnet</u> communication
March '97	<u>Site visits</u> to each core group novice and mentor <u>Second interview</u> ; focus on teaching support
April '97	ECS Program "Best Practices" <u>conference</u> <u>Survey</u> of 89 novices and mentors. (65%)
Summer '97	<u>First findings</u> ; ongoing data analysis <u>Continued interaction</u> with core group subjects (electronic, telephone, and informal contact)
Fall '97	<u>Hiatus</u> while third cohort of mentors trained, third tier of novices initiated ECS Program "Mentoring Skills" <u>conference</u>
Spring '97	<u>Survey</u> of 83 novices and mentors (40%) <u>Follow-up interviews</u> with core group (attrition=4) Extended analysis of <u>Metnet use</u>

RESEARCH QUESTIONS/DATA COLLECTION METHODS

PURPOSE: *Characterize and document the nature and development of the relationships established between mentors and beginning rural teachers in a distance-mediated mentoring program.*

QUESTIONS

1. What were the nature and frequency of the exchanges and discourse that were part of the mentoring relationship?
2. In what ways did the mentoring relationship change over the course of the academic year?
3. How did the mentors attempt to meet the needs and alleviate the concerns of the beginning teachers during the academic year?

DATA COLLECTION

- a. Interviews #2,3
- b. Informal data collection
- c. Monitored Metnet exchanges
- a. Interviews #1,2
- b. Monitored Metnet exchanges
- a. Interviews #2,3
- b. Surveys
- c. Monitored Metnet exchanges

PURPOSE: *Describe how discourse between mentors and beginning rural teachers in a distance-mediated mentoring program influenced the beginning teachers' perceptions about mathematics and science teaching.*

QUESTIONS

4. In what ways did the mentors and beginning teachers exchange ideas and materials related to mathematics and science teaching?
5. How were shared ideas and materials related to mathematics and science teaching incorporated by the beginning teachers?
6. Did the mentor teachers follow up on science and mathematics teaching ideas and materials which they shared with beginning teachers?

DATA COLLECTION

- a. Interviews #2,3
- b. Surveys
- c. Monitored Metnet exchanges
- a. Interviews #2,3
- b. Surveys
- c. Field observation
- a. Interviews #2,3
- b. Monitored Metnet exchanges

RESEARCH QUESTIONS/DATA COLLECTION METHODS (continued)

PURPOSE: *Determine whether telecommunication effectively supported a distance-mediated mentoring relationship for beginning rural teachers.*

QUESTIONS

7. How was telecommunication used to maintain and strengthen the mentoring relationship?

8. How often did the mentors and beginning teachers exchange electronic mail? Access bulletin boards? Obtain on-line materials?

9. What changes occurred in the attitudes of both beginning teachers and mentors toward telecommunication during the academic year?

10. Were the beginning teachers satisfied with telecommunication-based mentoring? (Did they feel 'mentored'?)

DATA COLLECTION

a. Interviews #2,3
b. Surveys
c. Monitored Metnet exchanges

a. Interviews #2,3
b. Surveys
c. Monitored Metnet exchanges

a. Interviews #1,2,3
b. Surveys

a. Interviews #2,3
b. Surveys

PURPOSE: *Investigate the overall effects of the distance-mediated mentoring relationship on beginning rural teachers' attitudes and concerns about teaching, as well as their professional growth and development.*

QUESTIONS

11. What were the initial concerns of beginning teachers, and how did they change as the year progressed?

12. In what ways did the beginning teachers evidence professional growth attributable to mentoring during the academic year?

DATA COLLECTION

a. Interviews #2,3
b. Surveys
c. Monitored Metnet exchanges

a. Interviews #2,3
b. Surveys
c. Field observations

HyperResearch™ Coding Sample for Pamela (can also be sorted by topic)

Pamela, Attitude telecomm EC,

I went--well, that really was my motivation when I went to [town name] or [town name], wherever I went up on the high line, and [name] somebody was just really neat about it. He made us all play with it, you know use it, and signed us all up--and so then I really was anxious to use it after that--before I kept thinking brother, okay, what is this

Pamela, Community EC,

[Town name] is a rural community, basically farming, ranching--most of my children are--most of my students, their parents are involved--I'd say half of my students, their parents are involved in farming and ranching. The other half are involved in businesses that support the farm

Pamela, Community EC,

So we are very dependent on ourselves as a community and a school. I think the school is the--the core of the entire community--everything revolves around the school. At this stage of the game the community is super supportive--you know, all the levies are passing, that sort of thing. We've been real lucky there, because we do--are--definitely declining enrollment

Pamela, Content concerns EC,

No, I'm not as confident as I would like to be. I try to grab every workshop and--and opportunity that comes up, because I felt like when I went back, that my math background was not what I want it to be. I love teaching math, and I feel confident while I'm doing it, but when I look back on it I think "Oh gee, did I do it--you know, the way I really should've--did I do everything I could have?" So--probably math is the one subject that I would say that I--I'd like more confidence in

Pamela, Content concerns EC,

I love science and--and I--my teaching is--is definitely literature based

Pamela, Content concerns EC,

Subject matter doesn't bother me so much as, as I would love more suggestions on ways to teach it. I would love to figure out how to--combine all of my different units--like I said, I'm literature--I try to be literature-based. I would like to be able to divide them into four units that I teach per year, and I could--and I'd like suggestions on that, I'm not quite sure how to go about that, and I think [mentor] would probably be able to offer suggestions on that for me

Pamela, Content strengths M,

And [mentor] is teaching science to all of [town name]'s elementary. *Oh, really?* Yes, that's a new pro--a project this year for her school. And I find that really, really exciting 'cause she just had--I mean, the id--the things were just rolling off of her, and I'm just soaking it in, and thinking "Oh, give me more, give me more." So I--I'd love to go--I'd love to watch her in action

Pamela, Current Metnet use EC,

I've had problems like I've told you before, getting onto the computer, so we haven't been able to communicate that way--in fact, I got my first message from her just a couple minutes ago. Not that she hasn't been sending them, I just have not been receiving them

HyperResearch™ Coding Sample for Pamela (continued)

Pamela, Current Metnet use EC,

Well, most of it's been on the phone, and—but I am up and going on Metnet, and so for the last two weeks I have composed several letters to her in my head

Pamela, Current Metnet use EC,

I—I get into Metnet every single day. I read everything in the STEP thing daily—unless I have troubles getting on [with] it. I'm going to work on—going on into the Net, and see if I have better luck, just 'cause I have waited long periods of time—I usually do it at five and 5:30 in the morning, to get on—(my best luck

Pamela, Current Metnet use EC,

Have you ever thrown out a question for the group, or—? Not yet, I'm not quite gutsy enough for that yet. *And do you write [mentor]?* I haven't yet. She wrote me once, and we were having problems with it—she can't write unless she's fixed—she cannot write a letter without it going to the whole group

Pamela, Current Metnet use EC,

And I just—I feel so important, like I've never been (?)—I feel so important that even in a staff meeting I have said a couple things, like "Are you aware that this is going on," or—(garbled) I know. Like I really know what I'm doing because I'm out there reading it, but—I will, I'll communicate

Pamela, Effects on attitude EC,

I'm probably more enthusiastic, especially about the science part. Of course I love science anyway, but yes

Pamela, Effects on attitude EC,

Think probably math was the one that I was the most uncomfortable about. And I can't even tell you why—I knew when I started last year, that we started with this new math series, and there's a lot of controversy about it in this particular school system, you know—some of them want to go back to the old—and that's frustrating

Pamela, Effects on attitude EC,

You know, the whole math thing was just—I felt kind of intimidated by it. But I am more comfortable about it, and I did get some things at the workshop that I brought home and have tried, and will keep trying

Pamela, Feelings about mentor EC,

Oh, she's just been super. She really has—she called—I mean, as soon as—as I was assigned, I wasn't even a day and she had called me. And she's been—been really good about calling me

Pamela, Feelings about mentor EC,

Because she was super about calling me immediately. I no more had a letter, and within two or three days she had called me. She was just great, and—and just so much—so friendly, and—and made me feel so relaxed. That gave me—I immediately at that time decided I had nothing to feel inferior about or worry about, she was just really—really neat

HyperResearch™ Coding Sample for Pamela (continued)

Pamela, Feelings about mentor EC,

She was—she just made me feel so comfortable. She talked about what—she could offer me for support, and that I should be really comfortable giving her a call any time—gave me all kinds of information on how to get hold of her, and told me quite a bit about the STEP program, which really was the first time that I completely understood what to expect. She told me, you know, that they would have these—more than likely the fall workshop, and—and right away just asked "You know, we can carpool, we'll do whatever is easiest for you"

Pamela, First face to face EC,

How many of us? Nine of us rode—no, eight of us rode together, and so that—and that was so much fun, that was a (garbled) too. (*Garbled*) a good part of it— It was great—got to visit, and—yeah. I—it was fun meeting her. [Mentor]'s one of those people who just makes you immediately feel comfortable, and *Yeah, she is neat--* she's real gifted that way

Pamela, Frequency of contact EC,

Oh, she's just been super. She really has—she called—I mean, as soon as—as I was assigned, I wasn't even a day and she had called me. And she's been—been really good about calling me

Pamela, Frequency of contact EC,

Phone. She called me probably—I'll bet she called me three times in the first three weeks of school, she was really good about it

Pamela, Got into teaching EC,

Well then, by the time my youngest was a senior in high school I—I had by that stage of the game been very involved in the school—you know, president of the PTA, all that kind of—my husband was chairman of the school board for twelve years

Pamela, Got this position EC,

I was fortunate that I had wonderful subbing jobs, like for instance I had fifth grade for six weeks. And then I got to student teach in third grade, and then the year before I got my job, I did just a ton of subbing in fifth grade—and then my fifth grade came up and boy, it was the dream job

Pamela, Local support EC,

Well, I'm very fortunate—I have a wonderful class of kids. No—no broad learning—in other words, they're all—almost all on the same learning level, I don't have, you know, any real lows, I don't have any real highs. I teach in a—a super supportive situation, where the principal is just—well, the entire administration is fantastic—so you always feel like you have that support. In my second year, and I just—I feel real fortunate that I'm in that situation. Plus the other teachers in my building are real—real supportive, and they're good mentors too—I'm lucky

Pamela, Local support EC,

She is—behind me 100%—may offer suggestions, recommendations, but I haven't been turned down on anything I want to do, and I've—done some really unusual things, you know, so—I'm—and visiting with other teachers too, I'm just so thankful I'm where I am. It's a great place to be

Pamela, Local support EC,

I have a lot of support from her, but we are both so opposite as far as teaching that we don't do a lot of things together, and right now she is on leave because she's had surgery

APPENDIX B
FORMS AND PROTOCOLS

DATE: _____

TO: _____

FROM: Jennie Luebeck

MEMORANDUM OF UNDERSTANDING AND PERMISSION STATEMENT

I have been selected to participate in a research study based on my membership in the STEP Project Early Career Support Program. This research is in support of a doctoral dissertation currently titled "Mentoring Through Telecommunication: An Early Career Program for Rural Mathematics and Science Teachers." The purpose of the study is to investigate the processes and outcomes of participation in the Early Career Support Program for beginning rural teachers.

As a participant, I agree to:

- Allow visits to my classroom on one or more occasions during the study
- Be interviewed on one or more occasions during the study
- Grant access to past and ongoing records of my Metnet and other exchanges with my mentor partner (with the right to deny access on sensitive items)
- Respond to occasional questions via Metnet, mail, journal, or telephone

I have been informed that:

- Any information exchanged will be kept confidential
- No identifiable reference to me, my students, or my school will be made
- General findings may be shared with the STEP 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

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

Participant: _____

Date: _____

School: _____

NAME: _____ DATE: _____ TIME: ____/____

OPENING REMARKS TO THE PARTICIPANT:

- I will be taking notes during the interview
- I don't want to miss, misinterpret, or misquote anything that's said
- with permission, the interview will be tape recorded as well
- recorder can be turned off at any time (demonstrate off button)
- everything said is confidential--no personal identification of you, your students, or your school will be made
- none of your comments will be shared with administrators, colleagues, or your mentor partner
- this is not a STEP evaluation or a check-up on participants, although the general findings may be shared with the STEP administration and used in future publications
- transcripts of each interview will be made available if you request them
- additions, deletions, corrections, clarifications are encouraged
- please be as candid as possible--take time to reflect before answering
- if any questions are not clear, stop and ask me to repeat, rephrase, or elaborate

INTRODUCTORY INTERVIEW: NOVICES

Clarify questions about selection process or purpose of the study--verify basic application information.

1. I understand that you teach (*list grade(s), subject(s), school*). Would you share some specifics about your classes and your students?

- number and size of classes, subjects, description of students
- classroom and school setting
- special/unique duties, situations or problems

2. I'd like to better understand the setting where you teach. What's the community like? What are the local resources for you as a teacher?

- population, degree of isolation--available resources and facilities

3. What circumstances led you into teaching at this location?

4. What kinds of support do you get from other teachers, your administrators, parents? How comfortable are you about interacting with these groups?
5. My research results will be more meaningful if I gather data from many sources. Would you be willing to:
 - let me visit your classroom one or two days this semester
 - let me interview you twice more
 - cc me on your Metnet exchanges with your mentor
 - answer occasional questions via Metnet (or journal, mail)
6. What are convenient times for me to phone you at school or at home?
7. Is your use of Metnet (Internet) frequent enough for me to message you online?
8. Is it possible for me to get copies of your exchanges over the fall semester with your mentor (hard copies, forwarded e-mail, or a summary)?
9. Finally, I'd like to set up a time to visit your classroom in the next six weeks. Can we work on that now? Are there any days/weeks that definitely don't work?

THANK YOU!

NAME: _____ DATE: _____ TIME: ____/____

OPENING REMARKS TO THE PARTICIPANT:

- I will be taking notes during the interview
- I don't want to miss, misinterpret, or misquote anything that's said
- with permission, the interview will be tape recorded as well
- recorder can be turned off at any time (demonstrate off button)
- everything said is confidential--no personal identification of you, your students, or your school will be made
- none of your comments will be shared with administrators, colleagues, or your novice partner
- this is not a STEP evaluation or a check-up on participants, although the general findings may be shared with the STEP administration and used in future publications
- transcripts of each interview will be made available if you request them
- additions, deletions, corrections, clarifications are encouraged
- please be as candid as possible--take time to reflect before answering
- if any questions are not clear, stop and ask me to repeat, rephrase, or elaborate

INTRODUCTORY INTERVIEW: MENTORS

Clarify questions about selection process or purpose of the study--verify basic application information.

1. I understand that you teach (*grade(s), subject(s), school*). Would you share some specifics about your classes and your students?
 --number and size of classes, subjects, description of students
 --classroom and school setting
 --special/unique duties, situations or problems

2. I'd like to better understand the setting where you teach. What's the community like? How long have you been (teaching at this location/level/subject area)?
 --population, degree of isolation--available resources and facilities

3. What can you recall about your experiences as a new teacher? What were your greatest challenges or concerns?

4. What kinds of resources have you accumulated for teaching (*math/science*)? What professional support systems have you developed?

5. My research results will be more meaningful if I gather data from many sources. Would you be willing to:

- let me visit your classroom at least once
- let me interview you once more
- cc me on your Metnet exchanges with your novice teacher
- answer occasional questions via Metnet (or journal, mail)

6. What are convenient times for me to phone you at school or at home?

7. Is your use of Metnet (Internet) frequent enough for me to message you online?

8. Is it possible for me to get copies of your exchanges over the fall semester with your novice teacher (hard copies, forwarded email, or a summary)?

9. Finally, I'd like to set up a time to visit your classroom in the next six weeks. Can we work on that now? Are there any days/weeks that definitely don't work?

THANK YOU!

NAME: _____ DATE: _____ TIME: ____/____

INTERVIEW #2: NOVICES

PURPOSE 1: MENTORING RELATIONSHIP

- Describe why you applied to participate in the Early Career Support Program.
--ALSO USE APPLICATION ESSAYS/INFO

- Recall your expectations when you first applied to the mentoring program.
What kinds of support were you hoping to receive from your mentor?
--in an ideal world, how do you visualize a successful mentoring relationship?

- This your first/second year in the program. Have you met your mentor in person?
Describe your initial mentor contact. What were the circumstances of your first face-to-face meeting? What did you talk about?
--prompt with details (when, where, how) as needed

- How have you stayed in contact since that first meeting? What have your interactions been like? Summarize the sequence of your activities to date.

PURPOSE 2: MATH/SCIENCE TEACHING

- As your first/second school year progresses, what are your greatest needs or areas of concern regarding your math/science teaching responsibilities?
--prompt with students, administrator, subject matter, conditions, isolation
- Is your mentor aware of those needs or areas of concern? Why or why not?

- Specifically, how has your mentor helped you with your needs or concerns regarding math/science teaching?

--prompt with curriculum, content, teaching techniques

- Consider the events in your classroom so far this year. What are examples of times when your mentor (or the program) influenced you as a math/science teacher?

PURPOSE 3: TELECOMMUNICATION

- Describe your level of experience with computer communication (either personally or in the classroom) when you entered the mentoring program.

--prompt with previous experience in electronic mail, networking, using a modem

- How do you currently use the computer as a communication tool in the mentoring program?

--prompt with length/frequency of exchanges, topics, personal vs conferences

- How do you feel about relying on the computer as a main avenue of contact?*--supplemental use of phone, mail, fax, other; what would you change about program*

PURPOSE 4: ATTITUDES, CONCERNS, GROWTH

- Has mentoring changed your attitude about math/science teaching in any way?*--probe to capture elementary teachers' feelings about math/science*

- Before we end this interview, would you like to add anything about how having a mentor and being in the program has affected your early teaching career?*-- influence on professional growth--memberships, resources, events, connections*

NAME: _____ DATE: _____ TIME: ____/____

INTERVIEW #2: MENTORS

PURPOSE 1: MENTORING RELATIONSHIP

- Describe why you applied to the Early Career Support Program.

--ALSO USE APPLICATION ESSAYS/INFO

- Recall your expectations when you first applied to the program. What kinds of support did you anticipate giving to a beginning teacher?

--in an ideal world, how do you visualize a successful mentoring relationship?

- This your first/second year in the program. Have you met your beginning teacher in person? Describe your initial mentor contact. What were the circumstances of your first face-to-face meeting? What did you talk about?

--prompt with details (when, where, how) as needed

- How have you stayed in contact since that first meeting? What have your interactions been like? Summarize the sequence of your activities to date.

PURPOSE 2: MATH/SCIENCE TEACHING

- Has your beginning teacher expressed any particular needs or areas of concern regarding math/science teaching? If so, what are they?

- Specifically, how have you helped your beginning teacher with needs or concerns regarding math/science teaching?

--prompt with curriculum, content, teaching techniques

PURPOSE 3: TELECOMMUNICATION

- Describe your level of experience with computer communication (either personally or in the classroom) when you entered the mentoring program.

--prompt with previous experience in electronic mail, networking, using a modem

- How do you currently use the computer as a communication tool in the mentoring program?

--prompt with length/frequency of exchanges, topics, personal vs conferences

- How do you feel about relying on the computer as a main avenue of contact?

--supplemental use of phone, mail, fax, other; what would you change about program

PURPOSE 4: ATTITUDES, CONCERNS, GROWTH

- Do you feel the mentoring program has influenced your beginning teacher's professional growth? If so, how?

- Before we end this interview, would you like to add anything about how your mentorship has affected your beginning teacher's early career?

- At this time, what is your opinion of this long-distance mentoring model? What would make your mentoring experience more effective for the beginning teacher?

Novice: _____ Date/Time: _____

INTERVIEW #3: NOVICES

This is a follow-up to our interviews last winter/spring, to finish the picture of your experiences in the mentoring program to date. Include the final months of the 1996-97 school year, and your activities through the 1997-98 school year, in your responses.

1. My committee has asked for more factual information about your teaching preparation.
 - a) If elementary: certified K-8 or 5-12? what math and/or science content did you take? If secondary: are you broadfield science? did you focus on any areas in math or science? what content courses did you take?
 - b) What were highlights or weak points of your student teaching experience?
Ex: breadth/depth, opportunities to teach, activities, cooperating teacher, other teachers
 - c) Now that you're teaching, what gaps or shortcomings do you perceive in your teacher preparation program?
2. When we spoke early last spring, you described the progress you'd made with your mentor partner to that point. Since then, how has your relationship with your mentor partner evolved?
 - a) Has your level of trust and depth of your communication increased? How?
 - b) How has the relationship grown (or not) in terms of:
 - how often you communicate and by what method(s)?
 - especially, what you talk and share about?
 - c) How has the quality of the relationship changed over the year(s)
3. When we spoke early last spring, you described your current status with Metnet. Update me.
 - a) Have you been using Metnet? For what purposes? How often?
 - b) Describe your Metnet activity since we spoke in as much detail as you can.
Ex: e-mail, folders, downloading lessons
 - c) How do you use Metnet to communicate about math and science?

4. What are your current concerns about teaching math and/or science?
How are those concerns communicated to your mentor?
Do you feel your mentor identifies and addresses your needs and concerns?
5. What kinds of support you have received from your mentor?
How has that support addressed your areas of need and concern?
Ex: mentor visited your school to model teaching with manipulatives; helped you solve a problem with an administrator; mailed you his year-long curriculum plan to compare with yours; encouraged you to reflect about the outcomes of a lesson you taught
- a) Focus first on tangible support in math and/or science. What has your mentor shared with you? *Ex: curriculum, lesson plans, activities, books, calculators*
- b) How appropriate is the math and science support you receive? Does it tend to be discrete (lessons) or continuous (curriculum)? Can you make timely use of the (materials, ideas, philosophy, models) your mentor shares? What difficulties do you encounter?
- c) Now think in terms of less tangible support in math and/or science. How has your mentor influenced your teaching practices? *Ex: integrating topics, more hands-on, technology, cooperative groups*
- d) How have you been mentored in areas beyond math and science?
Ex: classroom management, school relations
- e) Even more broadly, how has your mentor helped you develop as a teacher and a professional? Specifically, has your mentor encouraged certain behaviors in you as a teacher? *Ex: build trust, confidence, reflection, autonomy*
6. What fraction of your relationship with your mentor focuses on math and science?
How could that focus be increased?
- 7a. The STEP Early Career Support Program uses a distance mentoring model. How has this element of distance affected your experience with your mentor? How has distance increased or reduced the benefits you receive from the program?
- 7b. Given that distance mentoring support may be the only alternative in some rural settings, what improvements would you recommend for such a program to provide a better experience for early career teachers and mentors? What elements are essential to a successful mentoring experience? *Ex: better telecommunication support/training, closer matching of teacher characteristics, more structure, greater demand for commitment*

Mentor: _____ Date/Time: _____

INTERVIEW #3: MENTORS

This is a follow-up to our interviews last winter/spring, to finish the picture of your experiences in the mentoring program to date. Include the final months of the 1996-97 school year, and your activities through the 1997-98 school year, in your responses.

1. When we spoke early last spring, you described the progress you'd made with your mentor partner to that point. Since then, how has your relationship with your mentor partner evolved?
 - a) Has your level of trust and depth of your communication increased? How?
 - b) How has the relationship grown (or not) in terms of:
 - how often you communicate and by what method(s)?
 - especially, what you talk and share about?
 - c) How has the quality of the relationship changed over the year(s)?
2. When we spoke early last spring, you described your current status with Metnet. Update me.
 - a) Have you been using Metnet? For what purposes? How often?
 - b) Describe your Metnet activity since we spoke in as much detail as you can.
Ex: e-mail, folders, downloading lessons
 - c) How do you use Metnet to communicate about math and science?
3. What are your novice's greatest concerns about teaching math and/or science? How does he/she communicate those concerns, or how do you discover them? Do you effectively identify and address your novice's needs and concerns?
4. What kinds of support have you provided for your novice? How has that support addressed his/her areas of need and concern?
Ex: visited novice's school to model teaching with manipulatives; helped novice solve a problem with an administrator; mailed your year-long curriculum plan to compare with his/hers; encouraged him/her to reflect about the outcomes of a lesson he/she taught.
 - a) Focus first on tangible support in math and/or science. What have you shared with your novice? *Ex: curriculum, lesson plans, activities, books, calculators*

- b) How do you follow up on the math/science support you share? Does it tend to be discrete (lessons) or continuous (curriculum)? Do you know how your novice applies the (materials, ideas, philosophy, models) you share? What difficulties does the novice encounter?
 - c) Now think in terms of less tangible support in math and/or science. How have you influenced your novice's teaching practices? *Ex: integrating topics, more hands-on, technology, cooperative groups*
 - d) How have you mentored your novice in areas beyond math and science? *Ex: classroom management, school relations*
 - e) Even more broadly, how have you helped your novice develop as a teacher and a professional? Specifically, how do you apply your mentor training to support your novice teacher? *Ex: build trust, confidence, reflection, autonomy*
6. What fraction of your relationship with your novice focuses on math and science? How could that focus be increased?
- 7a. The STEP Early Career Support Program uses a distance mentoring model. How has this element of distance affected your experience with your novice? How has distance increased or reduced the benefits your novice receives from the program?
- 7b. Given that distance mentoring support may be the only alternative in some rural settings, what improvements would you recommend for such a program to provide a better experience for early career teachers and mentors? What elements are essential to a successful mentoring experience? *Ex: better telecommunication support/training, closer matching of teacher characteristics, more structure, greater demand for commitment*

STEP Early Career Support Program
Novice/Mentor Survey
 Spring 1997, 1998

*This survey is a valuable tool for researching the structure and effectiveness of a long-distance mentoring program. The information you provide will be analyzed for a doctoral dissertation as well as for program evaluation. Please complete it as fully as possible. Do not identify yourself by name. **Thank you** for your time! Many thanks also to Walt Woolbaugh and to STEP staff who contributed to the construction of these questions.*

Background Information

1. Gender: ☐ Male ☐ Female
2. Role: ☐ Novice ☐ Mentor
3. Is 1997-98 your ☐ first, ☐ second, or ☐ third year in the ECS Program? (*check one*)
4. Years of teaching experience: (*include 1997-98*) _____
5. Current teaching assignment : ☐ Mathematics ☐ High school
 (*check all that apply*) ☐ Science ☐ Middle school
 ☐ Technology ☐ Elem. (grade)
 ☐ Other (exp.) ☐ Other (exp.)
6. How many students are in your school? (*circle one*) 1-100 100-500 Over 500
7. What K-12 grades does your school serve? _____
8. How large is the community your school serves? (*circle one*)
 1-500 500-2,000 2,000-5,000 5,000-10,000 10,000-25,000 Over 25,000

Telecommunication

9. Currently, how regularly do you use METNET services as part of the mentoring program?
 (*check one*)
 ☐ more than five times/week ☐ 2-3 times/month
 ☐ 3-5 times/week ☐ about once a month
 ☐ 1-2 times/week ☐ never
10. Do you usually access METNET from ☐ home or ☐ school? (*check one*)
11. When you dial into METNET, how long does it usually take to gain access?
 ☐ I have direct access through Internet
 ☐ 0-2 min. ☐ 2-5 min. ☐ 5-10 min. ☐ more than 10 min.

12. What, if any, difficulties have you encountered using METNET? *(check all that apply)*
- ☐ I haven't had any difficulties
- ☐ difficulty getting a telephone line/modem
- ☐ difficulty getting an available computer
- ☐ difficulty getting an open line when calling METNET
- ☐ difficulty using the METNET software
13. In what ways have you used METNET as part of the ECS Program? *(check all that apply)*
- ☐ one-to-one exchanges with my assigned novice/mentor teacher
- ☐ one-to-one exchanges with other novice/mentor teachers
- ☐ reading information in the conference folders
- ☐ posting questions or requests to a folder (novices only, mentors only, combined)
- ☐ responding to questions, requests, or discussions in a folder
- ☐ communication with STEP staff or program co-chairs
- ☐ other (specify) _____

Mentoring Relationship

14. When was your initial contact with your mentor partner(s)? Month _____ Year _____
- How did that contact occur? *(check one)* ☐ Metnet ☐ Telephone ☐ Mail ☐ Face-to-face

15. If your first contact was not face-to-face, when did you first meet in person? M/Y _____
- Where did that meeting occur? *(check one)* ☐ STEP event ☐ another event ☐ arranged

16. How often do you communicate with your mentor partner(s) by means other than METNET?
(circle a response for each item)

	Number of Contacts per <u>Month</u>			
(a) telephone conversation	>5	3-5	1-2	0
(b) faxed message or materials	>5	3-5	1-2	0
(c) mailed message or materials	>5	3-5	1-2	0
	Number of Contacts per <u>Year</u>			
(d) face-to-face at a STEP event	>2	1-2	0	
(e) face-to-face at other events	>2	1-2	0	
(f) face-to-face by arrangement	>2	1-2	0	
(g) classroom/school visit	>2	1-2	0	
(h) other (specify) _____	>2	1-2	0	

17. Which form of communication do you find to be most effective for you? *(check one)*

☐ METNET ☐ Telephone ☐ Mail ☐ Fax ☐ Face-to-face

☐ Other (specify) _____

18. Assuming you want to increase communication with your mentor partner(s), rank the three methods which you believe would benefit you most. *Choose three items and rank 1 to 3 (1=most helpful). If you do not think increases would be helpful, check here ☐ and go on.*

☐ more METNET contacts ☐ more mail contacts

☐ more telephone contacts ☐ more fax contacts

☐ more face-to-face contacts ☐ other (specify) _____

19. How often do you discuss each of the following subjects with your mentor partner(s)?

Assign a value to each item : 1=frequent 2=occasionally 3=never

(a) preparing classroom activities or curriculum topics in math/science	1	2	3
(b) preparing classroom activities or curriculum topics in other areas	1	2	3
(c) locating teaching resources, materials, and/or activities	1	2	3
(d) interacting with students; classroom management and discipline	1	2	3
(e) interacting with administration	1	2	3
(f) interacting with parents and/or the community	1	2	3
(g) personal issues, moral support, or friendly conversation	1	2	3
(h) other (specify) _____	1	2	3

Mathematics/Science Teaching

20. Rank the following in terms of how participation in the ECS Program has most helped you. Rank from 1 to 5 (1=most helpful, 5=least helpful). If "other" remains blank, give it rank 5.

- ___ providing help with presenting and expanding math/science curriculum
- ___ providing help with math/science resources, materials, and activities
- ___ providing help with students and classroom management
- ___ providing help in working with administration, parents, and community
- ___ other (specify) _____

21. Which components of the mentoring program have been most useful to you?

Assign a value to each item: 1=very useful 2=somewhat useful 3=not useful

(a) survival kit resources and materials (novices only)	1	2	3
(b) summer training workshops (mentors only)	1	2	3
(c) ECS Program conferences and workshops	1	2	3
(d) interaction with your assigned mentor partner(s)	1	2	3
(e) interaction with other mentors	1	2	3
(f) interaction with other novices	1	2	3
(g) membership in professional organizations (MCTM, MSTA, etc.)	1	2	3
(h) other (specify) _____	1	2	3

OPEN-ENDED RESPONSES Answer each question as specifically as possible.

Mathematics/Science Teaching: use the space below; answer the question which applies to you

MENTORS ONLY: Describe an occasion when you feel you responded to your novice teacher's needs in mathematics and/or science teaching. How did you become aware of the need? How did you follow up on your response? How did the interaction take place (via METNET, telephone, mail, etc.)?

NOVICES ONLY: Describe an occasion when you feel your mentor responded to your needs in mathematics and/or science teaching. How did you communicate the need? How did you incorporate the information shared by your mentor? How did the interaction occur (via METNET, telephone, mail, etc.)?

Telecommunication: (*everyone please respond*) Summarize the advantages you have found to using telecommunication in the mentoring program--or elaborate on why you feel there are no advantages.

Mentoring: (*everyone please respond*) For each area listed, give examples or explain how participation in the mentoring program has influenced your teaching experience. If you feel there has been no effect in a particular area, please explain why not.

- (a) confidence in teaching mathematics and/or science
- (b) beliefs about teaching and learning mathematics and/or science
- (c) mathematics and/or science teaching practices
- (d) professional growth as a mathematics and/or science teacher

SECOND- OR THIRD-YEAR PROGRAM PARTICIPANTS

Compare/contrast your relationship with your mentor/novice teacher from one year to the next.

How has your relationship evolved from 1996-97 (or from 1995-96) to this year? (Example: If you completed this survey in April 1997, think about how your responses have changed.) How have the priorities and emphases of your relationship shifted, and what are they now? Has your mentoring bond strengthened or weakened? How have you progressed in the areas of trust, reflection, and autonomy?

MENTORS WITH TWO (OR MORE) NOVICE TEACHERS

Compare and contrast your relationship with each of your novice teachers.

What similarities and differences can you identify in how you interact with each novice teacher? What causes the differences? (Ex: Is one rural, the other in a city? Does one access Metnet, the other not?) How do you divide your time between them? Do you interact as a group? Do the novices interact with each other?

Thank you again for your thoughtful responses!
Completed surveys must be received in the STEP office by [deadline].
Don't forget to include your name on the prize drawing form!

APPENDIX C
ECSP WORKSHOP PROGRAMS

Mentor/Early Career Teacher Workshop Agenda

November 16-18, 1995
Montana State University-Billings

Agenda Items

Thursday (Nov 16th)

6:00 PM	Arrival and dinner on your own
7:00 PM	Introductions and Welcome
7:15 PM	Initial activities-Interview Booklet/Trust Building
8:30 -8:45 PM	STEP Overview / Lyle & Elisabeth
8:45-9:00 PM	Review Agenda for Friday and Saturday
9:00-10:00 PM	Social

Friday (Nov 17th)

8:00-8:30 AM	Reflection, Reflective Listening, Questioning
8:30-9:30 AM	Breakout Session #1
	#1- Early Career
	#2- Mentors
9:30-9:45 AM	Break
9:45-10:15 AM	Breakout Session #2
	#1- Survival Kits
	#2- Metnet
10:15-11:15 AM	Whole Group Role Play
	Early Career
	Mentors
11:15-12:00 PM	Modeling Good Science and Mathematics Instruction
	Table 1: STEP
12:00-1:00 PM	Lunch at the SUB- Choice
1:00-2:00 PM	Diversity Issues (Guest Speaker)
2:00-2:15 PM	Break
2:15-3:15 PM	Recognition of Personal Strengths
3:15-3:30 PM	Break
3:30-4:30 PM	Case Studies-Participant Anecdote or Real Issue
4:40-5:00 PM	Set up Case Study on Metnet
5:00-7:00 PM	Dinner-Open Metnet Lab
7:00-8:00 PM	Modeling Good Science and Mathematics Instruction
	Science and Mathematics Integration

Saturday (Nov 18th)

8:00-10:00 AM	Boosters and Barriers-Goal, Plans, Needs
10:00-10:15 AM	Break
10:15-12:00 PM	Mentor/Early Career Needs Breakout Sessions
	#1 Early Career Teachers
	#2 Mentor Teachers
12:00-1:00 PM	Lunch
1:00-3:00 PM	Debrief Needs; Whole Group; Closure

Early Career Conference Agenda

Great Falls, April 18-20, 1997

Friday April 18th	7:00- 9:00 pm	• Mixer at the Motel • Assessment of Best Practices? The Subjective or Objective Debate
----------------------	------------------	--

Saturday April 19th	8:20 am	Announcements	
		Session 1	Session 2
	8:30- 10:00 am	Michelle Kelly <i>"POW!" (Problem of the Week)</i> Teachers will solve problems through a variety of strategies, and learn ways to teach their students the strategies through writing. Opportunities for teachers to actively engage students in inquiry and problem-solving and for students to work with others.	Ken Miller <i>Targeting your Students' Misconceptions with Constructivist Models.</i> How do you know when your students have misconceptions? How can we target those misconceptions and allow children to construct appropriate understandings? Activities to help solve these questions will be done.
		Jay Sumner and Sharon Hlad <i>The Peregrine Falcon in the Classroom</i> A live peregrine falcon, slides, and video are used to detail the life history of the peregrine falcon. Learn how to show interrelationships among other falcons, prey species, and common Montana raptors in your classroom.	Michael Pierre <i>Elementary through Middle School Spatial Activities: Developing Formal Thought</i>
	10:00 - 10:15 am	Break	
	10:15- 11:45 am	John Graves <i>Process Skills for the Early Elementary Grades</i>	Rick Jones <i>Maury Project Thematic Integration in Oceanography</i>
		Kurt Cunningham <i>Activities with Project WILD</i>	Gordon Hahn Includes an overview of polymers and their varied forms. Hands-on labs and means of "teaching" polymers will be demonstrated.

Great Falls, April 18-20, 1997 – continued

Saturday April 19th	11:45 am - 12:00 pm		Announcements Ken, Mike, and John	
	12:00 - 1:00 pm		Lunch Video-Model Sites and Best Practices	
Saturday April 19th	Session 1		Session 2	
	1:00-2:30 pm	Denece Lord & Ken Miller <i>Evaluating Exemplary Science Lessons-It was fun! But did they learn?</i>	Kurt Cunningham <i>Project WILD Activities</i>	
		Lyle Andersen <i>Middle/High School Mathematical Modeling</i>	Nina Goddard & Judy Henry <i>Activities Integrating Science and Mathematics</i>	
	2:30-2:45 pm		Break	
	2:45-4:15 pm	Richard Nagengast <i>Journey to Lost Lake</i> Bus trip to a Montana geological wonder.	METNET Training John Graves <i>Having trouble with Metnet? Want to learn more? Want to learn some fun stuff about Metnet?</i>	
		Monty Brekke <i>Who said H.S. teachers do not use manipulatives? Manipulatives should be used in teaching K-12 math & science. Water, gameboards, miras, calculators, etc. will be used to demonstrate how manipulatives can help students grasp ideas. Examples transferable to grades K-12.</i>	Cynthia Baumann <i>A Plethora of Practically Profound Probability Problems!</i> A unit for all ages and abilities. Some traditional and non-traditional activities will be shared!	
	4:15-5:00 pm	Favorite Activity Sharing Time: Everyone bring their favorite activity to discuss and share. No need to make copies. We will distribute the activities via Metnet from sign-up sheets accompanying each activity.		

Great Falls, April 18-20, 1997 – continued

Sunday April 20th	<i>Session 1</i>		<i>Session 2</i>
	8:30- 10:00 am	Yvonne Gebhardt Yvonne's topic will be non-routine problems, written to incorporate group work, appropriate use of mental math, calculators, etc, along with some ideas about "spicing up" word problems using a holiday theme. She will give support from the math standards and other studies for group work, and appropriate skills for students.	Walt Woolbaugh <i>Messing around with Science:</i> Simple grabbers for introducing activities in many different concepts.
		Robbye Hamburgh, Anna Flynn, Kay Dighans, Sue Livers, Terri Goyins—Panel Discussion on Mentoring and Early Career: <i>"How Mentoring has HELPED our Teaching and Supervising of Student Teachers"</i> .	Marjorie Robbins <i>K-8--"Using Candy and Other Food Groups to Demonstrate Selected Scientific Concepts."</i>
	10:00 - 10:15 am		<i>Break</i>
	10:15- 11:15 am	Teacher Autonomy and Empowerment <i>Our Mentoring Mission</i> Richard Nagengast and Juanita Polston	
	11:15- 11:45 am	Mentor Only Meeting	EC Only Meeting
	11:45 am- Noon	Announcements Ken, Mike, and John <i>Lunch</i>	

Drive Carefully!

MONTANA STATE UNIVERSITY LIBRARIES



3 1762 10280424 0