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Instructional technology theory alignment with practical application during student teaching

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INSTURUCTIONAL TECHNOLOGY THEORY ALIGNMENT WITH PRACTICAL APPLICATION DURING STUDENT TEACHING

DISSERTATION

by

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Instructional Technology Theory Alignment with Practical Application During Student Teaching

Director: David Erickson

This naturalistic case study investigated what student teachers learn about practical classroom instructional technology applications during elementary field placement. Underlying influences on student teachers implementing instructional technologies are described along with their cooperating teachers' accounts of factors in the school that either promote or inhibit professional technological growth. Analysis of these experiences and influences was directed toward finding approaches to how schools of education can successfully merge instructional technology theory with classroom practice.

Student teacher/cooperating teacher participants were placed into the following "buddy system" configuration:

- *Pair One*: Novice instructional technology literate preservice teacher with a nearing proficient cooperating teacher.
- *Pair Two*: Nearing proficient instructional technology literate preservice teacher with a proficient or advanced cooperating teacher.
- *Pair Three*: Proficient instructional technology literate preservice teacher with a proficient or advanced cooperating teacher.

Technology experience acquired beyond educational coursework requirements added to the student teachers' fundamental technology ability and often reflected positively on their desire for self-directed learning. Daily cooperating teacher modeling and collaboration combined with proactive problem solving in classroom context became determining factors in each student teacher's capacity to approach technology implementation during his or her field experience. Student teachers with the strongest self directed-learning characteristics grew much more adept at synthesizing academic technology theory into practical technology curriculum classroom authentic learning experiences. The degree of synthesis was directly related to whether they moved toward technology integration approaches that motivates and challenges students in critical, creative, and constructive thinking and learning experiences.

Three themes heavily supported by data emerged: (a) collaboration and rapport; (b) self-directed learning; and (c) equipment: time and availability. Key barriers were: high classroom student-to-computer ratio, student computer skills, equipment availability, and confident knowledge in setting up equipment. Overall, time's relationship to effort often outweighed student teachers' decisions to integrate technology.

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CHAPTER I

INTRODUCTION

> *New prophets of hyperreality...argue that the computer is the final road to human freedom because it permits each of us to create our own worlds, to escape the straightjacket of linear text, to make thought of a collage of insight. (Aronowitz & Giroux, 1991, p. 192)*

With a new century upon us, educators are witnessing a convergence of brain-based research, technological innovations, a new culture of students, *au courant* learning theories and a federal agenda to place computer-based technology into the nation's K-12 classrooms. This notable amalgam of developments combined with the exponential growth of the World Wide Web and newly published National Educational Technology Literacy Standards (International Society for Technology in Education, 2000) for teachers and students provide promising new implications for teaching and learning. As a result, schools of education are becoming points of egress for encouraging and training preservice teachers to effectively synthesize computer-based technology into their newly developing classroom methodology.

> The effect of computer-based learning technologies in facilitating student learning and performance is seen only when participants have the knowledge and skill to use the technology. While this may seem self-evident, the authors report that it was perhaps because of the 'assumed power of the technology' that past researchers have not evaluated the knowledge and skill base necessary for students to use technology most effectively. (Fulton, 1998, p. 1)

Employment Context

For the last two decades the crest of the Information Age has been forming and sweeping our educational system into the new millennium. Change is in order for the preparation of a new generation of students and employees (Kortecamp, 1995).

> The new technology will enable students to acquire the skills that are essential to succeed in modern society. Exposure to computer technology in school will permit students to become familiar with the necessary tools at an early age. By using the technology well, they will also acquire better thinking skills to help them become informed citizens and active community members. (Kennedy, 1996, p. 2)

Cheryl L. Lemke, Executive Director, Milken Exchange on Education Technology agrees:

> The increase of productivity in American business over the last fifteen years has been linked to its increasing use of information technology.... It is clear that, with over 62% of America's work force employed as 'knowledge workers,' fluency with technology is a basic skill of the 1990s. (Lemke, 1999, p. 1)

This validates the primary objective of the Secretary of Labor's Commission on Achieving Necessary Skills (SCANS) Report for America 2000 (United States Department of Labor, 1991a). The SCANS objectives promote teacher understanding in how curriculum and instruction must change to enable students to develop into critical thinkers capable of using a variety of technologies. These high performance skills are needed to succeed in the 21st century workplace. Fundamental information and technology skills and workplace competencies include the ability to (a) acquire, evaluate, organize, maintain, interpret, and communicate information, as well as use computers to process information and (b) work with a variety of technologies through appropriate selection of technology procedures, tools or equipment; to maintain and trouble shoot equipment; and, to apply appropriate technology to the task at hand. (United States Department of Labor, 1991b). Sophisticated intelligent "...problem solvers, decision makers, adept negotiators and thinkers who are at home with open-endedness, flexibility and resourcefulness" (Caine & Caine, 1994, p. 15) profile tomorrow's successful employees.

Cultural Context

A recent survey found teachers in both the United States and Europe overwhelmingly reporting that today's students have shorter attention spans, are less able to reason analytically, to express ideas verbally, and to actualize complex problem solving skills (Healy, 1996). Increasingly fast-paced lifestyles, paired with a bombastic media offering immediate visual gratification, is generating students who are characteristically nonconformist toward traditional modes of academic learning. Furthermore, exposure to computer programs and TV editing techniques tend to "compress, extend, and distort normal time-space relationships, a critically important element in learning" (Sylwester, 1997, p. 3). The result of technology literate children and an "antiquated educational system" is the making of a growing educational dilemma between students and their schools (Fulton, 1998, p. 3). The student of today and tomorrow arrives ready to learn with new skills and needs. Our current educational system must embrace a new culture of learners. "Without major reforms, ...schools will continue to prepare students for a world that no longer exists, developing in students yesterday's skills for tomorrow's world" (Toffler in United States Office of Technology Assessment, 1995b).

Teaching and Learning Context

America's schools, modeled on an industrial age assembly line approach to education in which students remain stationary receptors and the product (facts) comes to them in organized units, are no longer sufficient. What, for past decades, was once considered an appropriate pedagogy, when teachers and parents were ordained "reliquaries and dispensers of knowledge" and "teaching was telling and learning was memorizing," (Fulton, 1998, p. 3) is no longer applicable. Papert (1998), Berge and Collins (1995), and Stuhlmann, Taylor, & LaHaye (1995) concur.

Sylwester (1995) expresses concern about current educational modes of testing through memorization and recall. He found that traditional methodologies cultivate "localized and static" (p. 93) short-term technological memory. Routine worksheets, explicit directions and multiple choice tests offer minimal cognitive challenge and little biological memory retention. Caine & Caine (1994) state:

> Memorization, particularly as practiced in our schools, does not work to provide a basic foundation in skills and knowledge (p. 14). Teaching content and skills are inadequate because they fail to take advantage of the brain's capacity to learn. (p. 16)

Traditional educational methodology does little to engage holistic long-term memories through either curiosity, at least, or engaging interaction, at best (Caine & Caine, 1994).

Curriculums sensitive toward integrating appropriate computer-based instructional technologies have been found to encourage deeper forms of understanding within and across disciplines. Audio, visual, and textual media access engages, excites and motivates learning. Sylwester (1995) maintains that when students are interested and eager about learning, they retain information. When teachers are adept at connecting academic concepts to personally meaningful experiences, students understand more deeply. In fact, brain activity increases when context is added to concepts and students become emotionally engaged in their learning (United States Department of Education, 1999; Sylwester, 1997; Kennedy, 1996; United States Department of Labor, 1991a). Caine and Caine (1994) have corresponding opinions: "educators need to orchestrate the experiences from which learners extract understanding, [therefore] optimizing the use of the human brain [by] using the brain's infinite capacity to make connections" (p. 5). Furthermore, "emotion drives attention, which drives learning, memory, behavior, and just about everything else…and now, due to advanced computer imaging, brain researchers have the data to back that claim" (Sylwester, 1997, p. 2).

Computer-based instructional technology is expanding at a precipitous speed and, at the same time, teachers' roles are changing. A curriculum structured around traditional teacher-centered methodology is no longer effective. "Digital technology is a learners' technology" (Papert, 1998, p. 1). Teachers can best serve students through motivating them to tap in to their higher-order thinking, integrating knowledge, and taking responsibility for their own learning within the context of the real world. "In using emerging computer-based technology as a resource, students are encouraged to explore their own interests and to become active educational workers, with opportunities to solve some authentic problems" (Berge & Collins, 1995, p. 2). Students will not benefit from this knowledge until the institutions of learning are redesigned to suit the various requirements of a new era of learners (Halal & Liebowitz, 1994). New generations of "students and their teachers will need to become active learners who can find information, organize it, evaluate it and then effectively express their knowledge and ideas" (Pisha & Hughes, 1996, p. 3).

Technological Literacy Context

Sylwester (1997) explains how technology innovations fit into the human - educational conundrum:

> Our curiosity and inherently strong problem solving capabilities allowed us to develop such tools as...books and computers...that compensate for...our brain limitations, and very powerful portable electronic instruments are now rapidly transforming our culture. We can thus view ... technology as a...technological brain--located outside of our skull but powerfully interactive with the [brain] within our skull. (p. 3)

Computers help to organize gathered information. For example, word processing software prepares modes of organizing, assimilating, evaluating, and communicating information. Education is no longer limited to information contained in bound print materials allocated to library shelves. Internet access allows students a connection to many non-traditional electronic sources of information such as university and museum databases. Students can apply this immediate technology to directly communicate with specialists and experts (Berkowitz, 1996). The successful incorporation of these tools, facilitated by creative professional teachers, into K-12 curriculum design has the capacity to open up learning to the widest spectrum of students–especially those who are not primarily mathematical-linguistic learners.

Both Eisner (1994) and Gardner (1984), respectively, speak passionately of the need for curriculum that promotes and enables multiple types of "literacies" (Eisner, 1994, p. 69) or "intelligences" (Gardner, 1984, p. 70) in students by incorporating development via multiple modes of learning and expression. The more educators can match students with congenial approaches of teaching and learning, the more likely it is that those students will achieve academic success.

The information and technology revolution has propelled many local, state, and federal institutions to initiate planning guidelines for integrating technology into classroom curricula. Technology integration involves effectively communicating that computer-mediated education will be integrated, is valued, and will be rewarded. The federal government is spearheading this movement. The Educational Technology Act of 1993 was introduced by Congress to encourage development strategies focused on integrating educational technology into national academic infrastructures (Calabrese, 1996). The Presidential Goals 2000: Educate America Act (United States Congress, 1994) outlined national goals to:

- Foster a "national strategy to infuse technology and technology planning" into all state and local educational programs,
- Demonstrate and "promote the effective ways in which technology can be used to improve teaching and learning," and

- Help ensure that no school system or student will be "excluded from the technological revolution" (p. 1)

Additionally, President Clinton's Technology Literacy Challenge (United States Department of Education, 1998b) officially recognizes "that technology can help expand opportunities for American children, to improve their skills, and ready them for the 21^{st} century" (p. 1).

Education is at the threshold of an astonishing unlimited universe of computer-based technologies. Students are already surfing areas of the world in a microsecond. Yet, in most K-12 public schools, Internet, e-mail, word processing, and non-interactive televised distance learning is merely supplemental to curricula and instructional support is infrequently applied to direct computer-based learning. "Denying a student easy and extensive exploration of electronic technology helps to create an electronically hampered adult in an increasingly electronic culture" (Sylvester, 1997, p. 4).

The American educational system has done a reasonable job of evaluating the impact of the technology it has developed and has access to these innovative learning theories and, in many cases, has successfully implemented computer-based curricula. However, due to the proliferation of new technologies and a greater public demand for applications of these innovative tools directed toward improving the success rate in educating our children, implementation is mandatory and inevitable (Kerry, Perelman, Twigg, Dyson, & Masullo, 1995).

Are new technologies going to be implemented "as an amplifier, [perpetuating] existing educational objectives or as transformational tools, which can change the teaching and learning to reflect the context of the digital age" (Serim, 1999, p. 1)? Papert (1998) points out:

> Children [will] become a driving force for educational change instead of being its passive recipients. Dewey had nothing stronger than philosophical arguments to support his attempts at changing school. But academic arguments can never budge an institution as firmly rooted as the School Establishment. This time we are beginning, just beginning, to see the effects of a wave that will soon become a veritable army of young people who come to school with the experience of a better and more empowering learning environment based on their home computers. There is much talk about schools setting higher standards for students. But what is more important is that these students are demanding higher standards from schools. And, moreover, they come armed with the know-how that makes better learning possible. (p. 2)

Cochrane (in Moreinis, 1996, p. 4) at the New York Academy of Sciences lends further food for thought, "Imagine school with children that can read or write, but teachers who cannot, and you have a metaphor of the Information Age in which we live." The necessity for using technology in the nation's classrooms is presumed. The question for the nation's schools of education and teachers is – Under what conditions and vision can educators capitalize on technology to create new educational environments and maximize learning (Lemke, 1999; White, 1997)?

Teacher Education Context

Changes in classroom methodology have their roots in the preservice programs in the nation's colleges of education. "The university unilaterally determines the curriculum, experiences, and expectations, and K-12 schools serve as the laboratory where preservice teachers practice what they learned at the university" (Stetson &

Stetson, 1997, p. 2). Prevailing coursework is taught through direct instruction or transmission of knowledge with students only observing in the school-based classrooms (O'Loughlin, 1989). The nation's traditionally based preservice teacher programs must change to meet the needs of educating teachers for the next century (White, 1997). McCoy (1998) examined technology integration in higher education teacher preparation programs. Teacher educators described the current status and importance they placed on technology integration into teacher preparation. The study revealed (a) more research is needed on types of technology use and methods of integration into instruction, and (b) research is also needed to investigate student perceptions of use of technology and integration of technology standards into teacher preparation programs.

The nation's colleges of education are "wrestling with how to train teachers to integrate technology into their classroom learning environments" (Smithey & Hough, 1999, p. 72). Changes include an increase in modeling, applying, and integrating the use of technology for instruction in concert with exemplar teaching methodology in a more articulate manner (Stetson & Stetson, 1997; United State Office of Technology Assessment, 1995a). These changes will help to develop a community of learners where instructors and students model and apply the effective integration and application of educational course work, field experiences, communication and reflection.

Even though 99% of public schools are equipped with access to computers and/or the Internet somewhere in the school site (United States Department of

Education, 2000b, p. 1), not all preservice teachers see the value of using computers for instructional support. Through effective modeling and instruction by school of education professors, preservice teachers should develop a comfort level with the technology and feel confident about integrating multimedia into their own classrooms (United States Office of Technology Assessment, 1995a). Smithey and Hough (1999) also found in a study of preservice teachers that the "power of multimedia is difficult to grasp without hands-on experience" (p. 2). Often skeptical at the beginning of the multimedia project, hands-on experience enhanced their vision for what technology could add to classroom instruction.

PROBLEM STATEMENT

Instructional technology is expanding at a precipitous speed and, at the same time, teachers' roles are changing. In using emerging instructional technology as a resource, all categories of "students are encouraged to explore their own interests and to become active educational workers, with opportunities to solve some authentic problems" (Berge & Collins, 1995, p. 2). Schools of education are becoming increasingly aware that technology literacy includes the acquisition of an understanding of what Bitter and Yohe (1989) describe as "the processes of technology, the ability to go beyond the application of the products of technology to the theoretical implications" (p. 23). This aligns with Dewey (1904) in his view that the ultimate intent of teacher education programs should be to prepare teachers to reflect upon the relationship between theory and practice.

This study is primarily concerned with investigating the student teaching practicum from the student teachers' viewpoints of being prepared to effectively integrate computer-assisted learning and instruction into their classroom practice. This will include underlying influences on student teachers implementing instructional technologies in their classroom practice. Emphasis will be directed toward revealing any internal and external support mechanisms and/or curriculum methods to better encourage appropriate proficient integration.

PURPOSE OF THE STUDY

The purpose of this case study was to identify information that will assist in a better understanding of the School of Education teacher education program's strengths and weaknesses in preparing preservice teachers to successfully integrate educational technology within the context of their elementary student teaching field placement. This research was conducted to recognize and interpret student teachers' perceptions of the process they go through as well as influences and constraints they encounter while using technology in practical classroom teaching strategies and instructional methods.

It is important to understand the process student teachers experience while assimilating academic instructional technology theory into their developing instructional methodologies. Findings will provide information to schools of education on teacher education programs' successes and challenges in preparing new teachers to appropriately implement informational and instructional technologies into their professional classroom practice.

DEFINITION OF TERMS

For the purpose of this study, the following definitions apply:

1. *Computer-assisted learning (CAL)*: "The interactions between a student and a computer system designed to help the student learn. Once limited to drill-and-practice software, CAL now includes tutorials, simulations, and virtual reality environments that can present complex learning situations" (Moursund, 1999, p. 6).
2. *Computer -based instruction (CBI)*: "The educational use of computers that usually entails using software programs [multimedia and information technology such as the Internet, e-mail] which drill, tutor, simulate, or teach problem-solving skills" (Hirshbuh & Bishop, 1996, p. 235).
3. *Cooperating teacher*: "A fully qualified teacher in public or private school who guides the development of a student teacher" (Teachers' Professional Practices Commission, 1976, p. 5).
4. *Generalizability*: "When researchers use the term generalizbility they usually are referring to whether the findings...hold up beyond the specific research subjects and the setting involved" (Bogdan & Biklen, 1992, p. 44). Dependability of findings and conclusions is not absolute but statistically probable.
5. *Higher-order instruction* (constructivist): "Students are encouraged to pose hypotheses and to explore ways to test them. They are encouraged to weigh information from these tests with previous experiences or understanding of the

topic. Students then construct a new understanding of subject matter" (United States Department of Education, 1999, p. 10).

6. *Information Technology (IT)*: "Computer hardware and software, the networks that tie computers together, and a host of devices that convert information (e.g., text, images, sounds, and motion) into common digital formats. IT is not just hardware, wires and binary code, but also the effective use of digital information to extend human capabilities" (Moursund, 1999, p. 5).
7. *Instructional technology; Educational technology*: "the theory and practice of design, development, utilization, management and evaluation of processes and resources for learning" (Seels & Richey, 1994, p. 129). For this study the term *instructional technology* is interchangeable with the term *educational technology*.
8. *Multimedia*: "The combination of text, sound, and video used to present information [and] bring pages of information to life" (Hirshbuhl & Bishop, 1996, p. 238).
9. *Preservice*: A period of learning [for a university school of education student] occurring prior to entering the classroom [as a certified teacher]. (United States Department of Education, 1999, p. 15).
10. *Student teacher*: "A university student who has been assigned to a cooperating teacher preparation institution to acquire practical teaching experience during a specific period of time, under the direction of one or more cooperating teacher(s) and a university supervisor" (Teachers' Professional Practices

Commission, 1976, p. 5).

11. *Student teaching*: "A period of directed teaching experience under the guidance of a cooperating teacher and university supervisor" (Teachers' Professional Practices Commission, 1976, p. 5).

12. *Teacher Resource Center (TRC)*: Located in the School of Education, the Center, designated an Eisenhower National Clearinghouse Access Center and a Microsoft Teacher Training Site, provides print and non-print materials for preservice and inservice educators to preview. (see Appendix A).

13. *Technology-as-a-tool*: "includes a large array of hardware and software – word processors, graphics packages, scanners, digital cameras, presentation applications, spreadsheets, and more. The common characteristic is for hardware and software not to have a limited educational purpose, but rather be designed to help people extend their abilities to do work" (Moursund, 1999, p. 6).

14. *Technology-rich classroom*: "A classroom environment equipped with Internet access, e-mail, educational software and multimedia capabilities where students are encouraged to actively participate with technology and content material in a technology-assisted collaborative learning experience" (Shapiro, Roskos, & Cartwright, 1995, p. 140).

15. *Traditional instruction*: "The transmission of knowledge or facts to students, who are seen as passive receptors. In classrooms where this type of teaching predominates, teachers typically conduct lessons through lecture format,

instruct the entire class as a unit, write notes on the chalkboard, and pass out worksheets for students to complete. In such classrooms, knowledge is presented as a fact. This is the type of instruction with which most Americans are familiar" (United States Department of Education, 1999, p. 10).

CONTRIBUTION TO THE FIELD OF EDUCATION

The results of this study provide insights for teacher educators and administrators into student teachers' and cooperating teachers' perceptions of the process of implementing instructional technology in their student teaching field placement experiences. These insights may assist schools of education to better support and facilitate future teachers with technology literacy beyond the application of hardware and software. Therefore, by using emerging instructional technology as a resource, classroom teachers, as active educational workers, will be able to (a) reflect upon the relationship between theory and practice and (b) implement thoughtful computer assisted curricular strategies in the classroom when appropriate.

The importance of this study is to:

- Provide insights that may assist schools of education to better support and facilitate future teachers with technology literacy beyond hardware and software application, and
- Provide teacher educators insights into factors that may implement and/or impede student teacher and cooperating teacher team's self-mediated learning about computer-based technology as a curricular tool.

DELIMITATIONS AND LIMITATIONS

Delimitations narrow the scope of the study (Creswell, 1994). On the other hand, limitations identifying potential weaknesses in the study are acceptable only if they are acknowledged openly and taken seriously in data interpretation (Anderson, 1990). This case study contains several delimitations and limitations.

Delimitations

The student teacher's field placement in local elementary school classrooms sets up a naturalistic environment for study. Like many qualitative methods, "naturalistic observation yields insights that are more likely to be accurate for the group under study" (Denzin & Lincoln, 1998a, p. 88). Limiting the research setting is of primary importance in conducting qualitative research (Bogdan & Biklen, 1992).

One of the most significant and key research instruments is recording and reporting experiences in the classroom. Observational research obtains validity from "thick description,...the complete, literal description of the incident or entity being investigated" (Merriam, 1988, p. 11). Denzin & Lincoln (1998b), Creswell (1994), and Anderson (1990) concur.

This case study focused on interviewing and observing three purposefully selected elementary education students enrolled in their final student teaching field placements. The research seeks a holistic description and understanding of how their experiences with instructional technology applications in the school of education align with practical classroom applications within their elementary student teaching field placement assignment. Purposeful selection of informants works "best to answer the research question" (Creswell, 1994, p. 148) and focus on the particular situation (Merriam, 1988; Guba & Lincoln, 1981). The small sampling also allows for the researcher to have "firsthand experience" with informants (Creswell, 1994, p. 150).

Limitations

Bias is a possible limitation inherent in observational research. Observers must rely on their own perceptions and are susceptible to intentional and unintentional bias via subjective interpretations of the events (Denzin & Lincoln, 1998b).

> The researcher's goal is to add to knowledge, not to pass judgment on a setting. The worth of a study is the degree to which it generates theory, description, or understanding....Qualitative researchers tend to believe that situations are complex, so they attempt to portray many dimensions rather than to narrow the field. (Bogdan & Biklen, 1992, p. 46)

Patton (1990) adds: "The investigator's commitment is to understand the world as it is, to be true to complexities and multiple perspectives as they emerge, and to be balanced in reporting both confirming and disclosing evidence" (p. 55).

As a primary instrument in this study, I bring my biases as an educational technology instructor and a technology advocate. I have developed this stance by experiencing teacher-student participation and achievement via hands-on approaches to teaching and learning. I grapple with understanding why preservice teachers, inservice teachers, and university professors often hesitate at infusing computer-based technology literacy into their educational coursework, field placement experiences, and professional portfolios. To ensure that these case study findings are a product of the inquiry's focus and not the researcher's biases, an adequate data trail will be conscientiously maintained throughout the study.

CHAPTER II

LITERATURE REVIEW

> *The probability that elementary and secondary education will prove to be the one information-based industry in which computer technology does not have a natural role would at this point appear to be so low as to render unconscionably wasteful any research that might be designed to answer this question. (Panel on Educational Technology, 1997, p. 93 - 94)*

To paraphrase Dickens (1859), the new millennium promises the "the best of times, ... the worst of times, ... the age of wisdom, ... the age of foolishness, ... the epoch of belief, ... the epoch of incredulity" (p.1) for the nation's educational system. The government, cognitive and educational researchers, school districts, educators, and parents have begun to recognize the call for transition away from over 200 years of traditional stand-and-deliver pedagogy accompanied by its *accoutrement* of single discipline, product-oriented classrooms. Information Age tools and technologies are catalysts for this change.

It is not a staggering conceptual leap to incorporate intelligently more computer-based instruction within classroom walls. In fact, a majority of teachers "view technology as a powerful tool...rather than just another fad being mandated by those above them" (Solomon & Wiederhorn, 2000, p. 8). Educational change agents must be purposeful and committed toward student-centered, multi-disciplinary, process-oriented classrooms.

Teacher education faculties are the keystones to this transformation. In order for beginning teachers to meaningfully integrate technology into new instructional methodology, school of education faculty need to both demonstrate and support technology as an integral part of preservice coursework (Thomas, Larson, Clift, & Levin, 1999; Queitzsch,1997; Jinkerson, 1995; Kortecamp, 1995; Topp, Thompson, & Schmidt, 1994).

Technology as an Instructional Tool

The Office of Educational Research and Improvement (United States Department of Education, 1993) conducted a case study of nine school district sites across the United States where teaching staff were active participants using technology as a catalyst for changing schools in ways that better support the acquisition of higher-order skills. Data analysis found recurring effects from integrating technology in the classrooms. Teachers observed their students to have increased (a) motivation and self-esteem among those who appeared uninvolved with traditional content delivery, (b) ability to accomplish more higher-order thinking skills and complex tasks aided by technology provided resources, (c) collaborative group work and peer tutoring where more students provide and ask for assistance for and from each other, and (d) attention to presentation delivery largely due to peer reaction and access to professional looking multimedia presentation software.

As an instructional conduit, digital computer technology delivers text, pictures, animation, video, and sound. These stimuli serve to engage, excite, and motivate learning. Sylwester (1997) points out "When youngsters are interested and excited in what they are learning, they learn more" (p. 116). Over the past few years, researchers have studied a variety of attributes characteristic of computer-based environments and their association with learning. Study results indicate computer technology has the potential to transform a conventional classroom into an integrated student-centered self-directed learning laboratory. For example, Pisha & Hughes (1996) studied 28 schools to determine the impact of Internet research on 500 fourth and fifth grade social studies students. Results showed that students using the Internet clearly understood issues within the context of society more completely than students limited to traditional text research methods. Ormrod (1995) established that a computer-based technology classroom setting engages students through visual, auditory and kinesthetic sensory activity replicating authentic learning environments that lend themselves to "interact with their environment by exploring and manipulating objects, wrestling with questions and controversies, or performing experiments" (p. 442). Replicating authentic learning situations (context), students become better equipped to connect academic concepts to meaningful real life situations. The connection of context to concept increases brain activity and comprehension (Sylwester, 1997). Solomon and Wiederhorn (2000) surveyed public schools in 27 states. Results indicated 64.2% of K - 12 students became "more engaged learners due to technology [while] 42.9% gained a deepened understanding of academic subjects and 22.1 % got better grades or test scores" (p. 8).

Problem-solving and procedural activities are the primary cognitive processes associated with computer-based learning. Curriculums sensitive toward integrating appropriate technologies have been found to encourage deeper forms of understanding within and across disciplines by providing a cooperative environment in which the learner can "apply knowledge to problems...control their learning, learn from others and develop reflection in action and reflection on actions as metacognitive skills" (Jonassen, Mayes, & McAleese, 1993, p. 3). Quality educational software programs have the ability to promote logical and procedural thinking by breaking down problem solving into smaller manageable components. "Technology-based environments support knowledge construction by providing thinking tools or cognitive learning tools [such as] database managers, semantic networking programs, hypertext, spreadsheets, expert systems, and microworlds" (Jonassen, Mayes, & McAleese, 1993, p. 4). Hopson (1998) analyzed quantitative data collected on 80 sixth grade and 86 fifth grade students to ascertain if a technology-enriched classroom had any influence on student development of higher-order thinking skills. Results indicated instructional technology promoted and encouraged the "development of the higher-order skill of evaluation. Technology was the tool that allowed students to move beyond knowledge acquisition to knowledge application" (Hopson (1998, p. 28). Peck and Dorricot (1994) found "[technology] tools engage students in focused problem solving, allowing them to think through what they want to accomplish, quickly test and retest solution strategies, and immediately display the results" (p. 13).

Technology as a National Agenda for Public Education

Seventeen years ago, *A Nation at Risk* (United States Department of Education, 1983) addressed the need for secondary students to take a computer course prior to high school graduation. Standard course work emphasized programming in BASIC. Computer literacy was rarely considered in preservice education curriculum. Five years ago, the federal government committed to connecting every public school and classroom to the Internet by the year 2000. Today, The Department of Education officially views technology as a change agent for public school systems. Clinton (2000) announced to the nation that all classrooms must be connected to the Internet. More than "half of them are. And 90 percent of our schools have at least one Internet connection" (p.5). The goal was to ensure 100% of the nation's schools would be brought up to building standards that can allow Internet connection and get students into "high-tech classrooms" (p. 5).

Student - computer ratios in K – 12 classrooms have become an indicator of the pervasiveness of technology in public schools. The President's Committee of Advisors on Science and Technology (Panel on Educational Technology, 1997) suggested a reasonable ratio of four to five students per computer in the nation's schools. Research shows the ratio declined last year "from 26.5:1 [in 1998] to 11:1 [in 1999]"...[and] the percentage of computers not being used in public school classrooms declined from 5.2% [in 1998] to 4.7% [in 1999]" (Solomon & Wiederhorn, 2000, p. 64).

The federal government has become adamant about closing the digital divide between those who have computer access and those who do not. A few years ago, the Office of Educational Research and Improvement (United States Department of Education, 1993) began to address technology equity issues:

> In the case of several schools serving students from low-income homes, technology innovators stressed the importance of giving these students the technology tools that would equip them to compete with children coming from more affluent homes where technology is commonplace. (p. 16)

An emphasis on connecting libraries and classrooms to the Internet spearheaded a national crusade. A federal budget was set in place this year to create "technology centers in 1,000 communities to serve adults" and to ensure "all new teachers are trained to teach 21st century skills and it creates (Clinton, 2000, p. 12).

The National Educational Technology Standards (NETS, 2000) project and International Society for Technology in Education (ISTE, 2000) recently developed standards for the educational use of technology. The National Council for the Accreditation of Teacher Education (NCATE, 2000a) has also adopted these technology standards in one or more indicators reflects

> commitment to preparing candidates who are able to use technology to help all students learn; it also provides conceptual understanding of how knowledge skills, and dispositions related to educational and informational technology are integrated throughout the curriculum, instruction, field experiences, clinical practice, assessments, and evaluations. (NCATE, 2000b, p. 3).

Technology in Inservice Teacher Education

The National Commission on Teaching and America's Future (1996) findings led to the development of a public school reform strategy centered on the classroom teacher. "What teachers know and can do is the most important influence on what students learn" (p. 6). Aligning this reform strategy with technology integration throughout the nation's K – 12 curricula is apparent. An emphasis on infusing technology into schools has prompted many inservice teachers to pursue restructuring classroom methodologies to make use of these new informational and instructional technology tools. Properly trained teachers make the difference between success and failure of a school's educational technology integration efforts (Siegel, 1995).

Dawson (1998) collected self-reporting data from 1,298 teachers from 53 elementary schools in southeastern Virginia. The school district commissioned the research to shed light on the dilemma of an existing "mismatch between the amount of money spent on computers and the nature of their instructional use suggest[ing] that teachers must be better prepared to use computers in instruction" (p. 1). To further underline the economic importance of teacher training, researchers Solomon and Wiederhorn (2000) found approximately 4.5% of [school] computers were not used…often because teachers are not trained to use them" (p. 9).

Expensive equipment gathering dust in the back of classrooms because of lack of inservice teacher professional develop is both an academic and financial waste of resources. The United States Department of Education (2000a) surveyed 2, 019 full-time public school teachers. Teachers were asked to report their feelings of preparedness to use computers and the Internet for classroom instruction. Survey results showed only 10 % felt "very well prepared" and 23% felt "well prepared"

(p. 88). Feelings of preparedness are especially significant. Learning technology even under the best circumstances can pose an ominous challenge in a couple of ways: (a) teachers are likely to ignore technology if they lack confidence to integrate new technology methodologies into their curriculum (Siegel, 1995) and (b) the challenge of learning technology may be threatening to most teachers "...because it represents a journey into the unknown, and they know they are inadequately prepared" (Fisher & Dove, 1999, p. 1339). In a United States Department of Education (1998a) sponsored longitudinal case study of nine school sites attempting to use technology in accordance with their respective school's curriculum reform agenda, investigations revealed how the immediacy of enormous information technology resources on the Internet challenged teachers' knowledge base beyond their comfort zones and put them into the position of becoming learners again.

Wenglinsky (1998) released data describing technology uses among the 6,627 fourth graders and 7,146 eighth graders who took the 1996 National Assessment of Educational Progress mathematics tests. Research on technology's effectiveness in teaching math corroborates what many educators have optimistically suspected: Computer use can improve student mathematics. Findings indicated, "professional development is positively related to higher-order thinking, suggesting that teachers who are knowledgeable in the use of computers are more likely to use them for higher-order purposes" (Wenglinsky, 1998, p. 19). In both the 4th and 8th grades, students whose teachers had professional development in computers outperformed students whose teachers did not. As a result, teacher professional development and student higher-order thinking are "both positively related to academic achievement" (Wenglinsky, 1998, p. 3). Eighty-one percent of the 4th grade teachers and 76% of the 8th grade teachers had received professional development within the past five years. Also, teachers who received any amount of professional development with computers within the past five years were more likely to use computers to build on student higher-order thinking skills than teachers who had not received such training. Consequently, effective integration of technology into classroom curriculum played an important role in student success.

Professional development is only as effective as the scope and sequence of the inservice curriculum. The 1995 Office of Technology Assessment (United States Office of Technology Assessment, 1995a) report found professional development more likely to be effective when it encourages teachers to participate in their own authentic learning rather than supplying them with prepackaged information or training. Yet, a nationwide survey on teacher training found 66% of staff development technology workshops were geared toward application rather than on how to use technology as a tool to expand curriculum (Siegel, 1995). "Teacher inservice has to model how to use the technology in the teaching and learning process. The idea is not only to teach them how to use the hardware and software, but how to integrate it seamlessly into the curriculum. Otherwise, it doesn't work" (Siegel, 1995, p. 34).

Dooley (1999) studied three schools noted for their interest in school restructuring and their innovative abilities. All levels of technology using teachers were surveyed on both technology implementation concerns and their decisions to integrate technology into their respective classroom curriculum. Dooley established successful technology growth "depended on the willingness of the *change facilitators* to understand and collaborate with the teachers in developing training and in-service programs to address their needs" (p. 11).

Two recent studies concluded that many times successful inservice technology training involves a slower methodology to become successful. First, Hobbs (1998) researched 26 New England K – 12 teachers after they completed a pilot media literacy Master's Degree program. Their media literacy emphasis was chosen as a way to develop higher-order cognitive skills by means of integrating educational technology into classroom curriculum methodology. These graduating teachers immediately began teaching peers how to integrate media literacy into the curriculum at all grade levels in their respective schools. Second, Dooley, Metcalf, and Martinez (1999) executed a naturalistic study of 13 teachers to determine the role of professional development and training in the adoption of computer technology and telecommunications in a small school district. After a series of eight formal instructor-led technology workshops complete with participant follow-ups, the interview process began. Data indicated

> formal training is obviously necessary …[however,] teachers training teachers works best, but takes longest. For this school, informal training was most

> effective. The peer pressure and informal network of placing technology experts on each team will enable the low users to gain knowledge and skill, without becoming angry because it is forced upon them. If training is initially directed to those who are interested and motivated, these teachers can train the other teachers. (p. 12)

Technology in Preservice Teacher Education

In the coming decade, the nations' public schools will hire approximately 2.2 million new K-12 teachers (Riley, in Morsund, 1999, p. 5). A large proportion will be recent teacher certified graduates. Teaching institutions are being continually challenged to restructure preservice teacher curriculums to incorporate the essential technology skills training and to provide practical skills application in authentic classroom teaching situations. However, research indicates that numerous schools of education have a long way to go before they are able to train preservice teachers adequately to use technology efficiently and effectively in their classroom instruction (Barksdale, 1996). Reasons for the academic gridlock are multifaceted.

Queitzsch (1997) surveyed 54 Northwest schools /colleges of education (serving 20,500 undergraduate preservice teachers) and discovered major technology concerns directed toward faculty curriculum integration and student field placements. When asking the deans of these educational institutions how well technology was integrated into their preservice teacher education courses, 10% of respondents answered *Very Well*, 38% answered *Well*, 35% answered *Fair*, and 13% answered *Poor* (p. 9). Twenty-one respondents pointed to integration as a major challenge. "Consistency in the ability of faculty to integrate technology within given schools was another concern. While some faculty have a good grasp of technological concepts and are willing to integrate it into their courses, others in the same department do not" (p. 10). Time and motivation were the largest stumbling blocks for education faculty, while a lack of training was a major concern of 64% of respondents. Contributing factors included a "lack of faculty preparedness, inability of faculty to remain up-to-date, [and] disagreement over how technology should be addressed as an integrated subject" (p. 10).

Even though the majority of preservice teachers accept the importance of integrating technology into K – 12 classroom curriculum, finding the appropriate integration methodology for effectively infusing constantly changing technology into teacher certification curriculum is sometimes elusive. For instance, Medcalf-Davenport (1999) surveyed preservice and student teachers' beliefs, attitudes, and preparation regarding instructional technology classroom curriculum uses and integration. All participants from several San Antonio School districts and St. Mary's education program believed "technology for educational purposes helps students learn, makes students and teachers more efficient, and is important in schools" (p. 1427). However, their comfort levels with the newest technologies rated "sharply lower" than with common classroom overheads, VCR, tape recorder and video camera (p. 1426). A majority of participants rated their lowest comfort level to equipment maintenance and troubleshooting.

> They wanted to be able to use technology, integrate it into the curriculum, view it as an assistive tool, they just do not know how, feel uncomfortable with

> making sure it will work properly, and have not been trained in the most current uses. (Medcalf-Davenport, 1999, p. 1427)

Additionally, the University of Missouri, Columbia School of Education recently completed a three-year longitudinal study of the effects of a reformed teacher education program on the class of 2001 found:

> The teacher education class of 2001 expects to have technology in their classrooms when they begin teaching – with expectations ranging from overhead projectors to laptop computers for every student. Nearly all expect to have at least one or two computers in the classroom. But most do not expect to have what we may call a high-tech classroom. They expect to use the web for researching ideas and resources for lessons, word processors for typing up class handouts, and email for staying in touch with family, friends, and colleagues. But relatively few can envision how they might engage students in learning activities using computers in the classroom. (Poole and Laffey, 2000, p. 40)

According to Thomas, Larson, Clift, and Levin (1999) technology is best infused in all preservice education coursework and the "autonomous course model" subtly promoting learning technology applications is "not valued by students" and they were "seldom able to incorporate technology into their own curriculum" (pp. 4 - 5).

The importance of modeling is noted by See (in Mitchell & Hutchinson, 1998) in the second of his four phases for successful teacher training in technology. "Teachers must… see how to *integrate* technology before they are ready to *refine* what and how they teach" (p. 2). Students deserve teachers who model the best that technology can bring to learning (Queitzsch, 1997; Jinkerson, 1995; Kortecamp, 1995;

Topp, Thompson, & Schmidt, 1994). The Office of Technology Assessment (United States Office of Technology Assessment, 1995b) study reports:

> The majority of teacher education faculties do not model technology use to accomplish objectives in the courses they teach, nor do they teach students how to use information technologies for instruction. Seldom are students asked to create lessons using technologies or practice teaching with technological tools (p. 165).

And, yet, five years later, a National Survey on Information Technology in Teacher Education commissioned by the International Society of Technology in Education interviewed education faculty about how often preservice teachers were "exposed to technology in their classes, field experience, and curriculum materials. The majority of faculty-members revealed that they do not, in fact, practice or model effective technology use in their classrooms" (Milken Foundation, 1999, p. 2).

Since educational technology is considered a vehicle for transforming education, schools of education must continue a concentrated effort to prepare preservice teachers in effective implementation of classroom technology applications. K - 12 students cannot become computer literate if their classroom teachers are not computer literate (Espinoza & Chin, 1996).

Technology: Student Teaching Field Experience

Student teaching has consistently been identified as the most significant element in the teacher preparation process (Guyton & McIntyre, 1999; Borko & Putnam, 1997). It is a time of transition from academia to apprenticeship.

Roddy (1997) found that prior to the student teaching field placement, student teachers are academically preconditioned to the traditional lecture, reflection, and cooperative learning model. Teacher educators using this model hopefully prepare education students toward molding future professional teaching philosophy and methodology. By nature, the student teaching practicum, an experiential world defined by a cooperating teacher's classroom and the school site, places student teachers into an entirely dissimilar learning situation often disconnected from educational theory. Therefore when "faced with an experience that requires action, they [student teachers] turn to their cooperating teacher for advice" (Roddy, 1997, p. 7).

Calderhead (1988) found that in the field placement experience student teachers are likely to "adopt the beliefs and practices of their cooperating teachers, rather than their university professors" (p. 35). Wetzel and McLean (1995) are of the same conviction. Richardson-Koehler (1988) studied 14 elementary student teachers and found that student teachers often "abandon what they have learned in teacher education courses in as little as two weeks. Rather than working to apply what they learned, they adapt and replicate the practices of their cooperating teachers" (p. 30).

Accordingly, cooperating teachers adopt the role of facilitator or resource within the context of the field experience rather than the role of lecturer or grader education students are more likely to have experienced in their previous academic coursework (Merriam, 1993).

Collaborative Learning

The unique learning experience incurred during student teaching requires the facilitator [cooperating teacher] to build a "psychological climate of mutual respect, collaboration, trust, support, openness, authenticity, pleasure, and humane treatment" (Pratt, 1993, p. 19). Collaboration and rapport "climate-building, [becomes]...integral to the personal relationship that develops and continues" between the cooperating teacher and the student teacher (Pratt, 1993, p. 19).

Borko and Putnam (1997), researching dynamics between preservice teachers and their cooperating teachers within the context of the field experience classroom, characterize the supervision and training semester as a "cognitive apprenticeship" (p. 41). Classroom contexts provide student teachers with participation in authentic, meaningful activities and "through social interaction focused on their participation... [cooperating] teachers assume the rolc of *masters* who model *expert* performance and guide students' participation through coaching" (p. 41). The cognitive apprenticeship assists in building conceptual teaching models that student teachers can articulate and explore during their field experience. Learning relies on daily trial-and-error problem solving.

Integrating Technology

Traditional direct instruction methods, though still effective for some skills, have been giving way to computer integrated student-centered curriculum. As technology-enhanced learning gains momentum in the national K – 12 educational agenda, it becomes more important that student teachers work together with educators who effectively model and coach this teaching approach. “We teach as we were taught, therefore teachers rarely see examples of technological integration into the curriculum after which they can model their own teaching” (Davenport in Medcalf-Davenport, 1999, p. 1425). Three studies make a case for technology integration being tied to the student teaching field experience.

Wild (1995) established that preservice teachers’ use of technology in their first year of teaching directly related to the cooperating teacher during field experiences. Within classroom context, the meanings student teachers build for integrating technology will most likely develop more deeply either with their gaining authentic experience or by viewing experiences via interpretive perspectives of cooperating teachers. “Supervising teachers in schools should be closely involved with designing IT [instructional technology] courses for pre-service student teachers” (p. 6). And the “superficial success of student-teachers…pleased to use the computer for creating good looking worksheets; or perhaps using the computer to displace some of the drudgery in compiling marks, grades and reports” (p. 3) were not considered a successful step toward student teacher integration of technology into classroom curriculum.

Carlson and Gooden (1999) compiled data from a two-year investigative survey into the ways 444 student teachers assimilated and applied technology in their classrooms. Barely “two-thirds of the student teachers reported that their supervising teacher ever used any of the [twelve] technologies listed in the survey except word processing" (p. 1316).

> Most technology is underutilized; therefore, student teachers have little opportunity to see it modeled in their college classroom setting by their university professors or in their practicum setting by their supervising teachers. If student teachers are not shown how to use technology they should not be expected to integrate it into their lesson plans. This encourages the continued underuse of tools that have a great potential to help students learn. (p. 1317)

Finally, Thomas, Larson, Clift, and Levin (1996) underscored the importance of student teachers' exposure to technology integration during field placement.

> Elementary student teachers whose cooperating teachers used the classroom computer strictly for parent news letters, lesson planning, assessment, and gradebook management were less apt to use the computer as a resource for curriculum planning or to explore other software for use with their students. (p. 6)

Field Placements

The schools of education field placement challenge is to place preservice teachers in technology-rich classrooms facilitated by competent technology-using cooperating teachers. Placements such as this are an utmost priority in establishing technology skills in future educators and their K - 12 students (Jinkerson, 1995). Queitzsch (1997) research of 54 participating education facilities found finding field placement classrooms capable of demonstrating adequate and consistent instructional technology integration a challenge. The study succinctly summarized the situation. "Even though placing students with technology-using teachers in technology-rich environments can provide valuable apprenticeships and can extend the quality and quantity of 'hands-on' technology experience for many teacher candidates, such placements are not always easy to find" (p. 3).

Taking the difficulty in placing student teachers with effective technology-using cooperating teachers, Brett, Lee, and Sorhaindo (1997) looked into an alternative technology integration learning method set in place at the restructured University of Miami teacher education program. The program required student teachers to attend six hours of instruction a week in a new field-based technology laboratory, then 12 hours field experience in a nearby elementary school. The goal was to link technology instruction with field experience via modeling and guidance while merging technology as an essential instructional classroom element.

Study results on 58 student teachers during the first year indicated only two students from all participant responses expressed an overall negative reaction to their field experience. In both cases, the students were frustrated working with teachers who did not provide them with enough opportunities to work with the children using technology. Major student experiences were synthesized as follows:

> The students often did not receive guidance or observe the teachers model the infusion of technology into the curriculum. Instead, the students had to devise plans of infusion....The students helped some of the teachers to become familiar with computers, overcome fears of technology, and recognize the importance of infusing technology into classrooms. (Brett, Lee, & Sorhaindo, 1997, p. 13)

Technology: Integration and Implementation Barriers

Barriers to technology integration take many forms within the walls of educational institutions. User time and availability were often entwined and redefined.

In fact, recent key findings by The United States Department of Education (2000a) study on the availability of computers and the Internet for instructional purposes in public schools found 78% of teachers felt they lacked adequate access to enough computers for their students. Eighty percent noted lack of time in curriculum schedules.

A sense of lack of time in the classroom produces pressures on teaching staff. Kane (1994) classified time as a coveted academic commodity. It was impacted by school district financial constraints that impinge on technology equipment availability as well as limited teachers' technology professional development time. Another time barrier is "rigid classroom schedules that do not permit students and teachers to use technology in productive ways" (p. 1).

Time and Training

Sheingold and Hadley (1990) researched inservice teachers and the time it took for them to integrate computers effectively into classroom practice. Data analysis established that the learning curve depended upon the sophistication of the chosen methodology. Drill-and-practice could be accomplished within a year time commitment. However, five to six years was not an unusual timeline for inservice teachers to become comfortable orchestrating student learning via technology supporting higher-order thinking skills, decision making, and collaboration.

Time and Access

Research conducted by Loehr (1996) surveyed 215 teachers in a large Colorado school district. Data indicated providing technology access was a major challenge and "convenient access to hardware and software at the teacher's disposal is a key factor influencing implementation to school districts....Almost 41% of respondents said that when they chose not to use technology in instruction it was because it was too great a hassle" (p. 5).

To put technology access into perspective, Cafolla and Knee (1995) spoke to the shortage of technology equipment availability in public schools.

> One is left to wonder how well pencils would be integrated into education if there were only 60 available per school! It may be that schools are so far from reaching a critical mass of technology that integration is not yet possible. The first teacher that becomes the building "expert" monopolizes the computers and other teachers are too intimidated to do more than just watch. (p. 2)

Time and Technical Support

Some teachers sometimes found educational technologists within school systems contributing to an element of technology refusal. Traditionally, teachers nurture student development via complex pedagogy while technologists are suspect of "reducing [classrooms] to an instructional delivery vehicle" – machine learning (Hodas, 1993, p. 16). Timely, competent, professional technology support is essential in all educational institutions. The following studies are representative of persistent technology integration and implementation barriers.

Thomas, Larson, Clift, and Levin (1996) conducted a three-year case study of student teachers working to infuse technology into their field placement experience. Qualitative data analysis emphasized the importance of support personnel during this important practicum. First, the importance of "readily available, consistent, and expert help ...in a non-threatening climate of support is essential for novice computer users and for continued sustained use of technology" (p. 3). And second, constant frustrations over "technical barriers" relating to repeated unreliable network connections eventually led to terminating any "desire and willingness to use technology" in the classroom (pp. 5 - 6).

Nantz and Lundgren (1998) pointed out the major amount of time teachers invest learning and adapting technology curriculum is often impacted by districts' technology support systems. Support system efficiency in the areas of (a) "routine maintenance and troubleshooting [by] skilled labor, (b) reasonable, clear, and available instructions for the use of technology, and (c) "timely procedures for getting help from a trained and responsive staff" is necessary to encourage continued use of technology in the classroom (p. 2).

Solomon and Wiederhorn (2000) reported a decline of 8.7% in the time it takes for technology problems to be fixed in the public school setting from the 1997 – 1998 academic year to the 1998 – 1999 academic year. The decline is viewed to be the issue of schools hiring more professional educational technologist support instead of relying on "school staff with additional responsibilities" to provide technical support (p. 64).

When working on technology-enhanced projects with elementary students, preservice teachers reported equipment imposing time pressures on their classroom teaching experience. Mitchell and Hutchinson (1998) found student teachers articulated frustration with computer freezes and slow downloading speeds for Internet sites.

> The value of access to good computer technology became very evident, especially in an elementary school environment. Elementary students' tolerance for idle time is very limited. The preservice teachers found how quickly they could lose their students' attention because of a lack of clear goals and objectives and computer glitches and downtime. (p. 7)

Summary

Even though we do not aspire to become a point and click generation, the presence of technology in society is an inevitable factor in the nation's learning environment. Computer technology's influence on the global society and on transmitting knowledge in the nation's educational institutions provides the nation with an impetus to improve upon good teaching practices already in place as well as contributing to shaping the most prepared teachers for every classroom.

No matter how exciting the technology appears to governmental and pedagogical visionaries on the surface, implementation finesse guides effective curriculum-driven change toward encouraging students to use the computer as a tool for problem solving and decision-making. Immediate feedback offered by today's technology assists evaluation procedures and encourages student awareness about their own thinking and learning processes – a step toward self-directed learning. On the other hand, technology-driven change toward fragmented computer application tasks and drill-and-practice reinforces traditional adult led teaching and learning educational practices seldom facilitating student decision making about their own learning (Goodlad, 1984). These practices often employ regurgitating facts without assimilating them into context and are as counterproductive as teaching by rote.

Multimedia capability of computer-assisted learning and instruction technologies correlate in ways to provide holistic learning environments encouraging student engagement in self-motivated learning and higher-order problem solving. Recent study results investigating these characteristics have proved useful in establishing technology tools as educational change agents.

Goodlad (1984) proposed that failure of education reform in the mid 20th century was primarily because the "movement never became linked to the structures and institutions preparing and certifying teachers" (p. 293). Teachers entering the classroom were not prepared to implement an innovative curriculum. Schools of education are fundamental in preparing preservice teachers to integrate instructional technology effectively into future classroom practice. The results of this educational process directly affect future K – 12 learning.

CHAPTER III

METHODOLOGY

> *A primary interest of qualitative-naturalistic [researchers] is describing and understanding... dynamic program processes and their holistic effects on participants so as to provide information for program improvement. (Patton, 1990, p. 52)*

Little evidence exists about what happens when technology users attempt to change non-technology users' behavior within the context of the student teacher - cooperating teacher relationship. As Creswell (1994) indicates, a qualitative methodology is called for when the theory base behind the study is "inadequate, incomplete, or simply missing" (p. 42). A foundational perspective of this research is that one must hear from school of education students and inservice teachers about what happens when technology users attempt to change non-technology users' behavior.

Bjork (1991) suggests research methods evaluating technology-based learning in the classroom are weak. He recommends close observation over an extended period of time. Bjork also maintains the importance for educators to understand the fundamental beliefs and experiences about adapting to and the use of computer-based technology in the field. Teacher education is successful only to the extent that technology can find a niche in the cognitive and cultural milieus of preservice and inservice teachers.

A holistic description and explanation of this process (Creswell, 1998; Anderson, 1990; Merriam, 1988) through naturalistic inquiry and inductive analysis was selected. "In education, qualitative research is frequently called naturalistic because the researcher frequents places where the events [s/he] is interested in naturally occur" (Bogdan & Biklen, 1992, p. 3). For the purpose of this study, the definition of naturalistic inquiry was expanded to include Patton's (1990) interpretation – "Studying real-world situations as they unfold naturally; non-manipulative, unobtrusive, and non-controlling; openness to whatever emerges - lack of predetermined constraints on outcomes" (p. 40).

Moreover, qualitative researchers analyze their data inductively (Creswell, 1998; Patton, 1990; Bogdan & Biklen, 1992). Patton (1990) places the researcher in a self-imposed state of "immersion of details and specifics of data to discover important categories, dimensions, and interrelationships...begun by exploring genuinely open questions" (p. 40). Considering the inductive data analysis rationale provided by these three sources, the inductive process worked best in addressing the research questions posed in this naturalistic inquiry methodology design.

Qualitative research parallels deductive, hypothesis-testing requirements in that it exhibits data based "rigorous and systematic empirical inquiry" (Bogdan & Biklen, 1992, p. 43). The procedures set up a flexible periphery of methodological components that enables the researcher, a key instrument, to investigate in depth within the naturalistic context of the student teaching experience. Recording and reporting experiences by the researcher are correspondingly significant (Bodgan &

Biklen, 1992; Merriam, 1988). "The researcher must be involved in collecting virtually all the data and in interpreting, analyzing, and recasting the issues and questions as data unfolds" (Anderson, 1990, p. 161).

This study fits the profile of a qualitative case study since its main concern is an interpretation through "intensive, holistic, description and analysis" (Merriam, 1989, p. 21) of behavior within the context of the student teacher - cooperating teacher relationship.

> Case study methodologies might focus on what happens to an individual or perhaps to an individual classroom setting. Case study methodologies are typically eclectic and combine some of the elements of ethnographic research, program evaluation and descriptive methods. (Anderson, 1990, p. 112)

Bogdan and Biklen (1992) found that the qualitative approach to research is particularly useful in teacher-training programs because "it offers prospective teachers the opportunity to explore the complex environment of schools...[and become] more aware of how they participate in creating what happens to them" (p. 219). Due to this rationale and because of the intricacy in directing this inquiry, the research was also particularistic in nature. Particularistic case studies, as defined by Shaw (1978), "concentrate attention on the way a particular group of people confront specific problems, taking a holistic view of the situation" (p. 11).

RESEARCH QUESTIONS

The research objective of this inquiry is to identify commonalties in the student teaching field placement experience that may inhibit and/or contribute to their implementation of computer-based technology in the classroom. Research questions are outlined in the form of a grand tour question followed by sub-questions (Miles & Huberman, 1994; Spradley, 1979; Anderson, 1990). These questions are purposefully open-ended. Bogdan and Biklen (1992) state (a) good questions that organize qualitative studies are not too specific (p. 62), (b) they will attempt to portray some of the terrain [the study] will examine (p. 77), and (c) the researcher encourages the subject to talk in the area of interest and then probes more deeply, picking up on the topics and issues the respondent initiates (p. 97).

Grand Tour Question

How can schools of education successfully merge instructional technology theory with classroom practice?

Sub-Questions

1. What forms of support are essential in assisting student teachers in incorporating computer-based technology into their teaching?
2. What themes or patterns, if any, emerge in student teachers' instructional technology classroom approaches from this semester observation?
3. What effects do instructional technology using educators have on non-instructional technology using educators?
4. What effects do non-instructional technology using educators have on instructional technology using educators?

As a primary method of examining a research question, qualitative research employs interviews "in conjunction with observation, document analysis, or other techniques" (Bogdan & Biklen, 1992, p. 96). In an attempt to gather data in the participant's own words so that the researcher could develop insights on how subjects interpreted their own experiences pertaining to specific aspects of the study (Anderson, 1990; Bogdan & Biklen, 1992; Patton, 1990), interviews were conducted with both preservice teachers and cooperating teachers. These interviews were designed to encourage participants to talk about personal attitudes, insights, and experiences and used a modified general interview guide approach as outlined by Patton (1990):

> This approach involves outlining a set of issues that are to be explored with each respondent before interviewing begins. The issues in the outline need not be taken in any particular order and the actual wording of questions to elicit responses about those issues is not determined in advance. The interview guide simply serves as a checklist during the interview to make sure all relevant topics are covered [and]...presumes that there is common information that should be obtained from each person interviewed, but no set of standardized questions are written in advance. The interviewer is thus required to adapt both the wording and the sequence of questions to specific respondents in the context of the actual interview. (p. 280)

Modification of the general interview is an inclusion of open-ended informal conversational interviews combined with observation experiences. It is a major tool permitting the researcher to comprehend participants' reactions to what is happening within the context of the observational experience. "This approach is particularly useful where the researcher can stay in the setting for some period of time so that [s/he] is not dependent on a single interview with a respondent" (Patton, 1990, p. 281).

Prior to participating in any interview, questionnaire, and/or observation, case study participants were required to read, agree to, and sign The University of Montana Liability Statement Consent Form. (see Appendix B).

PARTICIPANT SAMPLE SELECTION

Participants for this case study consisted of three preservice elementary education student teachers enrolled in their final student teaching semester and their respective cooperating teachers. Bogdan and Biklen (1992) state:

> Some researchers, prior to the study, decide on the number of the subjects they know they will have time and resources to interview. They develop a theory based on that number, making no claim for inclusiveness of their work. (p. 71)

Patton (1990) is in agreement:

> There are no rules for sample size in qualitative inquiry....In-depth information from a small number of people can be very valuable, especially if the cases are information rich. A qualitative sample size only seems small in comparison with the sample size needed for representativeness when the purpose is generalizing from a sample to the population of which it is a part. ...The validity, meaningfulness, and insights generated from qualitative inquiry has [sic] more to do with the information-richness of the cases selected than with sample size. (p. 185)

Qualitative inquiry "typically focuses on depth on relatively small samples, even single cases (n = 1), selected purposefully" (Patton, 1990, p. 169). Sample selection for this case study was purposeful and criterion-based.

> This type of procedure is "based on the assumption that one wants to discover, understand, gain insight; therefore one needs to select a sample from which one can learn most. (Merriam, 1988, p. 48)

The logic of criterion sampling is one in which the researcher develops a list of necessary attributes and identifies participants that match (Patton, 1990). The strength of using purposeful sampling is the ability of selecting information-rich cases from which detailed data can be collected. "You chose particular subjects to include because they are believed to facilitate the expansion of the developing theory" (Bogdan & Biklen, 1992, p.71). Patton (1990) concurs:

> The logic of purposeful sampling is quite different from the logic of probability sampling. ...The sample must be judged in context – the same principal that undergrids analysis and presentation of qualitative data. Random samplings cannot accomplish what in-depth, purposeful samplings accomplish, and visa versa. (p. 185)

Accordingly, preservice teacher participants were selected purposefully because they met the following criteria: (a) successfully completed the School of Education elementary block program and (b) were classified at a technology literacy proficiency level by their university educational technology instructor, School of Education field placement director, and methods instructors. Cooperating teacher participants were selected purposefully because they met the following criteria: (a) ranked at a specific technology literacy level by their school principal, (b) worked in the study site Building 1, and (c) were willing to work with student teachers.

The Foundations in Technology questionnaire was used to classify technology literacy proficiency levels of specific individuals considered for the case study. (see Appendix C). University educational technology instructors and the field placement director and / or school site principal evaluated each prospective candidate's technology proficiency. Responses were recorded using a five point continuous rating scale (from 0 – 4) with values ranging from "Not at all" to "Very much." The questionnaire also included an "Additional Comments" section for the evaluator to address items not embedded in the instrument. Three technology areas were rated:

(a) Basic Computer/Technology Operations and Concepts, (b) Personal and Professional Use of Technology, and c) Application of Technology in Instruction. (see Table 1).

The development of the instrument was accomplished in three stages; (a) a review of national surveys to refine the list of technology competencies, (b) a pilot study of C&I 306 students in the Spring 1999, and (c) a final review of the questionnaire by the dissertation chair. The National Survey on Information Technology in Teacher Education by the International Society for Technology in Education (ISTE, 1999) and International Society for Technology in Education Recommended Foundations in Technology for all Teachers (ISTE, 1998) guided this instrument's structure. (see Appendix C).

Table 1: Technology Literacy Proficiency Classification Rating Scale

Accumulated Points	Technology Proficiency Classification
88.00 - 70.40	Proficient technology literate
70.30 - 61.60	Nearing proficient technology
61.50 - 52.80	Novice technology literate

A quantitative study by Christensen & Knezek (1999) found:

> The general trend appears to be that preservice teachers are entering the profession relatively comfortable with technology, compared to their inservice peers...Such trends imply that a 'buddy system' in which new teachers instruct veterans on information technology skills, while experienced teachers instruct novices on classroom management and teaching technologies might serve to benefit both groups. (p. 1320)

Carlson and Gooden (1999) also agree on similar pairings. Based on these two findings, this case study placed participants into the following "buddy system" configuration:

- *Pair A*: Instructional technology proficient student teacher with a novice instructional technology literate cooperating teacher.
- *Pair B*: Novice instructional technology literate student teacher with a nearing proficient instructional technology literate cooperating teacher
- *Pair C*: Nearing proficient instructional technology literate student teacher with a proficient or an advanced instructional technology literate cooperating teacher. (see Table 2).

Table 2: Proposed Participant Pairing Configuration

Participants	*Pair A*	*Pair B*	*Pair C*
Student Teacher	Proficient	Novice	Nearing Proficiency
Cooperating Teacher	Novice	Nearing Proficiency	Proficient

THE STUDY

This naturalistic case study was an exploration of what student teachers learn about practical classroom instructional technology applications within their elementary field placement. The study included underlying influences on student teachers implementing instructional technologies in their classroom practice.

In education, naturalistic inquiry is synonymous with exploratory characteristics of qualitative research (Bogdan & Biklen, 1992; Merriam, 1988). No predetermined course is "established by or for the researcher" (Patton, 1990, p. 71). Study site settings are usually places where participants naturally go to execute what the researcher is investigating (Bogdan & Biklen, 1992; Patton, 1990; Merriam 1988).

Since this naturalistic inquiry is inductive, themes and / or patterns may emerge during data collection and analysis phase of the research (Creswell, 1994). Therefore, the researcher incorporated "purposeful strategies instead of methodological rules [and] inquiry approaches instead of statistical formulas" (Patton, 1990, p.183).

> In keeping with the qualitative transition of attempting to capture the subjects' own words and letting the analysis emerge, interview schedules and observation guides generally allow for open-ended responses and are flexible enough for the observer to note and collect data on unexpected dimensions of the topic. (Bogdan & Biklen, 1992, p. 77)

Biographical Phase

The first phase of the case study was biographical in nature. Participating preservice and cooperating teachers participated in an informal interview early in the student teacher's field placement experience. The informal interview introduced the study and allowed the researcher to better understand each participant's interests and concerns regarding the study. Interviews will were used throughout the semester to gain some perception into what teaching and computer-based technology signified to each participant.

Interview questionnaires were used to acquire data concerning participant technology backgrounds, comfort level, and attitudes. Anderson (1990) states "questionnaires may be used to collect self-report data on attitudes, preferences or background information" (p. 124).

Preservice teacher interview questionnaire protocols used to form individual technology biographies can be found in Appendices D, E, F, and G. Cooperating teacher interview questionnaire protocols used to form individual technology biographies as well as a sense of their instructional technology preparedness can be located in Appendices H and I. A summary of these Appendices appears in Table 3.

Observational Phase

Researchers "go to the subjects and spend time with them in their territory.... These are the places where subjects did what they normally do, and it is these natural settings that the researchers want to study" (Patton, 1990, p. 41). Therefore, to better understand the participants' classroom experiences, student teachers were observed in their classrooms during the second phase of the study.

> One great strength of the observational method lies in the ease through which researchers gain entrée to settings. Because it is unobtrusive and does not require direct interaction with participants, observation can be conducted inconspicuously. (Denzin & Lincoln, 1998a, p. 89)

Videotaping was the primary observational resource. The video camera placement in the participant's classroom was far enough away from the student teacher and his / her elementary students to be as unobtrusive as possible and to capture the most complete representation of classroom technology activities with a wide-angle lens. Flexibility in capturing detail was facilitated with a zoom lens.

The first observation was conducted on the first week the student teacher took over the classroom from the assigned cooperating teacher. The middle two videotaped sessions were equally spread, as circumstances allowed, between the first and the last formal week of the student teachers' field placements (once in February, twice in

Table 3: Interview Questionnaire Summaries

Appendices	Summary
Student Teachers *Cooperating Teachers* APPENDIX C: Prior to Participant Selection	*ISTE Recommended Foundations in Technology for All Teachers* is a written questionnaire to establish technology skills ranking of student teachers and cooperating teachers prior to beginning of study.
Student Teacher APPENDIX D: Technology Biography *Cooperating Teacher* APPENDIX H: Technology Biography	To be completed before the student teacher takes over the classroom. These interviews will be used to collect self-report data on preparedness, background information, and help establish a biographical educational technology profile.
Student Teacher APPENDIX E: Technology profile APPENDIX F: Success/Challenge APPENDIX G: Technology Preparedness *Cooperating Teachers* APPENDIX I: Technology Preparedness	To be completed during the second month of student teaching. These interviews will be used to collect self-report data on attitudes, preferences, preparedness, and/or background information. This interview will further establish an educational technology profile.
Student Teachers APPENDIX J: Future implications *Cooperating Teachers* APPENDIX K: Future implications	Reflective questions are to be addressed after the student teacher field experience ends.

March, and once in April). All videotaped observations were subject to student teacher classroom schedule demands.

The observer remained as non-participatory as research conditions allowed. “In general, …‘naturalistic research’, is ‘noninterventionalist’ in form, in contrast to experimental inquiry. Events such as schooling, curricular approaches, or classroom interaction occur 'normally,' and the investigator observes and interprets them" (Smith, 1990, p. 258).

The principal objective of this observational phase was gathering first hand information necessary to furnish detailed student teaching methodology accounts (Denzin & Lincoln, 1998b; Creswell, 1994; Anderson, 1990). Merriam (1988) also suggested the necessity of first hand informants in providing "thick description, …the complete, literal description of the incident or entity being investigated" (p. 11). Observational strategies and the comparison of the results of observations contributed to establishing common theoretical strands.

Reflection and Comparison Phase

The third phase of the case study entailed reflection and comparison. Student teachers and cooperating teachers were asked about their involvement with technology following their student teaching semester. (see Appendix J and Appendix K). Additionally, the School of Education Summative Assessment of Student Teaching form completed by the cooperating teacher and university supervisor was studied for each student teacher for any pertinent commendations (strengths) and recommendations (weaknesses).

The fourth and final phase of the case study is defined in Data Analysis.

NATURALISTIC STUDY

The naturalistic researcher does not maintain that knowledge gained from one context will have relevance for other contexts or for the same context in another time frame (Mathison, 1988; Lincoln & Guba, 1985). A naturalistic study, unlike quantitative research, requires that findings not be generalized to a population.

Generalizability

"The production of generalizable knowledge is an inappropriate goal for interpretive research" (Merriam, 1988, p. 175). Bodgen and Biklen (1992) also agree with this point. By selecting a naturalistic observational case study approach, the researcher sought to investigate student teachers' experiences in particular depth, not to find what is "generally true of the many" (Merriam, 1988, p. 173). As a rule, qualitative studies focus on "deriving universal statements of general processes rather than statements of commonality between similar settings such as classrooms" (Bodgen & Biklen, 1992, p. 44). "Generalizability is ultimately related to what the reader is trying to learn from the case study" (Kennedy, 1979, p. 672).

A traditionalist could argue that qualitative case study findings "may not be generalizable to other settings of the same substantive type" (Bogdan & Biklen, 1992). However, transferability is more relevant in a naturalistic study.

Transferability

Transferability "replaces usual positivist criteria" (Denzin & Lincoln, 1998b, p. 27). Purposive sampling is a transferability strategy. In contrast to random sampling that is usually done in quantitative research to gain a representative picture through aggregated data, naturalistic research seeks to maximize the range of specific information that can be obtained from and about that context by purposely selecting locations and informants that differ and "not facilitate generalization" (p. 202).

In a naturalistic study, the obligation for demonstrating transferability belongs to the reader of the study. When examining details of research results, methods, and theories, readers transfer or apply the information to personal context. Lincoln and Guba (1985) state that transferability in a naturalistic study depends on similarities between sending and receiving contexts. The researcher collects sufficiently detailed descriptions of data in context and reports them with sufficient detail and precision to allow judgments about transferability to be made by the reader. Skillful qualitative researchers provide full accounts characterized in accurate detail "so that anyone else interested in transferability has a base of information appropriate to the judgment" (pp. 124 – 125).

Lauer and Asher (1988) further maintain that the results of a case study are transferable if researchers "suggest further questions, hypotheses, and future implications [and] present the results as directions and questions" (p. 32).

Trustworthiness

Trustworthiness suggests the cogency of the research and the competence of the researcher ensuring that study findings are a product of the inquiry's focus and not the researcher's biases. A properly managed inquiry audit can be used to determine trustworthiness. An inquiry audit examines a researcher's data documentation and analysis procedures to determine whether it is compatible with the study's final analysis. If bias is not found, it allows the "assumption that what is left is the truth about what is investigated" (Mathison, 1988, p. 14). In this case study, an adequate data trail was assembled and documented, enabling any auditor in determining if the researcher's accounts, interpretations, and recommendations are supported.

DATA COLLECTION

In an effort to obtain in-depth understanding of this case study and aid in the elimination of bias, triangulation was used (Denzin & Lincoln, 1998a; Creswell, 1998; Yin, 1984; Patton, 1990; Bogdan & Biklen, 1992). Triangulation supports research findings with methods and sources independent of each other. This course of action assists in controlling researcher bias and establishing trustworthiness. The rationale for using multiple methods and data sources in this study was twofold:

- "The flaws of one method are often the strengths of another, and by combining methods, observers can achieve the best of each, while overcoming their unique deficiencies" (Denzin & Lincoln, 1998a, p. 308).
- Using many different sources of information, characterizing good case study research, provides "depth" to the study and is a "major strength" of case study research (Merriam, 1988, p. 69).

Observational research has a long and growing history in the field of education. Data gleaned from observations provide in-depth information and detail (Creswell, 1994; Brewer & Hunter, 1989). Denzin and Lincoln (1998a) explain, "Observers construct theories that generate categories and posit linkages among them....Observation [also] produces especially great rigor when combined with other methods" (p. 89). Participant observation "gives a firsthand account of the situation under study and, when combined with interviewing and document analysis, allows for a holistic interpretation of the phenomenon being investigated" (Merriam, 1988, p. 102).

In addition to classroom observation, a matrix of textual artifacts such as e-mail dialogue, cooperating teacher evaluations, and university supervisor evaluations were collected and analyzed. Casey and Roth (1992) and Merseth (1990) encourage electronic networking and maintain that it appears to strengthen student teaching experiences. Combinations of these textual artifacts have been traditionally employed to document teaching practices generally and to assess teaching quality specifically (Creswell, 1998).

Member checking was also used in data analysis (Stake, 1988). Informants and participants became essential to case study results by establishing credibility and validating the researcher's findings and interpretations. This was especially important in transcribed interviews. The peer reviewer, a fellow doctoral student in the School of Education, provided an external check throughout the research process by commenting on findings as they surface (Creswell, 1998; Creswell, 1994; Merriam, 1988). Qualifications for the peer reviewer included someone who was sensitive to the subject matter, detail oriented, and especially astute at synthesizing information into concise summaries.

DATA ANALYSIS

Inductive analysis is an "immersion in the details and specifics of the data to discover important categories, dimensions, and interrelationships... begun by exploring genuinely open questions rather than by testing theoretically derived (deductive) hypotheses" (Patton, 1990, p. 40). Data analysis, defined by Bogdan and Biklen (1992), is a systematic process involving searching and arranging data. The researcher can "organize them, break them down into manageable units, synthesize them, search for patterns, discovering what is important and what is to be learned, and deciding what [to] tell others" (p. 153). Miles and Huberman (1990) stress the importance of qualitative data analysis procedures: (a) "Data reduction – selecting, focusing, simplifying, abstracting the raw data," and (b) "Data display – arraying reduced data in a compressed, organized form" (p. 349).

Any patterns found in the data, such as descriptive themes and concepts, were organized and converted to coded categories for the analysis process (Merriam, 1988; Anderson, 1990; Creswell, 1998; Denzin & Lincoln, 1998a). "Conclusion drawing/verification [is] drawing meaning from reduced, organized data in the form of regularities, patterns, explanations, and testing them for plausibility, robustness, sturdiness, and validity" (Miles & Huberman, 1990, p. 349).

The analyses of data collected through qualitative methods were done both in the field as well as after the collection process were completed. "Several levels of analysis and interpretation are possible in case study research" (Merriam, 1988, p. 127). While in the field, questions guiding the study were continually reexamined based on themes that appeared as both interviews and observations were being done (Anderson, 1990).

> Data analysis will be conducted as an activity simultaneously with data collection, data interpretation, and narrative report writing….Simultaneous activities engage the attention of the researcher: collecting information from

> the field, sorting the information into categories, formatting the information into a story or picture, and actually writing the qualitative text. (Bogan & Biklen, 1992, p. 155)

The researcher incorporated coded data into a graphic holistic description of the processes that the preservice teachers and their respective cooperating teachers experienced while implementing computer-based technology in their classrooms. Creswell (1998) states, while "holistic design may be more abstract, it captures the entire case better than the embedded design" (p. 187). The resulting qualitative text was a "complete, literal description" (Merriam, 1988, p. 11) of the semester's classroom experiences. In a sense, "the major purpose of all qualitative research [is] to inform our deep understanding of educational institutions and processes through interpretation and narrative description" (Soltis, 1990, p. 249).

For years, educators and behavioral scientists have conducted quantitative research in order to compare the instructional effectiveness of instructional media. Focus has usually been on comparing traditional teacher-mediated learning with educational technology as either a substitute for or supplement to the teacher (Cuban, 1986). However, during the past few years there has been increased attention to the value of qualitative research and the methods for conducting properly designed inquiries executed in a rigorous manor.

One significant factor of this study was to qualitatively identify commonalties in the student teaching field placement experience within the context of the student teacher - cooperating teacher relationship that may inhibit and / or contribute to their appropriate implementation of computer-based technology in the classroom - a step toward assisting schools of education in successfully merging instructional technology theory with classroom practice in an effort to help teachers, not a step toward replacing them.

> Real people (who have both work and personal lives) can use qualitative knowledge to set new policies, to steer their day-to-day work, to decide where to allocate energy, and resources, to justify their work, to get added resources. And they can use qualitative knowledge to illuminate their own worlds, explore other worlds, delight themselves, reconsider who they are, fight off boredom, or lull themselves to sleep. (Miles & Huberman, 1990, p. 342)

Sustaining the pursuit to identify commonalties mentioned above, research now has available excellent discussions of issues of design (Creswell, 1994; Yin, 1989), data collection (Denzin & Lincoln, 1998a; Spradley, 1979), and analysis (Miles & Huberman 1994; Patton, 1990). Patton (1990) subscribes that there are three classical methods of generating qualitative data: reading (document analysis), talking (interviewing), and watching (observation). The general design of this qualitative research, while "needing to remain sufficiently open and flexible to permit exploration of whatever the phenomenon under study offers for inquiry" (Patton, 1990, p. 169), is a naturalistic case study incorporating all three classical methods.

CHAPTER IV

CASE STUDY RESULTS

I try to report what I observe and to offer an informed interpretation of those observations, my own or someone else's. (Wolcott, 1990, p. 131)

TEACHER EDUCATION DEMOGRAPHICS

School of Education: Department of Curriculum and Instruction

The School of Education identified in this study is fully accredited by the National Council for Accreditation of Teacher Education (NCATE), the Northwest Association of Schools and Colleges (NASC), and the State Board of Public Education. Certification/licensure is offered in elementary and secondary programs including certification in business and information technology education and office systems management. Master's and doctoral degree programs are also available at the graduate level.

For the purpose of this study, descriptions will be limited to the Department of Curriculum and Instruction Bachelor of Arts in Education degree and certification/licensure in elementary education. "[The] program features include integrated instruction by course clusters or blocks, faculty collaboration and student cooperative learning, multiple assessment strategies, developmentally sequenced field experiences, and university-school partnership activities" (Appendix L). Seven full, eight associate, and three assistant terminal degree professors comprise the tenure-track Curriculum and Instruction faculty.

Admission to the Teacher Education Program

The School of Education Certification program admits approximately 250 candidates each academic year. Eligible candidates must have at least sophomore status. Appendix L contains detailed School of Education admission criteria.

Teacher Preparation

Upon admission to the Teacher Education Program, usually at the start of the junior year, students are considered elementary education majors and are advised within the Department of Curriculum and Instruction. Students preparing to teach in elementary school complete a major in elementary education. "Applicants for state certification/licensure must: (a) satisfy all course, credit, and degree requirements, (b) pass a standardized test, (c) be at least 18 years of age), and (d) maintain a minimum GPA of 2.75 each semester" (Appendix L). Over the last three years, the department has graduated/certified an average of 208 elementary and secondary teachers combined. Student teachers participating in this study are expected to graduate in a class size of 210.

Instructional Technology requirements necessary for teacher certification include satisfying all course criteria for Curriculum and Instruction 306: Instructional Media and Computer Applications (C&I 306) and passing the technology component of both midterm and summative assessments in student teaching. Assigned university field supervisor and cooperating teacher are evaluators of the student teaching assignments. The technology component in both midterm and summative assessments asks if the student teacher:

> Uses a variety of technologies and resources to enhance instruction and student performance: a) consults with the cooperating teacher and various resource persons, b) develops and uses a variety of resources, c) matches appropriate technologies to lesson objectives, and d) has a knowledge of current technology and attempts to incorporate it in teaching. (University of Montana, 1999, p. 5)

Student Teaching Application

Application for student teaching practicum usually takes place at the end of the junior year or at least one full semester prior to student teaching. The Student Teaching Application may be viewed online at (http://www.umt.edu/education/departments/elementary.doc). Student teaching eligibility criteria include (a) full admission into the Teacher Education Program, (b) a grade of C or above in required certification coursework, (c) a minimum cumulative GPA of 2.75 in each field of certification/licensure, and (d) Director of Field Experiences authorization.

In addition, completion of required methods of Elementary Methods Block, an "integration of curriculum, modeling of cooperative learning and collaborative teaching, and developmental field experiences" (Appendix L), is necessary for elementary education majors. Elementary Methods Block is typically taken one semester before the student teaching practicum. The coursework requires concurrent enrollment in Curriculum and Instruction (C&I) 306, 309, 310, 311, and 300 or 301. (see Appendix L for detailed student teaching requirements).

Student Teaching Instructional Technology Coursework

In order to prepare new teachers for technology integration into their student teaching field experience, the Department of Curriculum and Instruction (C&I), preservice teachers are required to enroll in C&I 306: Instructional Media and Computer Applications. C&I 306 is a one-credit course that meets for two hours once a week. The course is an "introduction to the use of technology, media, and computer software application in instruction" (Appendix M) and offered every semester. The course curriculum is enhanced by a curriculum website for enrolled students (http://webback.educ.umt.edu/ci306b/).

Computer Science (CS) 171, C&I 183, or successful completion of computer competency examination is a course prerequisite for C&I 306. C&I 303 is also a prerequisite or co-requisite. School of Education faculty administer the computer competency examination. Over the last three years an average of 34 students per year passed the computer competency examination and C&I 306 prerequisite was formally waived. An average of 81 preservice teachers a year enrolls in the C&I 183 prerequisite course. (see Appendix M for detailed descriptions of each prerequisite or co-requisite course).

Curriculum and Instruction 306: Instructional Media Access

> *Technology Training Center (TRC)*: This dual platform lab contains 10 multimedia Macintosh computers and 10 Windows Multimedia computers...all of which are connected to the Internet. It has been designated as a High Tech Multimedia (HTMM) classroom because it is equipped with a Smart podium which controls an equipment rack which contains: two multimedia computers, one Macintosh and one Windows; a laserdisc player; a VCR; a CD audio

player; an audiocassette player; a document camera; and connections to both satellite and cable television. This lab also contains peripherals, such as a digital camera, a scanner, and a camcorder.

Curriculum Materials Center: Offers both print and non-print materials for educators to preview. Collection contains over 300 optical media and software titles...Two multimedia workstations are available for previewing materials or for technology tutoring. (Teacher Resource Center, 2000, p. 1) (see Appendix A for TRC details).

Curriculum and Instruction 306: Content

Purpose: To not only introduce students to a variety of technologies that they might use in classroom instruction but also to assist them in integrating the various technologies into their instruction.

Background: C&I 306 is designed to familiarize education majors with a variety of non-print media resources available for supporting instruction....A primary focus of this course is on utilizing resources that most effectively enhance the teaching and learning process.

Objectives: The student, while developing the skills and strategies appropriate to the use of educational technology, by the end of the semester will be able to:

1. Demonstrate basic operations of educational technology tools including camcorders, VCRs, CD-ROMs, laser discs, televisions, projectors and the ability to explain these operations to others.
2. Locate, select, evaluate, and use instructional software, Internet resources and other developmentally appropriate materials and resources appropriate to his/her area of specialization.
3. Become aware of a variety of telecommunications resources and techniques for retrieving, analyzing, interpreting, evaluating, synthesizing and communicating information and ideas.
4. Become familiar with the various aspects of instructional design and apply them to the production of instructional materials.
5. Design multimedia presentations for use at suitable grade levels and subject areas.
6. Communicate electronically with instructors and colleagues.
7. Plan a lesson using video sources.
8. Cite bibliographic resources properly. (Curriculum and Instruction 306: Instructional Media, 2000, p. 1)

The C&I 306 course addresses NETS and ISTE technology standards within sixteen weeks of coursework. (see Table 3 for a breakdown of weekly projects and standards).

Table 4: Curriculum and Instruction 306 Curriculum Schedule

Week	Topics for Discussion / Exploration	Technology Standards Addressed
1	Overview of course; file management, email basics; e-mail in the classroom	ISTE B. 3 NETS 4
2	Resources on the Internet; lesson plans; graphics; evaluation checklist; how cite resources	ISTE B. 3 NETS 5
3	School notes; calendar; reference tools; grade books	ISTE B. 1 NETS 5
4	*PowerPoint* Review; visual design; using Internet graphics	ISTE B. 2 NETS 3
5	*PowerPoint* - Add images from scanner or digital camera	
6	Media selection	ISTE C. 1 NETS 5
7	Elementary Methods Block in schools	ISTE A. 4 NETS 3
8	Planning a lesson using cable or satellite or video review guides in TRC	ISTE B. 7 NETS 4
9	Web page basics	ISTE B. 2 NETS 4
10	Web page - personal, informational, or instructional	
11	*HyperStudio* basics	
12	Audio and video capture	
13	Audio and video capture continued	
14	Lab time to work on *PowerPoint*, web page or *HyperStudio*	
15	Final Presentations with partner/Lab time	ISTE C. 3 NETS 4
16	Final Presentations with partner/Lab time	

(Curriculum & Instruction 306: Dynamic Schedule, 2000, p. 1)

FACILITY DEMOGRAPHICS

Elementary School History

This K – 8 school district serves as the second largest school district in the county. Its continual growth in student population, advancing ideas, and teaching strategies coupled with high test scores and awards gives it a national reputation of being one of the premier school districts in the area. The school has a reputation of one of the best and most progressive in the Pacific Northwest, especially in the area of technology.

The school district's physical plant is made up of three buildings. All building sites house three successive grade levels, each with its own principal, and an average of just over 400 students. Grades 3 – 5 are located in Building 1, a site documented as one of the first schools in the state. Building 1 hosted this study and one teacher from its 3rd, 4th, and 5th grades was a participant in this study. Building 2 accommodates kindergarten, developmental first, first, and second grades. Building 3, with grades six – eight, comprises the middle school, a National Blue Ribbon Recipient.

Student Population

Based on income, 35% of the students qualify for Title I Free or Reduced Lunch. The districts' student ethnicity is proportioned as follows: 4% Native American, 4% Asian, 1% Hispanic, 1% African American, and 90% European American. The K – 8 student population during this study was 1209. K – 2 class size averaged 20 students; grades 3 – 5 ranged from 24 – 28 students; and grades 6 – 8 ranged from 23 – 30 students. During this study, the 1999 -2000 school year student population in Building 1, grades 3 – 5, was over 400 with an average class size of 24.

Building 2

First and 2nd grade students partner with college counterparts from The University Center For Leadership Development. For the last two years, recycling and community pride clean-up day during Earth Week has become a part of their team building activities.

Building 2 also has several networked multimedia computers with access to a variety of computer-based learning applications in each classroom. Generally, students access computers from 15 to 30 minutes any given day. They learn computer skills while reinforcing the core subjects such as math and writing. Microsoft *PowerPoint*, *Word*, and *Excel* are the most used programs.

Sixth grade *Buddies* actively participate with K – 2 students each week. *Buddies* assist their younger partners in language arts and Internet research. They also tutor reading as well as read to students.

Building 3

The middle school, noted for its parental involvement, innovative curriculum and technology programs, is a National Blue Ribbon Recipient. Ever vigilant of educating its 6^{th} – 8^{th} grade students for the 21^{st} Century, Building 3 accommodates a fully automated computerized library system and a self-mediated vocational technology lab. A concise description of the vocational lab is located in the Building 1 Technology Access section of this chapter. The lab, with a strong emphasis on computer technology, gives middle school students the opportunity to investigate a myriad of careers throughout the semester. The library contains three public access terminals for searching collection data and Internet access through the computers.

Students and teachers also have access to a digital scanner and a CD-ROM burner in the library.

Staff

During the 1999 - 2000 school year, the school district employed 72 certified staff members. In addition to certified staff, 150 parent aides volunteered in classrooms to assist teachers and students every week.

The Building 1 principal is recognized at both state and national levels for his work in education and is currently serving as the Chairman of the Governor's Task Force on Technology. In recognition of his work in the field of education, he has received the state's Historical Citation of Merit Award, The University Distinguished Alumni Award, The International Reading Association's Presidential Service Award, and The National Distinguished Principal's Award.

The following comments regarding the Building 1 principal are participant responses from Appendix G and Appendix C Question 2: What role did the [principal] have in developing your attitudes toward technology used as a teaching tool?

- He has worked to provide solutions to tech deficits and to promote staff development (response to question in Appendix G)
- He helped initiate our whole technology program (response to question in Appendix G)
- He is a strong proponent of technology (response to question in Appendix C)

Curriculum

To date, no technology component exists in the elementary school's curriculum. A working draft to add technology component standards is currently in process. Overall, the school climate toward integrating technology into the curriculum is highly supportive.

Third grade students engage in learning about their relationship to the real world. Math prepares them to gather information, sort and classify, interpret information, make connections to math in daily life and other curriculum areas, as well as communicate mathematical ideas through justification and solution processes. Language arts skills further emphasize research materials, story mapping, sentence structure, drawing conclusions, and writing effectively. In life science, students learn about the role of living things in ecosystems–needs in relationship to their environments including adaptation, change, and response to population dynamics, cause and results of change in environmental conditions. Physical science focuses on forces, motion, and relevant tasks of simple machines. Historic inventions and identifying simple machines in everyday life are also included. This learning context encourages understanding systems, organization, and the form and function of design. Earth and space science highlights water and its relationship to geography, the water cycle, supply, and ecology.

The school website describes the 4^{th} and 5^{th} grade curriculum overview:

> *Fourth grade* is a time to focus on responsibility. This includes meeting deadlines for homework, preparing for tests, waiting their turn to speak, and

> learning to control outbursts and aggression at school. By the end of fourth grade, students should be able to multiply two and three digit numbers in mathematics as well as divide one digit numbers, work with fractions, mixed numbers, and common denominators. The main objectives of language arts are that children can write, edit, and revise all written assignments. They must know the parts of speech, and decipher between [sic] the different kinds of sentences. In reading, fourth graders are able to find and read books for both pleasure and research. We focus on the novel approach to immerse children in quality literature and work on coinciding skills necessary for this grade level. The social studies program encompasses each region of the United States. Continent names and locations are also focused upon. In science, the main themes covered are rocks and minerals, the solar system, animal behavior, and plants. Age appropriate personal hygiene subjects are covered along with acceptable social skills. (Grade 4, 2000, p. 1)
>
> All academic subjects are important, but in the *fifth grade* more emphasis is placed on independent reading and research. Fifth grade is a time to prepare children for middle school. It is important for them to take responsibility for their studies and behavior. In math, the focus is on fractions, decimals, analysis, problem solving and geometry. In language arts, spelling gets sharpened; reports get longer and writing diversifies. Reading materials become more complex. In social studies, the main events studied are prehistoric man through the Civil War. The science curriculum is covered by focusing on the use of the scientific method while collecting and gathering data. Issues such as resisting peer pressure, personal health, and sexuality are addressed in the fifth grade. (Grade 5, 2000, p. 1)

Cross-Age Tutoring

High-speed networked computers throughout Buildings 1, 2, and 3 make it possible to have standardized computer access in any classroom in the district. The technological benefit of this network configuration enhances cross-age tutoring within and among buildings. This tutoring program is referred to as *Computer Buddies*. Teachers find the *Computer Buddies* program to be a simple and valuable method to have older students work with younger students on classroom assignments. For example, first grade students send completed assignments to their fourth grade

Computer Buddies across the district network. Fourth grade *Computer Buddies* return corrected assignments back to the first graders. Assignments ranged from research, social studies, language arts, mathematics, and science to multimedia presentation design. Technology assisted cross-age tutoring showcased a cooperative learning with a 21st Century twist.

Building 1 Technology Access

Grades 3 – 5 teachers have a standard computer-based instructional technology toolkit at their fingertips. Instructional technology equipment is available in every classroom. (see Table 5). Students do not have to move to a computer lab for problem solving, research, and study skills. All computers are Windows platform. Fifth grade computers have CD-ROM drives. Each teacher is equipped with a personal use networked computer in his or her classroom. Students also have access to this computer station as well as four or five additional networked computers. Each classroom is equipped with a color printer.

Table 5: Classroom Instructional Technology Toolkit

Grade	3rd	4th	5th
Classroom Technology	Overhead projector Boom box Color printer Projection screen	Overhead projector Boom box Projection screen Color printer Website for parents & students	Overhead projector Boom box Projection screen Color printer Website for parents & students *AmericaQuest* Online Curriculum *Raging Planet* Online Curriculum

Teachers have access to the school server for bulk license purchased educational software, Internet access, and student project storage. Software purchase is the responsibility of the school technologist and purchased via bulk license. Software is located on the school server for classroom curriculum use. (see Table 6). *AlphaSmarts* are used in Special Services and for certain students. The addition of LCD wall panels for some classrooms is planned for the year 2001.

Table 6: Classroom Accessible Networked Software for All Grades

Abacus – Flash Cards	*Gizmos and Gadgets*	Microsoft *PowerPoint*
Bess Software	*Hot Dog Stand*	Microsoft *Word*
Compton's Home Library	*Knowledge Works*	*Multimedia Workshop*
Computerized Adaptive Testing	*L View Pro*	*Number Muncher*
Creative Writer	*Math Facts Tracker*	*Oregon Trail*
The Cruncher	Microsoft *Excel*	*Spellbound*
E-Mail Access	Microsoft *Explorer*	

All third, fourth, and fifth grade students attend keyboarding class once a week in a special computer lab module outside Building 1. This lab contains 30 older 286 networked computers that have been recycled and designated for keyboarding only.

Of the two computer labs located in the detached adjacent middle school building, one lab is accessible to all grades, including third, fourth, and fifth grade study participant pairs. A 1998 Northwest Regional Education Laboratory article describes this middle school computer lab:

> [There is] access to a sophisticated lab at the middle school next door, where students can experiment with real-world skills such as computer animation, robotics, broadcasting, rocketry, and Web page design. Field studies - an ongoing archaeological dig, for example, and a habitat study carried out jointly with the [university], the U.S. Forest Service, and [state] Fish, Wildlife, and Parks - provide more opportunities for linking technology to learning goals. (Sherman, 1998, p. 1)

Moreover, the school also developed a Computer Share Program sponsored by the Parent Teacher Association to provide technology to low-income families.

> The focus of this unique program is to assist children and families in obtaining recycled technology. Many children...go without technology because of economic restrictions. This creates a hardship for some students in that they are not able to word process at home and or use other computer applications... [The school's] PTA is rectifying this situation by asking parents and the community to donate their outdated working computers to the PTA so that computers can be given back to families needing practical technology in the home. (Building 1 Principal Personal Communication, September 28, 2000)

Inservice Training

Informal interviews with one cooperating teacher emphasized the challenge of involving traditionally entrenched teaching staff in integrating computer-based technology tools into their classroom curriculum. Many students are left out of technology assisted learning after a rich start in many lower grade classrooms. For example, after elementary students are promoted from 5th grade to the middle school, they may be placed with a teacher who has computers in the classroom but never uses them (Informal Interview, April 21, 2000).

School Administration Inservice Technology Program

A number of the school district's teachers attended local summer adult education courses on their own time to enhance their computer software applications knowledge base. The goal of these vocational courses and the elementary school administration's sponsored technology workshops are the same–to enable teachers to better use the technology they have readily available both in their classroom and the school's technology resource center (Jahrig, 2000).

Regardless of supportive objectives, some top down administrative technology implementation problems were noted by cooperating teacher participants. Electronic mail [e-mail] was not used at first until the administration announced that daily news would not be sent in hard copy. E-mail officially became the primary vehicle for school information. The result of this decision is that most everyone in the school district uses e-mail. However, a few teachers still prefer written and/or face-to-face communication (Informal Interview, April 21, 2000).

Pay-for-participation technology workshops are offered to teachers in order to promote integration of classroom technology. On occasion, teachers feel compelled to participate. It is not unusual for some teachers not to use any of the workshop information. Workshop schedules, especially school site summer workshops, often conflict with personal commitments and per diem attendance is not enough to draw a majority of teachers into attending during their personal time. One participant teacher speculated that some of the hesitancy to go to technology inservice might be related to some teachers feeling they are "being told what to do in their classroom" (Informal Interview, April 21, 2000).

COOPERATING / STUDENT TEACHER PAIR TECHNOLOGY PROFILES

Student teacher / cooperating teacher participant pairs were officially assigned to the study after considerable assessment from the School of Education field placement director, C&I 306 instructors, and the study site elementary school principal. Their respective C&I 306 instructors evaluated student teacher participants in order to determine individual technology literacy levels. Appendix C, Foundations in Technology, was used as the evaluation instrument. After careful consideration among the evaluators, study participants were placed into the pair configurations for their Spring 2000 field placement experience. (see Table 7). This differed from the proposed participant pairing configuration methodology. (see Table 2). A 4th pair, instructional technology proficient student teacher with a proficient instructional technology cooperating teacher, was added to the study.

Table 7: Study Participant Pairing Configuration

Participants	***Pair A*** **Pat & Gail**	***Pair B*** **Lynn & Anne**	***Pair C*** **Joshua & Peggy**	***Pair D*** **Max & Alex**
Student Teacher	**Pat** Proficient	**Lynn** Novice	**Joshua** Nearing Proficiency	**Max** Proficient
Cooperating Teacher	**Gail** Novice	**Anne** Nearing Proficiency	**Peggy** Proficient	**Alex** Proficient

By the end of the semester field experience, *Pair A's*, *Pair B's*, *Pair C's*, and *Pair D's* student teachers and *Pair B's*, *Pair C's*, and *Pair D's* cooperating teachers actively participated in research interviewing and observation. However, *Pair A's* cooperating teacher withdrew from the study due to her lack of involvement. This withdrawal was well within the participant's rights. (see the Voluntary Participation / Withdrawal paragraph from the Subject Information and Consent Form in Appendix B). Solis (1990) reminds researchers that within the context of qualitative research, researchers should remain flexible in that participants are not predictable.

Taking Solis (1990) and *Pair A's* cooperating teacher's withdrawal into consideration, I chose to include *Pair D* in the study's data analysis phase and exclude *Pair A* from the study's data analysis phase.

The choice is acceptable because *Pair D* was included in all aspects of the full semester inquiry. Data was intentionally accumulated on *Pair D's* student /cooperating teacher from the first to the last day of the field experience study. Pairing proficient cooperating teacher with proficient student teacher works in gathering information pertinent to the original research questions. It also intended to provide insight into how high-end student teacher technology competency translates into practical classroom application as well as the advantages and disadvantages of this field experience pairing. The resulting participant pairing configuration is presented in Table 8.

Table 8: Revised Participant Pairing Configuration

Participants	*Pair 1* **Lynn & Anne**	*Pair 2* **Joshua & Peggy**	*Pair 3* **Max & Alex**
Student Teacher	**Lynn** Novice	**Joshua** Nearing Proficiency	**Max** Proficient
Cooperating Teacher	**Anne** Nearing Proficiency	**Peggy** Proficient	**Alex** Proficient

Pair 1: Anne and Lynn

Anne: Cooperating Teacher

Prior to beginning her teaching career, Anne worked a variety of jobs without coming into contact with computer technology. She did briefly experience the excitement of being introduced to the potential of computers as a learning tool while working on her teaching certification in the early to mid 1980s. The School of Education was not equipped with computers at that time. Her education professors used overhead and film projectors, tape recorders, single reflex cameras, video recorders, VCRs, record players, tape players, and typewriters. Only one media course was offered in the core curriculum.

> It [the media course] was outdated even when I took it. [The course content included] how to make transparencies...[using] overheads, [and] reel-to-reel movies. It was really pretty outdated considering we only had movies reel-to-reel for the first four years that I taught.... I didn't really have a computer class, though before I graduated [from the school of education]. (response to interview question in Appendix H)

Anne was introduced to computers in a mathematics course, a School of Education course requirement for elementary education majors.

> Oh, ...not in the School of Education but in the math department is where I was exposed to computers when I went to school...[The professor] did a lot with Apple [computers] - Macintosh Apple IIes. We worked a lot on the Turtle LOGO...We did different things [including] problem solving...that was real exciting. And I think that that was just kind of a cutting edge as far as using computers in the school system. (response to interview question in Appendix H)

Anne, a devout whole learning advocate and practitioner, incorporated the philosophy both in and out of the classroom. Whole learning practices the whole-language concept: teach the whole person, not the subject. It supports the progressivist theory which focuses on educating the cognitive, social, physical, and moral aspects of each student in an experience-centered or student-centered classroom where the teacher's role is to serve as a guide or resource person whose primary responsibility is to facilitate student learning (Segall & Wilson, 1998).

She felt that cooperating teacher and education professor modeling is important to preservice teachers. Her experience with the local University School of Education was not a positive one because she did not experience professors modeling for their students.

Lynn: Student Teacher

Lynn was a nontraditional student - a wife and mother. In view of the fact that before entering the School of Education Lynn's computer technology skills were "quite limited", she used "the word processing program most extensively, limited e-mail service, and had some practice with basic computer games that were installed for [her] two children" (response to interview question in Appendix D). She credited course C&I 183: Business and Instructional Technology for Educators for making her "more comfortable with the computer in general…[and] able to tackle each new challenge eagerly rather than fearfully" (response to interview question in Appendix D). This attitude represented her tenacious character. Her tenacity during the semester was motivated by a strong desire to become an accomplished teacher. Lynn also approached her field placement as a concentrated preparation for employment. At the end of field placement, she became a substitute teacher and was subsequently hired as a fourth grade teacher for the school district.

Lynn's experience with computer-based technology during her elementary certification coursework was primarily in the block program. "The Block Professors encouraged technology and modeled its use. They were great" (response to interview question in Appendix J)! In fact, elementary block professors were the only education professors she found to use:

> Computer technology for their classroom instruction, other than the instructors for the two [required] computer classes... They [all block professors] utilized the computer station in Room 112 [science/math learning lab] quite extensively. Their usage included Internet access, video programs, CD-ROM demonstration, and the overhead projector. Several other [school of education] professors utilized the overhead projector or an occasional video. (response to interview question in Appendix D)

The required one credit C&I 306 was generally "less useful" than three-credit C&I 183 (response to interview question in Appendix D). Lynn elaborated on her experience:

> I did learn to create a web page, which was interesting and very useful. Unfortunately, I feel the other assignments for that class, were of less value. We concentrated on preparing two *Power Point* Presentations. While I feel learning to use Power Point is important and [I] plan to teach my students how to use it [*PowerPoint*] to present reports or class projects, I feel too much emphasis was placed on it for C&I 306. We were supposed to learn how to use *HyperStudio* but ran out of time...Other assignments such as computer grade book and using videos or television programs within a lesson were practices that I have done on my own.
>
> Other technology practices are important for elementary teachers. Integration of software programs into lesson plans was never really discussed. Instead, we viewed several programs and wrote a review for each. Having someone model how to set up an LCD project is of value to me. How to interface a video camera with a computer and how to create a video of *PowerPoint* Presentations are also of interest...I feel this class would have been more valuable to me if an overview of a variety of practices had been presented rather than such concentrated focus on *PowerPoint*. (response to interview question in Appendix D)

When speaking about positive computer-based School of Education course experiences, Lynn combined curriculum content with the instructor's personality and modeling.

> I believe the most valuable class I took was...a class directed toward business practices. I was introduced to a variety of [software] programs. I gained a much better understanding of computers, software, and program capabilities overall...My knowledge and comfort level with my computer skills definitely increased because of that particular class. The instructor...[a teacher] from the College of Technology was wonderful. Her expertise with computer programs was obvious. As an instructor, she was patient, very helpful, and seemed genuinely concerned with our progress. (response to interview question in Appendix D)

Pair 2: Peggy and Joshua

Peggy: Cooperating Teacher

Peggy, the cooperating teacher, will use the milestone of retirement in seven years to follow a prime interest – student teacher training. She plans to direct her channeled high energy from her technology-enhanced classroom to becoming a student teacher observing supervisor for the local university. Peggy "never used a computer prior to teaching" (response to interview question in Appendix H) nor was exposed to computer-based technology during either graduate or undergraduate school of education coursework. A major influence on her implementing technology into her classroom curriculum was when "the school district purchased many computers per classroom which gave me the opportunity to pursue this avenue" (response to interview question in Appendix H). The administration and peers view her as a firm supporter of implementing appropriate computer-based technology into the classroom curriculum as well as a leader in modeling its use with highly effective student results.

Peggy, a *Teaching and Learning with Computers* (TLC) advocate (Teaching and Learning with Computers, 1998), found that this instructional program utilized curriculum software to promote problem-solving and higher-order thinking skills in her classroom. TLC was a fundamental component in her instructional philosophy. Peggy works diligently on technology integration curriculum concepts after hours on her home computer.

Peggy also has a keen sense of how integrating technology impacts her 4th grade students. Even though 70% of her students have home computers, her 4th grade class website does not include daily assignment information. She feels she reaches a broader range of families by utilizing student - generated journals. Students write down assignments and parents return the journal entry with a signature. This practice encourages each student to become responsible for his/her classroom information.

The school's principal planned to promote Peggy's technology leadership by sponsoring her training as a lead teacher in *Knowledge Works* software. She will attend the workshops and "in turn, train other teachers" thus "bettering the teaching team" (Informal Interview, April 28, 2000). Of course the training depends on acquiring "release time and cost of substitute teachers" (Informal Interview, April 28, 2000) to cover her classroom duties. Fortunately, the school district's new superintendent who began in July 2000 values staff development as a priority. (Note:

Peggy was trained and as a *Knowledge Works* lead teacher. The *Knowledge Works* workshop, led by Peggy was held on September 9, 2000.)

Peggy actively serves on the school's Technology Committee along with two fellow teachers and the two technology assistants and has a keen awareness of administrative "priorities" and "roadblocks" which get in the way of "granting permission to purchase more [technology] equipment" for classrooms (Informal Interview, April 28, 2000).

Joshua: Student Teacher

Joshua was a traditional student. His parents were business professionals and resided in state but a great distance from the university. He shared living expenses, including a computer, with a fellow roommate during his field experience semester. Joshua was a stereotypical representative of a middle to upper middle class student raised in the emerging computer generation – comfortable and confident with computer hardware, software, and peripherals. He recognized instructional technology's educational and personal usefulness.

Joshua used a range of computer-based technologies before his acceptance into the school of education's elementary teacher certification program. He cited, "Microsoft *Word*, *Excel*, *PowerPoint*, Macintosh *Write* program with the Turtle, the Internet, and e-mail" as examples (response to interview question in Appendix D). His C&I 306 instructor, using Appendix C: Foundations in Technology, classified him at the highest end of a nearing technology proficiency level. While attending the School of Education's core curriculum classes, his education professors used *PowerPoint* presentations, research and interaction on the Internet, e-mail, the overhead projector, and videos.

Joshua shared how he benefited from taking the required C&I 306 instructional technology coursework as follows:

> The course I took was designed to become efficient in *PowerPoint*. I learned all aspects of *PowerPoint* and how to incorporate it into my classroom. We also studied interactive books and interactive exploration CDs [CD-ROM's] on the computer.
>
> The real benefit has been the repeated use in all of the class[es] from formatting correctly on Microsoft *Word*, to research on the Internet, *PowerPoint* presentations, and [using] interactive CD's [CD-ROM's]. (response to interview question in Appendix D)

Peggy spoke to his technology expertise: "Joshua came to the classroom more than qualified technically" (Informal Interview, April 28, 2000). During the field experience, he taught Peggy how to use the digital camera, Photo Express, and to make and access email attachments. Joshua's knowledge of html coding allowed Peggy's 4th grade classroom to establish a web presence on the [school] website. He also educated the 4th graders in how to transfer the website files to the school server using file transfer protocol (ftp) and how to update the website regularly. Joshua also spoke about helping students create a website during the first two weeks of his student teaching assignment. "They [the 4th grade students] picked the colors, content, graphics, and backgrounds." He "used a Microsoft html editor…and then went in and used html to fix things" (Observation Notes, March 3, 2000). Peggy is very proud of this achievement. "No [other] 4th grades have this to date. In fact, Joshua is qualified enough to be a technologist for any school" (Informal Interview, April 28, 2000). He taught Peggy computer troubleshooting skills including diagnosing and fixing inevitable snags in printing documents. Both Peggy and Joshua assisted other teachers with technology questions and troubleshooting when possible throughout the spring 2000 semester.

Pair 3: Alex and Max

Alex: Cooperating Teacher

Alex brought an extensive computer-based technology background into his teacher certification studies:

> I worked with a wide variety of computer technologies in college while studying aerospace engineering and meteorology. These included mathematical modeling of flight dynamics and structures, remote sensing and analysis of Earth weather systems, and analysis of atmospheric modeling data from National Weather Service super computers. While participating in meteorological field research, I ran a weather balloon data collection site that involved computer data analysis, radio telemetry and LORAN horizontal position control.
>
> After graduation... I worked for three years aboard a NOAA oceanic survey ship. While standing bridge watch, I regularly operated the ship's radar, various marine radios and several types of electronic navigation devices. Using a VAX main frame onboard the ship, I collected and analyzed survey data from multi-beam and dual frequency sonar systems. Spreadsheets and word processing software were used regularly to publish survey descriptive reports. (response to interview question in Appendix H)

Due to Alex's broad technology background, the School of Education coordinator of the C&I 306 course waived all required technology courses. His classroom professors did implement *PowerPoint* presentation software, e-mail communications, and CD-ROMs throughout his elementary education coursework.

Alex's innate ability to design higher-order thinking skills and dedicated effort to incorporate technology into his 5th grade curriculum elevated him in a few short years to being Building 1's technology specialist. With this reputation, he was known around the school by both his peers and the administration to be a true technology ambassador humbly and enthusiastically ready to assist in clarifying and unraveling any instructional technology question or technical troubleshooting. He championed the elementary school's culture of each teacher working "above and beyond duties… everyone goes beyond his or her official job definition" (Informal Interview, April 21, 2000).

His *above and beyond* duties included helping other teachers with their technology questions in an instructive manner. In doing so, he set an internalized *rule of thumb* whereas after about the third time assisting the same teacher on the same issue, he felt it was time for them to be able to manage it themselves. In the same vein, Alex created a multitask grade book accessible through a website. The grade book was designed by merging an amalgam of Microsoft *Office* software. Some of the applications allowed archiving teacher's notes concerning each student and project grades. All information was password protected. He tutored "very receptive" fellow 5th grade teachers in how to adapt this multifunctional grade book to their specific classroom management needs (Informal Interview, April 21, 2000).

Alex used a variety of instructional media. His philosophy of integrating instructional technology into his 5th grade curriculum was explained as follows:

> Getting kids to reason, analyze, and evaluate-the "higher-order" kinds of thinking that countless reformers and critics say schools should cultivate – is [my] true quest. Setting students loose on the Internet, and then having them assess the quality of information they encounter, is an authentic exercise in critical thinking. (Alex, as quoted in Sherman, 1998, p. 4)

He also enthusiastically shared his hobby interests with students. For example:

> Instead of offering extra recess as an incentive for good behavior, [he] pulls in hordes of kids every Thursday for a planetarium presentation on a Power Macintosh (software: *MacAstro*). Night sky images projected on a screen can zoom in for a close- up view of planets, stars, and whole galaxies. By year's end, students will have added celestial navigation to their accomplishments. (Alex, as quoted in Sherman, 1998, p. 2)

Over 75% of Alex's students have home computers. Taking advantage of this relatively high percentage, he utilized areas in the 5th grade website to inform parents about their child's assignments and the classroom activity agenda. Recommended websites and digitized student projects were also included. This digitized communication device never took the place of one-on-one parent - teacher communication. He also telephoned every student's family at least once a week.

Alex was working on writing a grant to support his research in setting up a technology classroom of the future. Within the context of designing a technology efficient classroom, he experimented with altering the conventional classroom furniture arrangement where computers are lined up against one wall. Nearing the end of the Spring 2000 semester, Alex's classroom was rearranged into furniture clusters consisting of four student desks radiating around each networked computer station. He felt this arrangement would promote "a better, more efficient way for each student to use the computers...eliminating the time and confusion it takes for students to move to the walls where computers are traditionally placed" (Informal Interview, April 21, 2000).

Max: Student Teacher

Max, a McNair Scholar qualified this year as a first generation college student whose household met the low-income guidelines established by the United States Department of Education. During the field placement semester, he worked a job outside of his student teaching responsibilities and became a family man for the first time. His tall physical stature accentuated his confident demeanor.

As a McNair scholar, the University provided Max with a mentor in the School of Education (his chosen discipline) and a research stipend to assist in conducting research. Research findings are published and presented at a professional conference. (see Appendix N for more information on the Ronald E. McNair scholarship qualifications).

This semester, Max spoke about designing and creating an interactive educational CD-ROM on navigational exploration of the Spanish galleon fleet with his cooperating teacher. This concept tied in nicely with his cooperating teacher's prevailing interest in the integration of computer-based technology into elementary classroom curriculum, a background in mapping coastal waters as a hydrographer (an underwater mapmaker) for the National Oceanic and Atmospheric Administration, and celestial navigation [astronomy] hobby. He was also enthusiastic about Alex's experimentation with traditional classroom furniture and possible furniture configuration solutions to best suit a computer-facilitated classroom of the new millennium (Informal Interview, February 24, 2000).

Max entered the School of Education elementary certification program with a working knowledge of Microsoft *Word*, *Excel*, Netscape *Composer*, *PowerPoint*, *HyperStudio*, and a variety of video games. Although he has used Scientific Notebook's *Word Perfect*, *Lotus*, *Pegasus*, and *Quatro Pro* components, he had not accessed any of these programs "for at least five years" (response to interview question in Appendix D).

"Overhead projectors, VCR's, the Internet, and *PowerPoint*," he reported, were the most often used technology in the education professors' teaching repertoire during his preservice coursework. On the other hand, modeling was most apparent in the one credit required C&I 306 course: Instructional Media and Computer Applications. "Why? Because it is the one and only...class the University offers!" Max interjected. He continued to express regret - "[C&I 306] needs more in depth requiring more hours and there needs [sic] to be more classes focused on educational technology as this is the future of education and the planet" (response to interview question in Appendix D).

Max often expressed that the School of Education shortchanges their students by not effectively preparing them in the area of instructional technology. During his student teaching field placement, Max reiterated that he planned to go to the University of Oregon to work on a Master's in Instructional Technology and return to his undergraduate alma mater to "bring the School of Education up to [technological] par" (Observation Notes, March 3, 2000).

PARTICIPANT'S CLASSROOMS: THE PHYSICAL ENVIRONMENTS

Classroom Technology Centers

All three cooperating teachers understood the benefits of having technology in the classroom. They subscribed to the Building 1 principal's philosophy that technology has made a significant impact in "increasing the amount and… quality of student writing; …enhancing cooperative learning and…the amount of student learning; enhancing the application of learning styles and…cross-age tutoring; and…developing a world of global learners" (Whitehead, 2000, p. 45).

Each cooperating teaching took full advantage of the Classroom Technology Center (CTC) approach. This method is not used in many schools. Usually, schools have computer labs or stand-alone computers in the classroom.

The Classroom Technology Centers were composed of at least five networked computers in every Building 1 classroom. Technology integrated classroom projects were designed to systematically rotate five students at a time through the computer workstations until all students used the hands-on technology portion of assignments. On a given day, computer stations were used to help students become more effective writers, researching a topic on the Internet or honing mathematic skills.

Not only did students benefit from technology enriched coursework, teachers found this "format enhanced cooperative learning...[and made] it easier to have students work in groups" (Whitehead, 2000, p. 45). In turn, each student teacher learned and participated in the practical application of Classroom Technology Centers in both classroom and project management for technology integrated classroom assignments.

Anne's Classroom Description

Anne's 3rd grade classroom contains 24 students in an oversized long narrow rectangular room. The entry door is in the north wall in the northwest corner and faces into a vestibule where an art station is set up, bulletin boards display *Flat Stanley's* latest adventures, and equipment is neatly arranged. (see Figure 1). A second smaller room adjoining the vestibule merges with the communal 3rd and 4th grade north - south hallway. The physical location of this classroom in relation to the rest of the grades 3 - 5 building (Building 1) established an oasis away from outside academic and administrative distractions.

The classroom décor and furniture configurations exhibit a high level of creativity establishing an abundance of visual interest. It is subtly divided into thirds. The first third nearest the door is a reference, reading, and equipment area where books, rat cage, and storage cabinets and colorful blue and yellow beanbag chairs line the south and west walls. To my amazement, upon entering this classroom for the first time, a huge rainforest tree, reaching from floor to ceiling, was constructed entirely

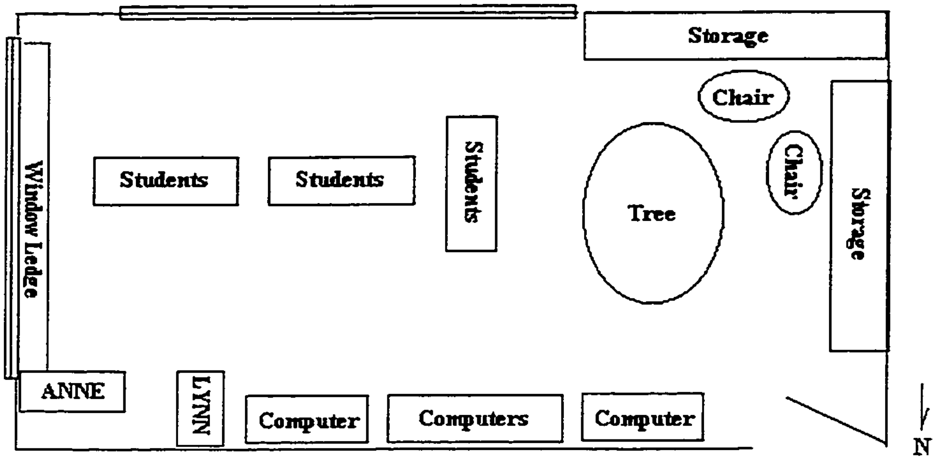

Figure 1. Anne's Classroom Floor Plan.

out of thick brown and green twisted rolls of heavy poster paper. Large curving branches made with the dark forest green paper was tightly wrenched into forming thick vines hanging in loops from a variety of points on the ceiling stretching like gnarled fingers in every imaginable direction. Stuffed animals whimsically straddled the branches and vines as if playfully swinging from one side to the other. The tree took up at least one fourth of the floor space, but plenty of room was left over for student desks, computer stations, storage, and instructional workspace.

She especially appreciates the link between her whole learning creativity and students. When discussing her rainforest tree in the room, Anne related, "I loved putting it up." The classroom decoration and "desks are always being reformatted for the students. It keeps them flexible and interested" (Informal Interview, March 13, 2000).

Student desk configurations take up the center third of the classroom sandwiched between the computer stations and the chalkboard. Different student desk furniture arrangements greeted students often. At times desks were placed in *Last Supper* positions where one linear arrangement of twelve students was perpendicular to a second row of students. On another date, the rainforest was removed and the student desks were moved into an open "U" shape. The "U" opening faced the south wall chalkboard (Observation Notes, February 28, 2000).

All five networked computers and one color printer were situated on tables side-by-side along the north wall near the entry door. Three computers were placed on a semi-circle table slightly protruding toward student desks placed in the center of the classroom. Two additional computers were part of the technology footprint, one to the right of the semi-circle table and one to the left of the semi-circle table.

Lynn's desk was positioned on the same north wall as the computers. Her desk was next to the last computer station desk. A hub of constant student activity, a bulletin board containing student assignment charts lined the wall next to the small desk. File cabinets and Anne's desk were nearby in the northeast corner. Her desk jutted out perpendicularly from the proportionally short windowed east wall. It faced toward the large green chalkboard centered on the south wall.

Peggy's Classroom Description

Peggy's 4^{th} grade classroom, containing 27 students, is situated directly on the Building 1 main corridor. The room's parameters resemble a square more than a rectangle and the entry door is in the far southwest corner with entry on the west wall. (see Figure 2).

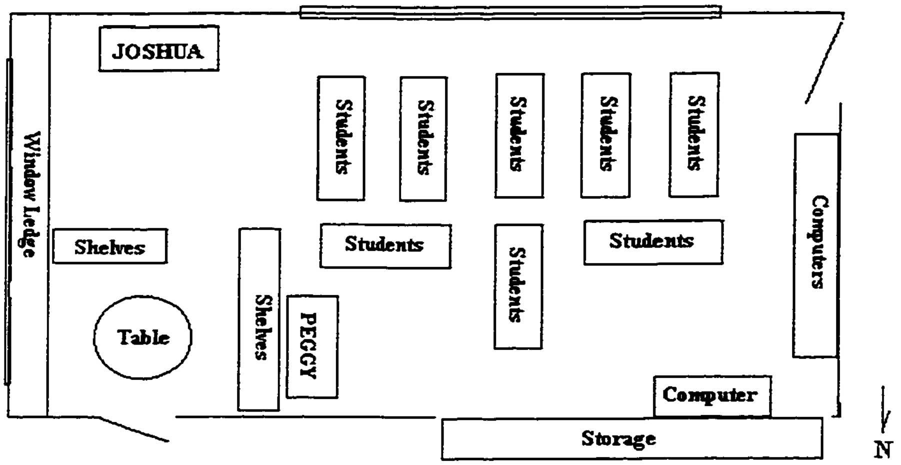

Figure 2. Peggy's Classroom Floor Plan.

Student desks are centered in the classroom. They are setup in two small "U" shape arrangements. An additional row of desks lined up in a linear fashion is situated between the two "U" shape arrangements. Peggy has voiced interest in Joshua's latest student desk setup with computers situated in workstation pods.

Computers are placed in a standard computer lab linear format. Four networked computers are positioned side-by-side on a row of tables along the west wall next to the door. The north wall, the back of the classroom, serves as a dwelling place for the fifth computer. This computer sets on a desk on the far side of a recessed storage cabinet that houses the Building 1 computer supplies. When students are not using the fifth computer, Peggy often utilizes this computer for her instructional applications including research and communication.

Peggy's desk is also on the same wall as the singular computer station. She has arranged her work area so that it extends perpendicular from the wall, facing the windows to the east. In addition, her desk faces a four-sided niche constructed from lining up short bookcases. Entries into the niche are opposite each other. One entry is to a second hallway on the north wall and the second entry opens into the center of the classroom. A large round table, lending itself to private discussion and study is housed in the center of the niche. Files, lesson plan notebooks, curriculum manipulatives, and textbooks line the peripheral bookcase shelves.

Textbooks uniformly line the wide east window wall ledge. Joshua's desk is in the southeast corner. The desk faces south with its back to the student desks in the center of the room. A liberal sized whiteboard is also centered on the interior south wall directly to the right of his desk. The whiteboard is a focal point and workhorse of this classroom. In addition to the customary whiteboard applications, Peggy uses this board to tape printed curriculum instructions and projects and show *PowerPoint* slides and overhead transparencies.

Alex's Classroom Description

Alex's 5th grade classroom of 27 students resembles a sizeable standard rectangular shoebox form most American public school graduates are so familiar with. (see Figure 3). The entry door is in the northeast corner and faces into the communal 5th grade hallway. Four networked computers are situated on tables side-by-side along the east wall near the door. An expansive whiteboard is centered on the interior north wall.

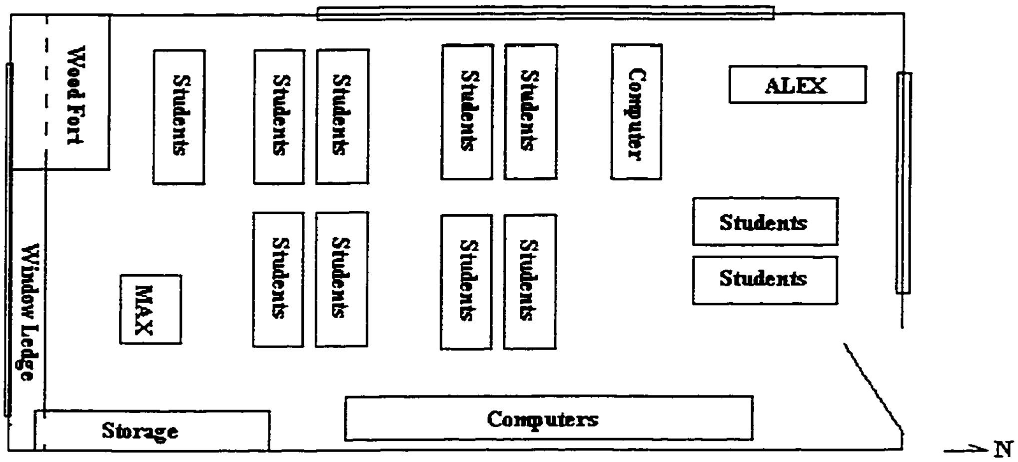

Figure 3. Alex's Classroom February Floor Plan.

A liberal rectangular configuration of plate glass resides on the south wall windows facing the playground. Customary curriculum paraphernalia including graded projects and textbooks are stacked and propped along the widow ledge counter. Down from the window ledge is a two-story fort-like structure constructed with raw two by fours and plywood. A large floor pillow on the upper floor serves a student's minimal creature comfort for reading or contemplating activity.

Max's desk is situated in the southeast area in front of the window ledge counter, back to the playground, and facing the door to the 5th grade hall. Alex's desk, situated in the northwest corner of the classroom near the whiteboard, faces east, overlooks all the students, and the four networked computer screens lined up far away on the east wall. A pair of networked computers is placed back-to-back on a rectangular arrangement of student desks to the right of Alex's desk. A large chalkboard is situated on the west wall behind him. The chalkboard holds daily and weekly reminders of the students' curricular schedule. One of the two computers is positioned for easy access, allowing minimal privacy, to his desk. The second computer is accessible to students. Singular student desks are placed in clusters of short rows at perpendicular angles to each other in the classroom's center floor space.

In April, Alex changed his classroom's student desks – computer arrangement configuration. (see Figure 4). Classroom rearrangement was set in motion to address "the physical access issue of students having to crowd around keyboards at computers

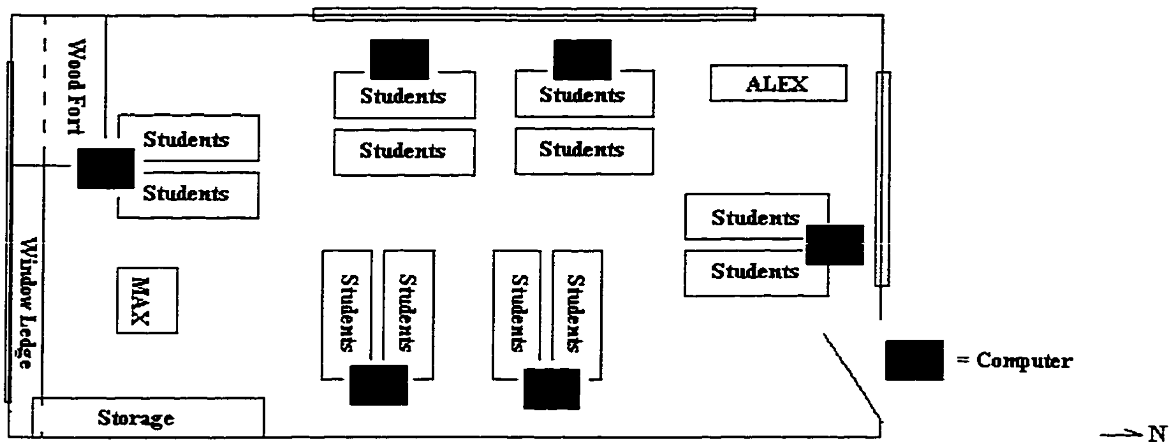

Figure 4. Alex's Classroom April 2000 Floor Plan.

that were not well placed physically for productive use" (response to interview question in Appendix H). The change was to facilitate a better, more efficient way for each student to access and use classroom computers. "Use of computer workstations has been enhanced by positioning them in learning groups for spontaneous use when appropriate" (response to interview question in Appendix K). Each computer was centered in the midpoint of a cluster of four student desks. As a result, community computer workstations replaced the conventional linear computer lab footprint arrangement. Alex offered to showcase this computer setup to other teachers in the building.

EMERGING STUDY PATTERNS

In order to determine the themes that became the foci of this report, I scrutinized the case data multiple times. Data included student teacher e-mail, interviews, interview questionnaires, videotapes, field notes, and observations. As patterns emerged, I took notes for consideration. After a list of half a dozen dominant themes was compiled, I reexamined the information that led me to each particular theme. I next constructed a matrix of tables delineating the themes and the number of times each of them was supported by the data. Each participant's input was highlighted by a specific font color supporting specific themes.

After perusing and careful analysis, the themes emerged from the matrix. Even though key factors at times coalesced, overlapped, and intertwined, the themes remained distinct. I focused on the three themes that were heavily supported by data:

- Collaboration and Rapport
- Self-Directed Learning
- Equipment: Time and Availability

Each theme will be described separately illustrating each participant pair case study.

Collaboration and Rapport

Pair 1: Collaboration and Rapport

A pattern of respective interaction nurtured the professional connection between Lynn and Anne throughout the semester. During an impromptu visit to their classroom early in the field placement, I noted, "All interchange is respectful of each other's input" (Observation Notes, February 23, 2000). Anne provided an environment where Lynn felt safe to experiment and to work at putting her teaching theories into practice. She felt her input was valued and feedback was always presented to her in a constructive manner; incorporating technology in the classroom was not so overwhelming.

They developed into collaborators early in the field experience. When working collaboratively on technology projects, Lynn learned curriculum integration through Anne's experience and Anne learned new technology approaches from Lynn that strengthened her methodology. For example, Lynn's Microsoft *Excel* software knowledge led to teaching Anne how to use its application. Anne's collaboration with Lynn led to integrating Microsoft *Excel* into a computer mediated science project for the third grade classroom.

Camaraderie was apparent especially when they were in each other's company. Comments such as "I appreciate her [Lynn's] enthusiasm and support" (response to interview question in Appendix H) and "Lynn has been bringing in some stuff

[CD-ROMs] for me and I've asked her about things [technology] and that is exciting to me" were not uncommon coming from Anne (response to interview question in Appendix H). Anne felt free to leave the classroom when Lynn was teaching. The following assessment of Lynn's professionalism is an excellent indicator of Anne's respect for her student teacher:

> [Lynn has] presented the most actively engaging and dynamic lessons that sometimes it's hard for the kids not to start before you're finished with directions!! They have loved the activities, and I really appreciate the joy and planning that goes into them!! [Lynn's] expectations for them are so much clearer that the excitement of their exploration and your observations make a powerful combination for learning and growth. (Cooperating Teacher Final Assessment of Student Teaching Progress, May 2, 2000)

Pair 2: Collaboration and Rapport

Joshua remained in the elementary school helping his cooperating teacher and sitting in and observing classes taught by other teachers in the building after his field placement officially ended. This is noted because early in the semester, he had the days counted. "May 5th and not one day more," he shared at a group meeting (Field Notes, February 28, 2000). He was adamant about getting out on May 5th to the point of counting the weeks and excluding the university spring break because [this school] does not honor it as vacation time.

Joshua, clearly the most pragmatic of the student teaching participants, enjoyed his teaching experience with Peggy - especially team teaching. Following a particularly challenging teaching session, a discouraged Joshua explained how the students in his classroom had a rather large population of *tattlers*. In relating a personal experience with his twin brother, he exposed his philosophy to live by - "Don't they understand that the best way to get along is to *not* cause problems" (Observation Notes, April 5, 2000)?

Early in the semester when responding to question 4 on the Appendix E Interview Questionnaire, "How important will your assigned cooperating teacher be in determining your attitudes and comfort level in using these technologies in your student teaching experience?" Joshua projected about his field experience relationship with Peggy:

> My cooperating teacher will have a huge influence because it is her/his classroom. If they [sic] are uncomfortable having their [sic] students taught by a student teacher with stuff they [sic] would not use then I would not use the technology. Of course I would use it as soon as I get my own classroom and I would also try to use it in different ways during my student teaching experience, if and only if, my cooperating teacher was 'ok' with it. (response to interview question in Appendix E)

Coincidentally, one of Peggy's classroom assignments near the beginning of Joshua's field placement was to use his knowledge of web authoring – something Peggy was not comfortable in teaching. Joshua reported

> For two weeks "...we used the [web] page to get the students interested in technology as well as working on writing with correct grammar...I have already designed a web page for my fourth grade class. We used the page to get the students interested in technology as well as working on writing with correct grammar. We also incorporated artistic design into the design of the web page. (response to interview question in Appendix D)

He learned about integrating Language Arts and keyboarding around web authoring software. Peggy and Joshua were very proud of this achievement. Joshua responded well to this early vote of confidence from his cooperating teacher. On the other hand, Peggy learned how to create a website.

An illustration of how well they worked together as a team in the classroom played out during a group math activity facilitated by the Teaching and Learning with Computers approach (Teaching and Learning with Computers, 1998). While the 4^{th} graders were working feverishly on decimals moving from manipulative stations to computers, it became clear to Peggy that the students were whizzing through the computer generated math problems faster than anticipated. After a brief conference with Joshua, he directly went to the computer at the back of the classroom and added more decimal math problems to the network. Students remained on task while Joshua and Peggy, without missing a beat, continued assisting students on opposite sides of the classroom.

Peggy's final assessment of student teaching progress commended Joshua on his professionalism:

> Joshua demonstrates a solid understanding of what he [teaches]...[He is] very well prepared...nice job. All lessons [were] appropriate to [the] curriculum...[He] knows curriculum well and teaches it in a step-by-step manner that is conducive to learning...[Joshua has] a good accommodation of different skill levels...and does a great job connecting new concepts to prior knowledge.
>
> Joshua [is] very ethical and responsible...[He] treats all students fairly...[and] does an excellent job overlooking nuisance interruptions [in the classroom] and instead focuses on important things...[He] interacts very well with the staff. (response to Summative Assessment of Student Teaching Form, University of Montana, 1999, p. 4)

In the same vein, when reflecting on the positive influences nearing the end of his field placement, Joshua wrote, "My cooperating teacher influenced me by being supportive and showing me the way to incorporate the technology available into my lessons" (response to interview question in Appendix J). Not only did he learn how to incorporate the Teaching and Learning with Computers methodology, he also learned how to organize classroom technology and to use and design curriculum around the Classroom Technology Center.

Pair 3: Collaboration and Rapport

Max often and with great respect quoted Alex on teaching. One of Max's favorites was, "You have to know over 100% of the material for the student to learn 50%" (Observation Notes, March 14, 2000). During the study, he often remarked on his cooperating teacher's professionalism and the skill in which he integrated technology into the classroom curriculum.

Early in the semester, Max shared how excited he was to be working with Alex because they had very similar interests. One discussion focused on their mutual interest in how traditional classroom furniture may not be the best for computer access in the classroom and possible solutions. During another informal discussion, Max commented about "holding back on pursuing his professional interest in the integration of technology due to Alex's skilled expertise" (Field Notes, February 28, 2000). Later in the semester, Max responded to a questionnaire in similar manner - "Alex uses these technologies all the time. He is much more versed than I and that is a little disheartening, however I feel that he is more than supportive and helps with any questions that I have" (response to interview question in Appendix E). Alex's technical proficiency appeared somehow intimidating.

During all research observations, Alex and Max worked collectively as a team. When Max took over the classroom, Alex was never too far away for occasional guidance. Alex commended Max on the extensive reflective journaling and his openness to suggestions and feedback on his development as a teacher. Max was very adept at getting in tune with student needs and circumstances of individual students. This and his habit of conducting good student feedback and verbal assessment on an ongoing basis led to establishing a good classroom rapport. Alex especially appreciated Max's strong content knowledge in both math and sign language. Max introduced Alex to the sign language dictionary website. Additionally, his natural interdisciplinary instructional approach was an asset to be cultivated.

On the other hand, Alex struggled all semester with his student teacher not being prepared. Alex found Max was mostly overwhelmed by a combination of student teacher commitments and personal obligations. Time management became insurmountable many times during the student teaching field placement. By April, Alex explained Max apparently lacked interest in this semester's student teaching. "He is often sick, absent, or distracted" (Informal Interview, April 4, 2000).

Alex did not want to interfere negatively with Max's student teaching experience and, thus, continually weighed how best to help Max.

> Max does not do his preparation for getting ready to teach. I used to be up all night preparing when I was a student teacher - not the way Max is doing it. He sees me setting up things [for an assignment] and assumes it is a spontaneous thing without preparation. I have done each assignment so many times it is more spontaneous. That is something Max does not understand yet. (Informal Interview, April 4, 2000)

Self-Directed Learning

In this case study, each participant pair shared a common attribute - individualized self-directed learning. Two student teachers clearly had an academic history of self-directed learning and the third eventually put it into action near the end of his field experience. All three cooperating teachers effectively modeled self-directed learning in their personal approach toward honing their technology skills especially while designing, facilitating, and promoting integration in the classroom curriculum. (see Table 9). Modeling became tangentially related and an extension of their collaboration and rapport with their respective student teachers.

Participant Self-Directed Learning Characteristics

No cooperating teachers in the study were enrolled in computer-based School of Education coursework during their preservice education (response to interview question in Appendix H). Their use of technology in the classroom is a synthesis of self-discovery learning. (see Cooperating Teacher / Student Teacher Pair Technology Profiles). Alex somewhat represents an exception in that he came into the teaching profession with an extensive professional background in scientific technology tools. However, he transformed and utilized these scientific tools into dynamic curricular devices. Peggy, highly regarded as being well versed in integrating technology into the

Table 9: Cooperating Teachers' Application of Classroom Technologies

Technology	Anne: 3rd Grade	Peggy: 4th Grade	Alex: 5th Grade
Web Authoring	Still experimenting with that when I have a free moment.	[Joshua and students] just completed our class web page.	Students maintain the site and create html pages to put in their electronic portfolio on the web.
Multimedia Software	[*PowerPoint*]... presentations on the different animal habitats...and poetry reading at the end of the semester... We use it in book reports to share with the class.	Not introduced in class yet; children use it at home.	We use *PowerPoint* and Multimedia Workshop regularly to present student's work.
Word Processing and Spreadsheets	We use *Excel* in the *MathLand Multimedia* for graphing displays and also we use Microsoft *Word*.	[As a] grade book for me; word processing stories and poetry [for students]	Used daily for student compositions, math concepts, data analysis, graphing and charting
Classroom Management Tools	I prefer writing my grades in a book whenever I want to access it not having to plug into something	[For] record keeping and report cards	I designed *Excel*- and *Word*-based database software now used by the fifth grade team
Electronic Communication	Used...[to contact colleagues] the district. I also use it for our union association.	[Used] daily with coworkers	[For] professional communication with other educators. Students use e-mail to contact experts in field they are studying... [They] e-mail files to school for presentations, papers, and graphing. Parents use e-mail link on our classroom's web site to contact me about concerns.
Internet	I like to use it for research, exploration, *PowerPoint*, [and] *HyperStudio* information. The Internet is such a vast wealth of information ...It is almost overwhelming and I prefer to bookmark a lot of times just to save time for the kids.	Teaching strategies for frequent information gathering. I have participated in many distance education fieldtrips.	We use the Internet everyday for information relating to our topics of study.
Educational Software	I use it as a station to supplement the curriculum.	[Used] daily with students; math and reading predominantly; also used at home with myself and my children	We don't use much software that is specifically designed to be educational. We use open-ended software that serves as tools for learning, creativity and expression. We do use a CD-ROM called *Redshift 3* to learn about astronomy and the night sky

4^{th} grade curriculum, often downplays the amount of time she spends working through technology integrated curriculum design. In retrospect over the past years, she has competently embraced the Teaching and Learning with Computers curriculum approach fostering innovative technology appropriate classroom assignments and remained perpetually interested in upgrading her instructional technology knowledge base at conferences and software training as well as facilitating inservice technology workshops (Informal Interview, April 28, 2000). Anne shared, "I learn best by discovery and so I like exploring that on my own and trying out things...I'm always looking for something [on the World Wide Web]" (response to interview question in Appendix H). She also felt that the 3^{rd} grade students have had a role in developing her attitudes toward using technology tools.

> [The students] are extremely helpful and challenged me to discover more on my own time...My attitude is it's a 2-way street or exchange – the kids learn from me and I learn from them. I consider myself a lifelong learner – always curious about how things work, not always having all the answers, but most definitely will explore with the kids to find answers together. (response to interview question in Appendix H)

Participant responses to questions in interview questionnaires often indicated innate self-discovery learning characteristics. For example, Joshua considered himself "to be self-taught" when it comes to e-mail, the Internet, word processing, and web authoring. "I learned by messing around on my own time as well as being required by professors, like e-mailing assignments, who assumed we already knew how to do it. If I didn't, I just asked someone to show me and I learned" (response to interview question in Appendix F). Joshua and Lynn continued to point out more self-discovery learning factors in their student teaching experience:

> Joshua - The fact that there is a very strong computer program at my school makes me eager to learn more about technology as well as incorporate all I can into my classroom… I have known problems using software networked on the school server in that I often struggle with finding the best software to match what I want to teach. (response to interview question in Appendix E)

Lynn shared, "There are many [software] programs available and I keep in contact with the library media specialist in the [university] Teacher Resource Center (see Appendix A) for any programs that would be of value for the students to use" (response to interview question in Appendix E). Sharing the latest CD-ROM educational software delighted Anne. A big drawback was that only one of the computers in her Classroom Technology Center was capable of playing the software. Max added:

> At other universities that I have gone to I have taken a couple of classes on spreadsheets and word processing. Since then I have struggled through learning as I go…I remember that a guest speaker came in [to C&I 306] and told us that the use of technologies in the classroom is more and more becoming common place and that we should, if we wanted to be competitive, learn as much about technology as possible. I chose to listen to that advice and am now pursuing a masters and doctorate in educational technology. (response to interview question in Appendix E)

Lynn's exposure to technology has been by way of the School of Education's C&I 183, C&I 306, and self-exploration.

> [While taking C&I 306], I was able to go over the text several times and went into the lab on my own time to practice the exercises so that the steps became more clear and comfortable for me. I am the kind of person that needs to do something several times before I really understand it. Now that I am more familiar with a variety of programs, I won't need to put so much time in

> learning new steps…I am comfortable reading directions, at this point in time, and trying to figure things out on my own. I feel I know enough to get me started. If the directions are clear, then I can fumble my way through something. I need to do it to understand it. I think it is very interesting and exciting to learn something new and experiment. (response to interview question in Appendix E)

When asked about the factors in the student teaching experience, if any, that have influenced his interest in taking more technology courses, Alex answered, "I have seen the pace at which children learn computers and in order for me to keep up I must continue my technology education" (response to interview question in Appendix H). Lynn replied, "I just know that I must stay current if I am going to be able to utilize the new programs when they come out. So many teachers are afraid to learn, or feel intimidated…Many are afraid to ask questions" (response to interview question in Appendix J).

When cooperating teachers were asked to explain how they helped students learn to solve problems, accomplish complex tasks, and use higher-order thinking skills in an information technology environment, the responses replicated self-discovery learning environments. For instance, Peggy designs "hands-on assignments. [They] are given when they [the students] need to find answers from the web using past students to become tutors" (response to interview question in Appendix I). Anne has "students work in partners or cooperative groups to research topics – mountain songbirds, different habitats, famous Presidents, etc…[Students] are allowed to use resources available: CD-ROMs, Internet, create *PowerPoint*'s, etc…and make choices as a group to divide up the work and how they will present it" (response to interview question in Appendix I).

Alex is well known in the school district for his imaginative use of spreadsheets. Teaching kids how to use spreadsheets "makes a valuable pre-algebra lesson… Spreadsheet functions, formulas, graphs, and charts are algebraic." Spreadsheets also give students "a clear visual layout of numbers and number relationships independent of the child's drawing and organizational skills," he notes.

> Another advantage of keyboards over graphite: Kids can think more deeply and broadly without getting bogged down in computations. While computational skills are important for kids to master, an error in arithmetic can mask the student's mastery of a larger concept…The computer can perform higher-order operations on data much more quickly than students could do with paper and pencil…It extends their thinking. (Alex, as quoted in Sherman, 1998, p. 4)

Pair 1 Self-Discovery Classroom Video Observations 2 & 4: Animal Habitats

In the 3rd grade Life Science curriculum students learn about the role of living things in ecosystems – deserts, forest, arctic, and the jungle. During the semester, students researched information on these animal habitat; results were converted to *PowerPoint* presentations, and eventually presented to their parents at the end of the school year. Anne talked about the final parent presentation:

> I love to do these presentations on the different habitats that we cover in science – desert, arctic, rainforests, etc…also we will be using it for our poetry reading in April – the end of April or May possibly…and kind of do a continuous reel [*PowerPoint* presentation] of the authors or the poets….While the parents are being seated, they can watch….and then the kids will actually do their own poems live. (response to interview question in Appendix H)

As I set up the video camera, Anne worked on connecting cables to the back of one of the classroom computers. Lynn was supervising the 3rd graders who were on task finishing and cleaning up multimedia assignment, remnents of photocopied animal pictures, white glue, large format manila paper, and scissors.

Beyond supplemental use of the Internet and educational software, Anne's creative whole learning curriculum approach insures that this classroom and its students are not deprived of instructional stimulus. Technology for technology's sake is not in her repertoire.

Anne's 3rd graders learned *PowerPoint* in the Cross-Age Tutoring environment – *Computer Buddies*. Once a week, five 8th grade female students came from the Building 2 middle school facility into the 3rd grade classroom for half an hour and paired up with predetermined 3rd grade partners working on *PowerPoint* presentations. They worked together on the jungle animal habitat reports together and rotated in groups of five until the project was completed. The 8th graders were supplied with a list of 3rd graders' names and as the *Buddies* completed the project with each young student, another name was called out, and a new 3rd grade *Buddy* joined his/her partner to start their new *PowerPoint* presentation. The 3rd graders were eager to get their turn to work with their *Buddies*.

Anne constantly explored using the computer as a learning tool. She shared with me about preferring female *PowerPoint Buddies*. The first set of 8th grade *Buddies* were boys and they tended to hoard the mouse and take over the entire creation of each presentation. Anne observed her 3rd graders not getting a chance to contribute to the construction of their own *PowerPoint*. "Girls," she added, "are more patient and allow the 3rd graders to work on their own" (Informal Interview, March 14, 2000). The 8th graders appeared very technology astute with this software, especially when layering visuals and creating slides in an effortless manner (Observation Notes, March 14, 2000). As a student teacher, Lynn observed the Cross-Age Tutoring and multimedia curriculum approaches and reflected:

> At the 3rd grade level, I think it is important to teach the students to create their own *PowerPoints*, and use various programs such as [Microsoft] *Word*, and *Excel*. But to try to teach a lesson using a *PowerPoint* presentation is not necessarily how I believe you should teach 3rd grade students. (It can be used on occasion to introduce a topic). Our students have all created a *PowerPoint* with 8th grade buddies helping them. I worked with most of the students to create graphs on *Excel*, and they are comfortable typing on *Word* and searching the Internet for information with some assistance. I think that is pretty good for this age group. (response to interview question in Appendix E)

During a March observation, some students were working in small groups and others were working individually using the Internet to investigate rainfall in African regions. Anne and Lynn were using the Classroom Technology Center working students through computer workstations five at a time. Once the data was gathered, they used *Excel* to graph the total rainfall in bar graphs and pie charts. Early in her field placement, Lynn planned to "create a lesson that will introduce spreadsheets to the 3rd grade class" (response to interview question in Appendix F). The rainfall analysis worked beautifully. Near the end of the semester, Anne reflected on working with Lynn - "[She] got me using *Excel.* That I had forgotten about" (response to interview question in Appendix K)!

While observing Lynn working with four 3rd graders at the computer, I noticed she was very good at not taking the mouse control from students when giving individual instructions. This project required one-on-one instruction and patience in repetitive facilitation. Not only did Lynn meet each requirement, she showed excitement when students proudly printed out their results (Observation Notes, March 31, 2000).

A larger than life roll of poster paper stretched across the chalkboard in the front of the 3rd grade classroom. Upon closer inspection, the long paper was divided into a large grid resembling a spreadsheet. Animal characteristics were printed on the top of each column. Animal species were printed on each vertical cell on the first column on the left hand side. This larger than life grid was a touchstone for the assignment. Computers became one of many tools made available to students for finding information necessary to fill in the grid.

Students were energetically on task researching their assigned animals on the Internet. Anne sat at a computer next to them offering advice when they needed it. She instructed them on using *Searchopolis*, *Lycos*, or *Momma* search engines. Anne spoke about students and the Internet:

> I like to use it [Internet] for research, exploration, and [compiling] *PowerPoint*, *HyperStudio* information [for the students]. The Internet is such a vast wealth of information – It is almost overwhelming and I prefer to bookmark a lot of times just to save time for the kids. Sometimes they get into areas that

> innocently you wouldn't think would have any kind of side effect as far as getting into things they shouldn't but I know that we studied the artic tundra and we typed in arctic and got things that we shouldn't have been into before, but the kids are smart enough to question that when they show on a map where the artic is located and it says New York City, we know definitely that it is an acronym for something else and we shouldn't go there. So, I think you have to be really careful with the screening of things from the Internet. And I say that not as just an educator but as a parent too. (response to interview question in Appendix H)

She adroitly monitored and guided the students at the computer station. When students found the appropriate information, they went to the chart taped to the chalkboard and filled in the correct information (Observation Notes, April 25, 2000).

Pair 2 Self-Discovery Classroom Video Observation 1: Introduction to Decimals

Prior to the beginning of the assignment, Joshua voiced his concern that this was the first time the 4th graders were being introduced to decimals. He was apprehensive about their ability to grasp fundamentals.

Peggy went to the whiteboard and began to write the five assignment workstations with color markers on the white board. Computer station access was explained first. Since there are only five computer stations for 20 students (some are absent), four other math manipulative workstations were set up completely utilizing the classroom floor plan. These logistics allowed for students to rotate through each workstation and work out assigned problems in small groups. Computer access codes and *Knowledge Works*, a drill-and-practice software, was pointed out to the students. Logistics for the remaining four stations were then explained, i.e., Making Models, Base Ten, Race to One, and Concentration. Names of group members handwritten on small 3 inch by 5 inch index cards in groups of four were taped to the middle of the whiteboard. Peggy called out each groups' members and directed them to their assigned math station.

Both Joshua and Peggy showed respect for students, their questions, and enthusiasm for the project. Joshua mainly remained in the computer area. Peggy rotated around all five stations including the computer area. At one point, Peggy, from across the room, applauded a student who correctly answered one of the software mathematics problems. Joshua mentioned before the assignment began that students liked the payoff of the computer-programmed sounds when they do *Knowledge Works* mathematics correctly and quickly. Computer sounds also seemed to motivated the teacher to respond similarly.

Midway into the lesson, Peggy quietly conferred with Joshua about adding more mathematics problems to the computer station. Apparently, while monitoring the student progress at individual workstations, Peggy realized that most students working at the math station finished problems early and had to be directed to repeat the sequence. Peggy announced, "The Race to One group assignment was decreased to Race to 0.25" (Observation Notes, March 3, 2000). Immediately after the conference and announcement, Peggy then continued to the other side of the classroom to assist some students and Joshua went to a networked computer at the back of the classroom to add three more mathematics problems to the mathematic station.

Students were actively rotated through each of their assigned stations–90% on task at any given moment. During the assignment, manipulative stations engaged students as much as the computer station. A scheduled recess and limited number of computers did not allow for every group to make a complete rotation to all five stations. However, Peggy assured everyone that each group would eventually complete all stations.

I discovered that Joshua's apprehension prior to beginning the assignment about this being the students' first time doing decimals was quickly turned around when he added three more decimal problems to the computer station during the exercise. He was surprised and happy to have this take place. Some fourth graders still finished early and were told to do the series again (Observation Notes, March 3, 2000).

Pair 3 Self-discovery Classroom Video Observations 2 & 3: AmericaQuest/Raging Planet

This observation focused on Max facilitating the *AmericaQuest* Series on the Anasazi Indians of the American Southwest. Alex introduced the *AmericaQuest* online educational product produced by Classroom Connect to Max. The K - 12 Classroom License includes a poster, curriculum guide, and password and costs $149.00. Classroom Connect provided extensive teacher support supplying access to numerous curriculum tools including downloadable student activity sheets, management ideas, assessment rubrics, and professional development links for related articles, resources, and lesson plans.

> From March 6 through March 31, 2000, an online audience of over a million students joined a team of scientists and adventurers on an exciting journey through the American Southwest, in search of clues to one of the greatest mysteries of ancient America. Over a thousand years ago, Ancient Pueblo Indians, often referred to as the Anasazi, developed a highly advanced culture in the Four Corners region. However, despite a century of archaeological research by experts, there is no evidence that any Anasazi people remained in the Four Corners region after 1300. Their dwellings were left in ruins-abandoned, some set on fire. Where did these desert people go? What drove them out? On *AmericaQuest*, our online audience directed the team as they looked for answers to this great mystery. (AmericaQuest, 2000, p. 1)

Max learned to set up a curriculum using the *AmericaQuest* site as an Anasazi fact-finding resource for the 5^{th} grade students. Information was to be presented in *PowerPoint* format. By now, Alex felt Max should be comfortable with the Classroom Technology Center rotation project management approach to integrate it into this technology intensive project. Students worked in their pre-assigned groups. Each group consisted of from four to five students assigned to specific workstations. Groups 1 - 4 worked on networked computers set up along the east side of the classroom. Group 5 worked on an additional laptop placed on a desk in the front of the room near the west wall. Another group formed around Alex's computer. Eventually, all groups logged on to their respective computer and went to the online *AmericaQuest* library.

At first, students appeared on task and engaged in the research process. But over time, the other three or four students in each group without the mouse and keyboard are just standing around each computer watching the screen. Approximately

25% of the 5th graders were not engaged in this project at all. Many students who were not on task began talking among themselves with their backs to computers – no eyes on the screen. The noise level increased to a high pitch.

About every five – six minutes, Max rang a small round silver lobby bell. The ring signaled a command to switch computer operators. Each student in charge of controlling the mouse and keyboard relinquished the tools to the *controller in waiting*. This exchange went smoothly. Students appeared familiar with this course of action. Max asked a particular student how their group had progressed. She reported, "Not at all" (Observation Notes, March 14, 2000).

The bell rang again. Two other groups reported that they have acquired a lot of information. I noticed Max asked this question to individual groups in a louder than ordinary voice as a verbal reminder to each group that they were clearly not focusing by their apparent noise level and had an assigned task to accomplish. A few minutes later, Max voiced another reminder to all the students that their information gathering was "critical" to their group reports due the next day (Observation Notes, March 14, 2000). The noise level was also brought to their attention. Twenty minutes into the assignment, the noise level decreased and more students were on task.

Max and Alex constantly moved around the classroom answering questions about both the assignment and technical issues related to the *AmericaQuest* site. Alex asked a group, whose chatting obviously marked them the least involved with the information gathering how they could best share the screen. He calmly explained the procedure of one person scanning while at the same time another could work the keyboard. This suggestion put the small group on task. Occasionally both Alex and Max took breaks from the project to document the project with still cameras.

Max rang the bell and announced to the students:

> Listen before you move. Remember the website you are currently on. Have the website recorded. Put the most responsible person in your group in charge to bookmark the site. We will work on the group reports tomorrow. Groups will return to the same computers tomorrow. Now, log off. (Observation Notes, March 14, 2000)

This whole process from computer log on to log off took less than thirty minutes. It was a chaotic experience to say the least. In order to understand the *AmericaQuest* events, immediately following the lesson Max reflected that he did not receive the curriculum information until the Friday before Monday's first lesson plan. He felt the time frame was not adequate for him to prepare for the five-day commitment to the Anasazi series. He found the website not "user friendly." Getting familiar with the hot links was "too time intensive especially for first year teachers" (Informal Interview Notes, March 14, 2000). Preparation time "takes a lot of footwork and takes a lot of time for a teacher" (Informal Interview Notes, March 14, 2000). The following points are a continuation of this dialogue further explaining Max's reflection on the events around today's online facilitated project.

- Today's lesson was more about cooperation around the computer and classroom management – crowd control.
- It is hyped up and looks exciting but *AmericaQuest* is a mile wide and an inch deep.
- The curriculum is not age appropriate for 5^{th} graders. It is more grades 2 - 3 appropriate.

- Student interest fell flat on its face after the second and third day.
- Today's lesson was self designed because *AmericaQuest* [curriculum] was so off base.
- Rubrics are too specific and too detached from the integrated unit. They [the rubrics] are good for heading you in the right direction but not holistic enough.
- Alex will not use the [*AmericaQuest* curricular] five-day commitment.
- Another *AmericaQuest* is planned in September. Alex will not use it.
- Books are better...Technology is not always the best way to go. (Informal Interview, March 14, 2000)

On April 21 during an informal discussion with Alex, he found *AmericaQuest* to be a very strong program and he *will* use it again. He continued to explain that the classroom events taking place while I was conducting Observation 2 were "due to lack of Max's preparation" (Informal Interview, April 21, 2000). Alex "weighs which things he can interfere with Max's [teaching] and not unsettle the students" (Informal Interview, April 21, 2000).

In May, an additional two months of Alex's classroom and project management guidance has shown a positive effect on both Max 's and the students' classroom demeanor and productivity. This *Raging Planet* project was a product of Max introducing the Discovery Channel video series and website to Alex. Alex developed an intensive engaging classroom weather investigation around the website content.

During *Raging Planet*, another type of online mediated curriculum, Max was much more in charge of the content even while facilitating student questions. Other than a brief period of restlessness about an hour into the exercise, students remained on task. Those groups, who had completed the initial assignment, went about preparing their *PowerPoint* presentation two weeks away.

Observation 3, which took place in the 4th week of a five-week online science project researching weather systems entitled *Raging Planet*, recorded a more dynamic computer-facilitated lesson. The Discovery Channel hosts *Raging Planet* - a series of one-hour geosciences documentaries "on the most powerful, beautiful, and destructive forces of nature. From fearsome hurricanes to life-threatening forest fires, from volcanic eruptions to the menace of an avalanche, this series covered all the violent manifestations of nature" (Raging Planet, 2000, p. 2).

Educators may record the documentaries and use these geosciences documentaries free of charge for a year. The Discovery Channel website provides on-line support, questions, activities, vocabulary, benchmarks and links for each program. "The site is constantly reviewed for educational relevance by practicing classroom teachers in elementary school, middle school, and high school" (Raging Planet, 2000, p. 1).

The *Raging Planet* curriculum was placed on the elementary school server for networking to Alex's classroom. Today the 5th grade students worked in their pre-assigned groups for approximately one hour and fifteen minutes on specific weather phenomenon. The *Raging Planet* unit requirements were carefully outlined in a lesson plan:

1. Each student must have a complete portfolio containing information from in class work/experiments as well as information gathered for the research project.

2. Students will have an active roll in their group. This will be documented and will be their [sic] job for one week. At the end of that week, the student will write a reflection about their job for that week and place it in their portfolio. The student will then rotate to the next job so that each student will have experience with each job. (see Table 10)
3. Jobs are as follows:
    - Recorder - this person is responsible for recording (typing, writing, etc) all information that the group will need for their presentation. This includes charts, graphs, and pictures.
    - Discussion leader - This person is responsible for making sure that the group completes daily objectives set forth by the group.
    - Information tech - this person is responsible for making sure that the group utilizes each resource (Internet, newspaper, magazines, encyclopedia, maps, public library as well as the school library) available and that they are recorded.
    - Reporter - this person is responsible for all oral reports to the teacher ands class except for the final presentation, which will be given by all students.
4. Evaluation/mini projects
    - Students will create a goal each day to work on. At the end of the week the group will report on their progress.
    - Students will create newspapers with news reports, editorials, weather reports, and any extra information that they want to include.
    - Students will create a final presentation that will include newspaper articles and research reports. (Alex's *Raging Planet* Lesson Plan)

Table 10: Evaluation/Mini Projects Rubric Example

Group Work		**Graded [Points] 4 3 2 1**		
Name		**Group Number**		
Date	Goal	How do you plan to accomplish this goal?	What went well?	What could you do better next time?

On the sixth week, students were scheduled to present their subject area to the entire class using *PowerPoint* software. The final *PowerPoint* Presentation Rubric for each student group established the requirements for the five-week science project. Ten to fifteen *PowerPoint* slides were required for presenting research information. No more than three hyperlinks were allowed. Sound and/or video clips became an option. Alex planned to have finalized *PowerPoint* presentations published on the school's 5th grade website. And by working with Max through the semester on using the digital camera, manipulating *Multimedia Workshop* software, authoring web pages, and constructing websites, Max would be helpful in getting things prepared to go online.

On the day of the observation the classroom was set up in the new computer pod configuration. Max remarked positively on the classroom's new layout. An extra laptop computer made up an additional pod arrangement. Shortly before the assignment began, Alex worked diligently in getting the online maps up to par due to some computer glitch on the school network. As soon as he felt secure in the performance quality of the system, student groups logged on to Netscape. Max directed the students to search for SNAP:

> Type in Seattle Times. Once Seattle Times appears, scroll to the archives. He has some difficulty finding the archives. Once the archives are found, bookmark the web page and begin looking for newspaper articles. Your objective is to find a newspaper article on your subject. This is the start of a primary resource. (Observation Notes, May 5, 2000)

Max and Alex circulated throughout the classroom helping each pod. All groups were on task. Max rang the bell during the *Raging Planet* exercise to explain:

- Each job title, individual responsibilities attached to the titles, and how to rotate.
- How to limit the search and uses the whiteboard to illustrate the most efficient procedure.
- What to do with the article once you find it. (Observation Notes, May 5, 2000)

It became obvious that by now, Max had learned more about preparing, organizing, and assessing technology-based projects. And when observing the 5th grade students' *Raging Planet* PowerPoint presentation, Max had also grown in his ability to use the LCD panel.

Equipment: Time and Availability

The issue of time surfaced early in the study as a tough taskmaster and often served as a determining factor in integrating technology into the classroom curriculum. Alex offered these words of wisdom when it comes to using technology tools:

> There's a potential for disaster all the time, and there's also the potential for glorious success...I get the same kind of high from teaching that I get from mountaineering. Things can go so well, and they can go so wrong, and I need to continually improve my skills. (Alex, as quoted in Sherman, 1998, p. 2)

Classroom Implementation: Time and Availability

Participants were well aware that they taught in technology-rich classrooms far better equipped than surrounding school districts. However, in many ways, limited technology availability often created curriculum barriers within their own teaching experience.

Max found his field placement experiences were repeatedly "limited to students work[ing] in groups on projects. We [the 5th grade classroom] don't have the resources for smaller activities" (response to interview question in Appendix G). His cooperating teacher is of the same opinion. "Individual student projects involving computers are still limited due to limited number of machines" (response to interview question in Appendix K). Joshua believed "the most difficult task of teaching technology is...having enough computers for students to be able to complete their tasks in a reasonable amount of time" (response to interview question in Appendix G).

> Frustration came with the fact that [the 3rd grade classroom] has five computers with varying capacities and 24 students. It can be very time-consuming trying to get all the students through one lesson. It can be done, and if I have computers in my own classroom, [I will] plan so that I can rotate the students through. (response to interview question in Appendix E)

Joshua summarized a similar field placement experience in his 4th grade classroom:

> The fact that there is a very strong computer program at my school makes me eager to learn more about technology as well as incorporate all I can into my classroom...It is also difficult to organize a whole class computer activity since we have only five computers for 27 kids and no computer lab. (response to interview question in Appendix E)

The student teachers found integrating technology into instruction required considerable amounts of time involving curriculum development work, structuring classroom schedules to accommodate technology, and dependable access to appropriate hardware, peripherals, and software to execute that work. On many levels, time and availability strongly dictated curriculum. Max, concerned about the teaching schedule and following an exasperating nonproductive half hour with the 5th graders researching on the *AmericaQuest* website, commented, "The curriculum is so full. We only have a half hour three times a week to focus on a technology-based assignment - and it is usually [during] standard writing time...We need to start the American Revolution right away" (Observation Notes, February 28, 2000). Near the end of his student teaching experience, Joshua reflected – "In the future I will probably incorporate it [technology] into more lessons, but right now I need to focus on mastering more teaching and survival skills"(response to interview question in Appendix G). Anne and Lynn's plans for creating a 3rd grade web presence never came to fruition - the field placement ended. Max's Spanish galleon interactive CD-ROM remained on the drawing board.

Keyboarding: Time and Availability

Student teachers came into their field experience directly from the academic pace of the Elementary Methods Block. Participants often spoke to the surprise they experienced when their student teaching met the array of elementary students' developmental abilities and learning curves - let alone facilitating technology integration into the curriculum and equipment availability.

Unanticipated developmental abilities of the elementary students often impacted schedules. Student teachers expressed concern at their respective students' keyboarding speed (or lack there of). Observations to that effect came up at an impromptu discussion I held early in the semester. All agreed upon three main keyboarding points that impacted time when using computers:

- Word processing group work is tediously time consuming.
- Pupils are slow typists and could often use traditional means [cursive writing] much faster.

- Keyboarding is cumbersome for most elementary students because their hands are too small for standard computer keyboards (Observation Notes, February 24, 2000).

Part of Lynn's student teaching responsibilities was teaching keyboarding to her 3rd grade class. Her experience teaching in the keyboarding lab reinforced these three earlier observations. "The students must learn to keyboard in the early grades before they develop bad habits of one *finger typing*" (response to interview question in Appendix D). After his 4th grade finished putting their website online, Joshua commented, "They are extremely slow typists - about four words a minute. Word processing takes a long time" (Observation Notes, March 3, 2000). All three student teachers became keyboarding curriculum advocates during their field placement semester at the elementary school.

An additional keyboarding benefit to Lynn and Joshua was they learned a keyboarding system lab setup was simple, inexpensive, and *doable*. Keyboarding only required recycled computers capable of word processing, a keyboarding manual, and /or software program.

Technology Reservation Protocol: Time and Availability

Technology integration and collaboration did not occur without some pitfalls and obstacles. A simple reservation protocol is in place for using technology equipment, software, and peripherals stored in the library and managed by the media specialist/librarian. However, problems occur in creating an egalitarian procedure for distributing high-ticket technology items for classroom use. The recurring issue is a low ratio of high demand peripheral equipment to the 15 teachers in Building 1. (see Table 11). Some participants recognized a problem of involuntarily accumulating some technology equipment in Alex's classroom. Equipment availability had a negative influence on the implementation of classroom technology in Building 1.

> Availability either makes it or breaks down the use factor. If we all had LCD [panels] and scanners in our rooms they would be put to good use!! Trying to track down equipment or locate it is not a good use of our time. (response to interview question in Appendix K)

> Having all the technology in Alex's classroom makes it awkward for the other teachers to obtain easy access. Technology would be used more widely if it was more easily obtainable and there was some workable reliability in assigning it to teachers. (Informal Interview April 28, 2000)

Student teachers seemed especially vulnerable to access issues. The following comments are taken from informal and formal interviews with the study's student teacher participants:

> One of the scanners is in the library so access is somewhat limited. The other scanner and laptop computer are kept in [another teacher's] classroom even though it is supposed to be available to the entire school. I believe this inhibits many from using it. I think it should be kept in the library, or more centrally located, so that is more accessible to the other classrooms. (response to interview question in Appendix G)

> I am hesitant in my school to ask for the overhead computer monitor (for a *PowerPoint* presentation), as it seems to be in high demand. (response to interview question in Appendix E)

> The LCD panel sets in Alex's room. He is considered technology leader and uses it more. [Other] teachers must reserve well in advance to get the privilege. I am willing to reserve but have witnessed other teachers being disappointed because of a certain pecking order. Alex has unconditional priority. (Informal Interview, February 24, 2000)

> Multimedia is difficult to use when there is only one overhead computer projector (the LCD panel). You cannot cram 27 kids around one computer to watch a presentation. (response to interview question in Appendix F)

The upside of this access issue is that more teachers and student teachers want to use technology equipment in their classrooms. Alex's summarized his observations of teachers' growing interest in technology: "LCD projector and flex cam use are

Table 11: Spring 2000 Shared Instructional Technology Resources

Quantity	Location	Instructional Technology Equipment
2	Library	Digital camera
1	Library	Camcorder with tripod
1	Alex's classroom	LCD panel (liquid crystal display)
2-3 per grade	Through out school	TV with VCR (video player) on cart
1	Alex's classroom	Laptop computer
4	Library	CD/Tape Boom box
2	1 Library; 1 Alex's classroom	Scanners
1	Alex's classroom	Video Flex camera
2	Library	35 mm slide projector
1	Library	16 mm film projector
2	Library	Digital camera
3	Library	Filmstrip Projector
13	Library	Cassette recorder
7	Library	Cassette player
1	Library	Opaque projector
24	Library and each classroom	Overhead projectors
4	2 Library and 2 storage	Record player

extremely limited by increasing demand for this equipment among the teachers in our building" (response to interview question in Appendix K). Hardware access management in a public school setting requires the ability to plan and share limited high demand hardware.

Self Sufficiency: Time and Availability

Most participants preferred to own some of the technical responsibility for both efficiency (time) and convenience. They expressed desire to become independent in setting up their own technology needs in the classroom. While I was conducting an informal interview with Lynn about the use of technology and its ease of availability, Anne made some reflective points in this area:

- Information is needed for teachers to have confidence and / or to learn how to wire the computer to TV for ease in presentation. There is little time for setup.
- Often, one has to search down someone to hook it up and that takes time from the helper and the teacher if it happens in good time at all.
- "All we need is a chart to show how to do it" maybe next to the cords [cables] in the library.
- "No one teaches us this" [at the School of Education]. (Observation Notes, February 28, 2000)

Anne, Lynn's cooperating teacher, responded to an interview question along the similar lines:

> I would LOVE someone to develop a user friendly teacher guide – written reminder – of "how to" use various items (LCD, scanner, etc) so that any individual (student teacher, parent, etc) would be comfortable working with kids and following directions on how to do the hook up or operating of equipment. It would make my time more efficient for teaching because I wouldn't be taking class time to explain the mechanics to another. I also think it would involve more parents and help them develop a comfort zone with the changes in technology in the classroom. (response to interview question in Appendix H)

Anne also recommended that the School of Education could better prepare preservice teachers in the effective use of technology in their student teaching field experience by requiring a "*How-to-hook up* class – they [the student teachers] are taught how to put together *PowerPoints*, but don't know how to hook up the LCD to the computer or a laptop to the LCD. They also need a little troubleshooting especially with VCRs, TV, and cable connections" (response to interview question in Appendix H).

Media Technologists: Time and Availability

Qualified school media technologists [lab techs] are an important part of the efficiency and convenience equation. Faculty who wish to integrate technologies into curriculum consider technologists as a chief point of contact. To a large extent, they are both advisors and facilitators in curriculum development and support. In fact, they are the school's front line of support and that support often takes the form of technical and instructional consultation.

All three cooperating teachers volunteered input concerning the school's media technologists. One cooperating teacher explained, "Two lab techs are available to the teachers. One is especially good. The other is good 'but not an educator…He is working on this'" (Informal Interview, April 28, 2000). A second cooperating teacher noted in an interview question directed toward support personnel, "Philip is AWESOME!! He will put things in writing for us visual folks" (response to interview question in Appendix K)! A third cooperating teacher's statement went in another direction:

> Some technology should not be the responsibility of the teacher. For example, when the computers were set up, those in charge [media technologists] placed a setting for screen images that has to be encountered deep within each computer setting so that classroom computers may be projected via a TV screen. Just because of the tech's aesthetics, teachers find it close to impossible to figure out how to use the computer and TV monitor in a compatible way. (Observation Notes, April 21, 2000)

Cooperating teachers also questioned the appropriateness of the policy authorizing media technologists to purchase educational software. Peggy brought up a controversial case in point - a software program that the teachers were comfortable with was not transferable to the new network (Informal Interview, April 28, 2000). Thus, the real quest to find quality software that is *networkable* has become a high profile challenge.

Anne also believed that media technologists are not a cogent choice for choosing "appropriate software" for the teachers (Informal Interview, February 23, 2000). She expanded upon the points Peggy brought up:

> [Look at] programs like *Math Facts Tracker* - That is such a great math program. And since they [the media technologists] changed over to our new cable system or upgraded the computers, we are not able to print out student progress reports on *Math Facts Tracker* any more. So here is a case of having the software that's wonderful [and] that the kids enjoy, but we can't print out the awesome results that we used to be able to share with parents at conferences. And that is real frustrating to me because it was a real time saver and I am not going to sit and look at each kid's information on the computer and physically write it down. That defeats the whole purpose of the program so that's disappointing to have software that works, upgrade your system, and then have it no longer work the way it should...I think you have to just be conscientious of that – defeating the purpose of upgrading if none of your old programs can run on your new system. Or, you need to allow teachers to go to more conventions that offer software instead of the media tech people because they can only tell you if it will run on our system. But the teachers are the experts at knowing which software fits with our curriculum. I think the teachers should be attending more of those things. I think that is really, really important. (response to interview question in Appendix H)

Conversely, when Max approached the topic of purchasing software for the school. He thought it should be left to the technologists.

> Software is purchased in bulk license. Imagine if the software was left to individual teachers for their classrooms. Who would have the time to download it properly? Not the already taxed techs that are applying Band-Aids to these computers that are already demanding special attention. (Observation Notes, April 13, 2000)

Each participant's descriptive input derived from the Spring 2000 semester supplied candid perceptions about the five-month learning process within the culture of the technology-rich field placement site. From the vantage point of researcher, I interpreted student teacher / cooperating teacher professional interactions, personal information, and reflections within the classroom context. The three distinct themes: (a) Collaboration and Rapport, (b) Self-Directed Learning, and (c) Equipment: Time and Availability evolved from careful data collection, concerted documentation, and thoughtful analysis.

CHAPTER V

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

> *A primary interest of qualitative-naturalistic [researchers] is describing and understanding... dynamic program processes and their holistic effects on participants so as to provide information for program improvement. (Patton, 1990, p. 52)*

The naturalistic study presented here was conducted to identify information that will assist in a better understanding of the elementary teacher education program's strengths and weaknesses in preparing preservice teachers to successfully integrate instructional technology within the context of their elementary student teaching field placement. Knowledge of the process student teachers experience while assimilating technology theory into practical application in the elementary classroom is important in evaluating the teacher education program and its future direction. Research focused on one Grand Tour question and four Sub-questions.

Grand Tour Question

How can schools of education successfully merge instructional technology theory with classroom practice?

Sub-Questions

1. What forms of support are essential in assisting student teachers in incorporating computer-based technology into their teaching?

2. What themes or patterns, if any, emerge in student teacher's instructional technology classroom approaches from this semester observation?
3. What effects do instructional technology using educators have on non-instructional technology using educators?
4. What effects do non-instructional technology using educators have on instructional technology using educators?

SUMMARY

Cooperating and student teacher pairs were studied as a means to provide teacher educators and administrators insights into enhancing student teachers' ability to merge instructional technology theory with the classroom practice of integrating computer-based technology as a curricular tool. Student teacher selection criterion insured that individual participants experienced the same School of Education academic preparation for their respective student teaching field experience. Individual cooperating and student teacher technology ratings, determined by unbiased evaluators, served to establish commonalities as well as distinct technology abilities–a key in considering their field placement classroom pairings. Noteworthy student teacher study exceptions included technology experience prior to admission to the education program, School of Education instructors, and cooperating teacher designation. By placing student teachers in the same field placement elementary school site, participants had access to the same technology. This was important in investigating individual views of a technology-enhanced teaching environment and its underlying influences on implementing instructional technologies during the student teaching practicum.

Study data was collected through a variety of qualitative methods. Descriptions characterizing the school site, classrooms, and available technology equipment provided a narrative of each participant's field experience. Interview questionnaires supplied a means for generating individual technology profiles early in the study. The School of Education certification program description establishing academic background information further enhanced each of the profiles. These technology profiles served as individualized summative technology attitudes / experience and educational framework from which to follow all participants' experiential perceptions.

Participants were asked to consider how the field experience contributed to their personal attitudes concerning curriculum technology use. Their reflections over time facilitated identification of perceptual changes that surfaced during the semester. Information garnered from interview questionnaires helped establish additional investigative topics to pursue. Informal interviews allowed me to probe into developing themes and clarify unclear data interpretation. Videotaped observations provided tangible illustrations of student and cooperating teacher pairs' instructional technology curriculum application, integration, and distinction between the two. Observations also provided a chronology of student teacher educational technology sophistication and evolution as well as further insight into effects of cooperating teachers on student teachers and vice versa.

Information resources required a holistic data collection and analysis approach. A linear research approach would not do the participants' perceptions justice. These many qualitative methods rarely served as informative entities unto themselves. Each contributed to a growing symbiotic relationship of perceptions and facts as the study progressed.

Study Results Diagram

Figure 5 shows major influences that contributed to the participating student teacher's synthesis of effective technology integration. The right side of the diagram represents School of Education (SOE) program requirements, including academic

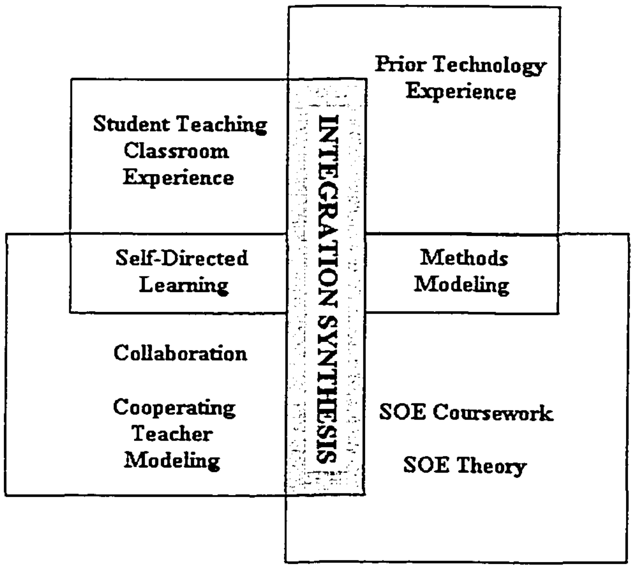

Figure 5. Study Results Diagram.

coursework and prior technology experience, contributing to formal theory-based education. Modeling by Elementary Methods Block professors and surrounding education faculty assisted in preservice assignments translating into eventual student teaching practice. Prior technology experience acquired beyond the School of Education program requirements added to the student teachers' fundamental technology ability and often reflected on their desire for self-directed learning.

The left side of the diagram represents the practical application of theory during the student teaching field experience. Daily cooperating teacher modeling and mutual collaboration between each cooperating / student teaching pair enhanced authentic classroom proactive trial-and-error problem solving and curriculum design. Self-directed learning along with daily collaboration and modeling surfaced to be determining factors in each student teacher's capacity to approach technology implementation during their field experience.

Student teachers who had the strongest self directed-learning characteristics became much more adapt at synthesizing the culmination of academic and authentic learning experiences. Instructional technology synthesis represented by the center vertical rectangle grew from factors illustrated on both the right and left sides of the diagram. The degree of synthesis was directly related to whether student teachers moved toward technology integration using higher-order curriculum approaches.

DISCUSSION

From the onset of the study, I sought to identify commonalties in the student teaching field placement experience that may inhibit and/or contribute to the implementation of computer-based technology in the classroom. Sub-question research data analysis contributed to synthesizing some resolution to the Grand Tour question: *How can schools of education successfully merge instructional technology theory with classroom practice?*

Sub-Questions 1 and 2: Time and Collaboration

1. What forms of support are essential in assisting student teachers in incorporating computer-based technology into their teaching?
2. What themes or patterns, if any, emerge in student teacher's instructional technology classroom approaches from this semester observation?

Emerging themes and patterns are directly linked to establishing essential support mechanisms necessary to help student teachers incorporating computer-based technology into their teaching methodologies. The study recognizes that many of the student teacher participants' field experience perceptions correspond to substantial national data regarding obstacles to and facilitation of a national thrust toward technology literacy. Such recognition should contribute to teacher educators' realization that teaching skills demanded by a new century requires dedication to the renovating teacher preparation practices that no longer work.

Diversity in support strategies clearly became essential in motivating the integration of computer-based technology into classroom methodology. And time quickly emerged as an overlying theme throughout the entire study. Study data became predisposed to a multiplicity of participant time perceptions influencing technology integration decisions on many levels. The present analysis is congruent with existing research findings citing time as a critical implementation component (c.f., Beggs, 2000; The United States Department of Education, 2000a; Mitchell &

Hutchinson, 1998; Nantz & Lundgren, 1998; Kane, 1994; Sheingold & Hadley, 1990). Since so many factors affected time issues, factors are divided into separate sections.

Time and Research

Since the first day of the study, participants wrestled with a responsibility overload. Even though they were committed to following through with this study, it became painfully apparent that weekly student teacher focus groups soon became frustrating experiences for everyone involved. Participants began sharing how much daily stress they faced just in preparing for their student teaching assignments, university field placement meetings, and the additional work required for the research. Weekly focus groups were scaled down to bimonthly scheduling. As the semester progressed, increasing participant stress over time and their inconsistent attendance was taken into consideration. I opted to end the focus group in favor of preceding and / or following each video observation with informal student teacher interviews as well as conversing with participants when I was visiting the study site for supplementary data. These options worked out well because they allowed me to immediately clarify any questions that came up from classroom observation and obtain information in a less formal manner. However the overlying issue throughout this study was how much *time* influenced the field placement experience (c.f., Fisher and Dove, 1999; United States Department of Education, 1998a).

Time and Pre-established Curriculum Schedules

On many levels, time and equipment accessibility influenced technology integration. Public school curriculums are crammed with meeting state and federal content standards even without an official technology component (c.f., Kane, 1994; The United States Department of Education, 2000a). During many classroom video observations, I witnessed schedule conflicts with technology-enhanced projects. For example, *Raging Planet* required 90 minutes a day for six weeks. *AmericaQuest* required 30 minutes a day for five weeks. When comparing the amount of content demands on an 8:30 A.M. to 3:32 P.M. academic schedule (minus one hour and 10 minutes for lunch and recesses), 30 – 90 minutes takes up a considerable portion of the daily schedule. Student teachers related that it is not uncommon for technology proficient teachers to sacrifice other content areas for a technology-integrated assignment.

During Joshua and Peggy's decimal project, student momentum was interrupted until the following day due to scheduled recess and other curriculum content to be covered later in the day. Because of such a tight daily academic schedule, Lynn soon settled into the routine of modifying lunchtime into tutoring 3rd grade computer-assisted learning. Further investigation using informal interviews revealed a pattern of the teaching staff engaging in unofficial reprioritizing of subject area scheduling.

Time and the Reality of Technology Integration

The need and motivation to integrate technology during the field experience waned for two of the three student teachers as the semester progressed (c.f., Thomas, Larson, Clift, & Levin, 1996). Lesson planning was time consuming enough and incorporating goals and objectives involving technology made a demanding endeavor even more so. One example surfaced from observing a lesson planning session between a cooperating teacher and student teacher. Since the cooperating teacher offered the content already designed into a working lesson plan (complete with accompanying overhead transparencies) the student teacher proposed to elaborate on the project by incorporating computer stations into the following day's assignment. The plan to include computer stations was very astute in that it transformed a traditional stand-and-deliver teaching approach into a more engaging hands-on interactive learning experience for the class.

The next day, I videotaped this same student teacher using the original overhead transparencies, the whiteboard, and color markers. No computer stations were added to the lesson plan. Some students were called upon to work on the whiteboard with color markers. Many students, especially those furthest from the whiteboard, began fidgeting after 15 minutes. I witnessed a student teacher's good intentions overridden by not enough time to integrate technology effectively into the lesson plan, to choose software content to supplement the subject area, to prepare the computers for the project, and apprehension about not enough time in the schedule to work all the students through the computer station component (c.f., Medcalf-Davenport, 1999; Larson, Clift, & Levin, 1999; Queitzsch, 1997).

Student teachers often became frustrated over the amazing amount of time it took their students to work through technology-integrated assignments and to use technology not typically located in their classroom. Even though their 5:1 student to computer ratio was slightly two times better than the national average, not enough computers in the classroom was a recurrent technology barrier during field placement (c.f., Beggs, 2000; The United States Department of Education, 2000a; Cafolla & Knee, 1995; Kane, 1994).

Integrating technology equipment usually stored outside the classroom became another persistent curriculum barrier. A majority of student and cooperating teacher participants reflected on the time it took to locate and set up technology for curriculum integration.

Collaboration

The preoccupation with time led to a parallel investigation into what factors contributed to these student teachers' coping mechanisms (i.e., support systems) during their field placement experience. Cooperating teachers served as the student teachers' fundamental ongoing transitional support system toward becoming skilled educators. Field experiences provided a mentored trial-and-error authentic learning environment where, hopefully, theory may connect to practice. Third, fourth, and fifth grade classrooms represented the bell jar wherein student teachers had daily opportunities to synthesize previous academic coursework, including two semesters of school observations, on a conscious *Ah, ha* level. Participant pairs became collaborators working together in real time, not just in theory–a missing element in their university-based teacher education program. Feedback was immediate. Elementary students either responded or not. Ultimately, a safe classroom environment to make mistakes and experience victories was essential.

Sub-Question 3 and 4: Self-Directed Learning

3. What effects do instructional technology using educators have on non-instructional technology using educators?
4. What effects do non-instructional technology using educators have on instructional technology using educators?

The bonding element between the participant pairs in the study underscored the heavily researched and proven phenomenon of student teachers readily implementing their cooperating teachers' classroom practices in lieu of the university professors with which they have spent two years of prior preparatory work (c.f., Calderhead, 1988; Wetzel & McLean, 1995; Pratt, 1993; Merriam, 1993; Richardson-Koehler, 1988). I saw a direct connection evolve between this study's participant pairs' collaboration and rapport and their individual self-directed learning characteristics.

Even though cooperating teachers often wore the hats of role models, advisors, counselors, guides, tutors, cohorts, and, in some instances, devil's advocates and gurus on any give day, they never dictated information to student teachers for regurgitation at a given time. This classroom setting for experiential learning involved the self-directed learning activity of gleaning and synthesizing knowledge – placing student teachers with personal responsibility for their own learning.

All student teachers participated in three important instructional components leading to effective technology curriculum integration: (a) technology-enhanced cooperative learning and curriculum content approaches, (b) valuable experience with the Classroom, and Technology Center teaching methodology, and (c) hardware and software management and organization,.

Working with their cooperating teachers, Lynn and Joshua gained experience in the application of cross-age tutoring. Joshua intimately worked with *Peggy's Teaching and Learning with Computers* program. Max was initiated to and played a key role in *WebQuest* online curriculum planning and implementation.

Some student teacher reports on insufficient modeling preceding the field experience might have provided incentive to implement their cooperating teachers' classroom practices. Max, jaded by lack of effective modeling during his preservice coursework, often skeptical of teacher educators' instructional technology curriculum approaches, worked to emulate Alex, his cooperating teacher. When attempting to replicate Alex's ease in delivering curriculum content integrating technology, Max often fell short. Early on, he overlooked Alex's exacting attention to every detail leading to effective curriculum design and facilitation. Often Max's efforts to emulate without building a foundation of preparation resembled mimicking. Synthesis and self-direction were often lacking and led to teaching difficulties.

On the other hand, Lynn who experienced modeling in both Elementary Methods Block and C&I 306 was very capable of analytically discussing facets of Anne's technology implementation approach and how to alter them for her own classroom purposes and teaching style. She acquired a track record with Anne of diligently and ably investigating curriculum technology integration that both enhanced and challenged students.

Early in the semester, Joshua recognized the importance for him to deliberately pace his field experience responsibilities. His respect for Peggy and her teaching approaches played out in his amalgamation of her technology integration techniques. Distance from the intensity of the student teaching field experience will provide opportunities to harvest and synthesize from Peggy's methodology knowledge base. (see Table 12 for detailed technology contributions from each participant).

Pair One complemented each other's contributions toward increasing curriculum technology integration. Anne's strengths gave impetus to Lynn's ability to synthesize and grow. Lynn's strengths activated Anne's drive to investigate venues she was either curious about, such as web authoring, or had forgotten, especially Microsoft *Excel*. The technology literate novice student teacher and nearing proficient cooperating teacher expanded each other's technology literacy base and energized further learning toward a common goal – creating and facilitating a challenging engaging learning environment.

Pair Two's experiences appeared more one-sided. Peggy's proficient computer-assisted learning and instruction integration methodologies put theory into action for Joshua. He actively witnessed and participated in setting up and using computer station learning strategies. Classroom conducted Internet research further reinforced his personal theory and experience regarding this informational tool. Joshua also took part in converting simple web authoring into a language arts project. Peggy valued Joshua working with students to create a 4th grade website and his competent technology skills. Under Joshua's tutelage, she discovered a comfort level with the digital camera and many software applications. In this study the proficient technology literate cooperating teacher greatly affected the nearing proficient student teacher.

Table 12: Technology Influences Within Student / Cooperating Teacher Pairings

	Pair 1	Pair 2	Pair 3
Student Teacher Learned From Cooperating Teacher	• IT classroom management • Using Classroom Technology Center • IT integrate into curriculum • Cooperative tech project w/cooperating teacher • IT empowerment	• IT classroom management • Using Classroom Technology Center • TLC curriculum concept • Keyboarding curriculum integration	• IT classroom management • Using Classroom Technology Center • IT Peripheral set up • Ethernet network /network printing • Digital camera • *Multimedia Workshop, Excel,* software • Website authoring /organization • *WebQuest* online curriculum • IT accessible arrangement • Internet streaming content • IT assessment • Hardware access / management
Cooperating Teacher Learned From Student Teacher	• *Excel* software • Established IT curriculum connection • Website authoring / ftp • New educational software from TRC	• Website authoring • Computer printer troubleshooting • Use of digital camera • Photo Express software • Email document attachments	• *Raging Planet* curriculum enhancement • Internet sign language dictionary

Pair Three's proficient technology literate team appeared as an anomaly. Max did not flourish in this technology-rich learning environment. Eventually he began to synthesize Alex's accomplished modeling of classroom professionalism especially in the area of designing and facilitating higher-order technology enhanced curriculum. Toward the end of the semester, Max reengaged his self-directed learning abilities to prepare for class. Neither participant grew exponentially. Both voiced frustration. All the software and hardware instruction Alex provided for Max suggested that Max was not as proficient technologically as he was ranked prior to the field experience.

Improving on the Research Methodology

In retrospect, I found some practical approaches toward improving on this case study methodology:

- More rigorous screening process for determining participants. This process would be in addition to the procedures already in place. The number one priority would include personal interviews to establish a better understanding of the participants' commitment to being involved in the research.
- Establish more structure in participant interview questionnaire turn around time. The study experience developed my preference for supplying a blank audiocassette with each questionnaire to encourage participant verbal responses. When writing the replies to questions, participants at times contributed terse responses and / or delayed questionnaire return. On the other hand, audiocassette responses provided vast amounts of information concerning the structured question and peripheral input.
- Set up scheduled follow-up discussions with student teachers after each formal classroom observation. This would serve to reflect on their experience and immediately provide an avenue for interpretation.
- Meet with each of the student teacher's university supervisors to validate observational data and provide for member checking.

RECOMMENDATIONS

Teacher educators and administrators working in technology accommodating university environments are ultimately responsible for working toward setting functional integration priorities in motion throughout preservice curriculum. Implementing these priorities will emphasize a necessary goal of the educational institution – preparing teachers for the new century of students. In the past decade, classroom technology integration debates have shifted from *if* to *how*. *How can schools of education successfully merge instructional technology theory with classroom practice? How* cannot possibly be approached until priorities shift to facilitating the process. The following recommendations generated from this study may serve to strengthen the technology content of the teacher education program and in turn help prepare graduates who can use technology in a way to encourage higher-order thinking in all their future students.

Recommendation 1: Begin Now

Appropriate computer technology integration should become an automatic response to specific methodological needs prior to student teaching. Teacher educators must begin to modify their own curriculum design toward facilitating this goal. Once the student teacher enters his or her field placement experience, time elements are often weighed against exploring technology integration. Unless more student teachers establish a better comfort level with the latter, integration is often bypassed. So, if and / or when a student teacher becomes overwhelmed from his or her field experience demands, with the proper preservice training, integrating technology should not be interpreted as an overwhelming additional curricular chore.

Recommendation 2: Infuse Technology Into Every Course

Holistic integration is key. Systematically infusing educational technology into every teacher education course in some way will assist the curriculum transition toward graduating technology competent new teachers. As teacher educators enhance their own technology-based skills by connecting computers with each facet of school curriculum and instruction, preservice students will begin to connect technology to contextual learning activities involving age-appropriate, competency-building learning experiences to be used in student teaching. Even a beginning observation course could require students to locate instructional technology within the building site and establish a familiarity with reservation procedures.

Recommendation 3: Avoid Confusion Between Application and Integration

Educational technology courses estranged from the main body of educational coursework like C&I 306 further perpetuates the notion that technology is an entity to be dealt with outside mainstream academic educational courses. A danger lies in isolating technology applications from curriculum design and authentic learning environments. Doing so may encourage a literal translation of the course title - Instructional Media and Computer Applications.

A degree of naiveté exists in program expectations that a one-credit educational technology course such as C&I 306 can effectively prepare all preservice teachers who enter the course with a variety of technical abilities. However, courses of this type could be renovated to include authentic learning environments where preservice students design, implement, and evaluate technology-integrated activities in K – 12 settings.

Recommendation 4: Do Not Assume Synthesis

Think of the disservice to education if teacher educators certified new teachers who built and teach curriculum methodology and content standards around equipment, like pencils or color markers. Laughable perhaps, but novice educators need to be able to assimilate and synthesize the difference between computer technology applications and integration. Student ability to use technology applications confidently certainly enhances their ability to apply instructional technology appropriately to curriculum design but does not necessarily guarantee that their curriculum will encourage higher-order thinking skills in their student teaching classroom. Sometimes a *PowerPoint* is just a *PowerPoint.*

Teacher educators should avoid assuming preservice students have the ability to assimilate theory into practice. The ability to synthesize is not a given for every undergraduate, especially since they have most likely spent at least 13 years in educational systems primarily entrenched in drill-and-practice and memorization.

Recommendation 5: Debrief Cooperating Teachers

A thorough yearly debriefing of cooperating teachers' perceptions of fundamental strengths and weaknesses found in the School of Education program's technology component might benefit short-term and long-term program goals. Cooperating teachers are a valuable program evaluation resource. They work one-on-one with student teachers and witness the results of beginning efforts to meaningfully integrate technology into classroom practice.

Recommendation 6: Model, Model, Model

Modeling reflects heavily on student teachers' ability to integrate technology into their field experience classroom curriculum. School of education faculty and administrators must evaluate how to make modeling prevalent in every preservice classroom every day. Then, set the practice into action as soon as possible demonstrating and supporting technology as an integral part of preservice coursework.

FUTURE DIRECTIONS FOR RESEARCH

Although this study provides evidence that individual participants' experiences integrating technology into classroom curriculum was not extraordinary by any means, future educators' journey toward technology literacy should be considered.

- Follow-up research on this study's student teacher and cooperating teacher participants to gage any long-term effects of their partnering on technology integration into their professional classroom methodologies.
- Similar studies conducted on elementary, secondary, and K –12 student teachers in the larger surrounding school districts.
- A longitudinal study of preservice teachers beginning upon entrance into the School of Education program until completion of the student teaching practicum. This case study would involve data collection on how often education faculty integrated and modeled technology content throughout the

course of the academic program. The study would look at the effects of faculty integration and modeling on student teaching methodology.

The issue of integrating technology into classroom curriculum is complex. However, complexity should not impede educational institutions from overhauling their technology programs. This naturalistic case study contributes to a knowledge base that will promote well-informed technology integration into preservice instructional settings.

Preservice teachers deserve the encouragement, modeling, knowledge, and skill necessary to competently synthesize computer-based technology into their forming classroom methodology. Careful selection and pairing of cooperating teachers with student teachers are important. However, technology abilities of either are not always a guarantee that technology will be successfully integrated into classroom instruction during field placement. K – 12 students deserve teachers who are technology literate and sensitive toward integrating appropriate computer-based instructional technologies that encourage deeper forms of understanding within and across disciplines.

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APPENDIX A

THE TEACHER RESOURCE CENTER DESCRIPTION

THE TEACHER RESOURCE CENTER DESCRIPTION

The Teacher Resource Center (TRC) is located in the School of Education. The center is designated an Eisenhower National Clearinghouse Access Center, a Microsoft Teacher Training Site:

- The TRC offers both print and non-print materials for educators to preview.
- The TRC collection contains over 300 optical media and software titles.
- The collection is composed mainly of non-print materials and textbooks. Non-fiction children's books and teacher reference tools supplement these items.
- Inservice teachers may check out optical media for one week to preview them in their classrooms with their students.
- Print materials may circulate for two weeks.
- Computer application software must be previewed in the Technology Training Center (see next paragraph).
- Two multimedia workstations are available for previewing materials or for technology tutoring.

The Technology Training Center

This dual platform lab contains ten multimedia Macintosh computers and ten Windows multimedia computers; all of which are connected to the Internet. It has been designated as a High Tech Multimedia (HTMM) classroom because it is equipped with a Smart podium which controls an equipment rack which contains: 2 multimedia computers, one Macintosh and one Windows; a laserdisc player; a VCR; a CD audio player; an audiocassette player; a document camera; and connections to both satellite and cable television. This lab also contains peripherals, such as a digital camera, a scanner, and a camcorder, necessary to create multimedia presentations. This lab is used to teach computer-based classes, such as C & I 306 Instructional Media and most of the courses in the Master of Education in Instructional Design for Technology. In addition to regularly scheduled courses, methods classes use the lab to preview software.

Details on the Teacher Resource Center may be viewed at the School of Education website (http://www.umt.edu/education/trc/default.htm).

APPENDIX B

SUBJECT INFORMATION AND CONSENT

SUBJECT INFORMATION AND CONSENT FORM

Instructional Technology Theory Alignment With Practical Application During Student Teaching

Study Director: Carole S. Robinson
Department: School of Education – Curriculum & Instruction
Telephone: 406.721.4388
E-mail: CSR_MT@email.msn.com
Study Co-Director: Dr. David Erickson
Department: School of Education – Curriculum & Instruction
Telephone: 406.243.5318
E-mail: erickson@selway.umt.edu

Special instructions to the potential subject:
This consent form may contain words that are new to you. If you read any words that are not clear to you, please ask the project director or co-director to explain them to you.

Purpose:
The purpose of this study is to gather information in order to discover new things the School of Education needs to learn in order to assist educators in acquiring technology literacy in the classroom.

- Primary to the purpose is the ability to go beyond the application of the products of technology to be able to generalize the use and applications of a wide variety of technologies in the teaching and learning process.
- This study attempts to answer these questions and help identify, analyze, and synthesize informational components that affect efforts in implementing computer-based presentation software teaching approach within the context of the student teaching field experience.
- Hopefully, the research will assist schools of education, school administrators, and educators in understanding these issues and influences accompanying the process that preservice student teachers and inservice cooperating teachers experience while incorporating technology into their classroom methodology. The inquiry explores:
- Preservice teachers'/cooperating teachers' perception of their experience while implementing computer-based presentation software as a curricular tool into the classroom.
- Preservice teachers'/cooperating teachers' description of developing attitudes about technology and their comfort level using technology in the classroom.
- Preservice teachers'/cooperating teachers' choices in implementing computer-based technology pedagogy

Procedures:

- If you agree to take part in this study, you will be asked to participate in interviews, which may be audiotaped.
- Interviews will last no longer than 90 minutes.
- You will be asked to answer questionnaires.
- Questionnaires will take no longer than 60 minutes to complete.
- Four prescheduled video tapings of your student teaching methodology will be performed in your classroom by the researcher.
- The study will take place in Hellgate Elementary School until May 18, 2000. Written questionnaires and interviews may take place at a mutually agreed alternate location.

Benefits:

Your help with this study is a valuable part of ongoing research into The School of Education instruction. Study results may be an important factor in decisions affecting the development and improvement of Instructional and Informational Technology curriculum.

Confidentiality:

- The study data will be stored in a locked file cabinet in the researcher's office.
- Your signed consent form will be stored in a cabinet separate from the study data.
- Only the researcher and her dissertation supervisor will have access to the research files.
- Your identity will be kept confidential via pseudonyms.
- If study results are published or presented at a professional conference, your name will not be used.
- Audiotape and videotape will be transcribed without any information that could identify you.
- All audiotapes and videotapes will be destroyed by erasure no later than six months after the dissertation defense takes place.

Compensation for Injury:

Although we do not foresee any risk in taking part in this study, the following liability statement is required in all University of Montana consent forms.

In the event that you are injured as a result of this research you should individually seek appropriate medical treatment. I f the injury is caused by negligence of the University or any of its employees, you may be entitled to reimbursement or compensation pursuant to the Comprehensive State Insurance Plan established by the Department of Administration under the authority of M.C.A., Title 2, Chapter 9. In the event of a claim for such injury, further information may be obtained from the University's Claims representative of University Legal Counsel.

Voluntary Participation/Withdrawal:
- Your decision to take part in this research study is entirely voluntary,
- You may refuse to take part in any segment of the study or you may withdraw from the study at any time without penalty.

Questions:
- You may wish to discuss this with others before you agree to take part in this study.
- Is you have any questions about the research now or during the study contact: Carole S. Robinson, Study Director at 406.721-4388 or e-mail CSR_MT@email.msn.com
- If you have questions regarding your rights as a research subject, you may contact Dr. Jon A. Rudbach, IRB Chair through the Research Office at the University of Montana at 406.234.6670 or e-mail TRILTD@aol.com.

Subject's Statement of Consent:
I have read the above description of this research study. I have been informed of the risks and benefits involved, and all my questions have been answered to my satisfaction. Furthermore, I have been assured that a member of the research team will also answer any future questions I may have. I voluntarily agree to take part in this study. I also understand I will receive a copy of his consent form.

____
Printed (Typed) Name of Subject

______________________________ _______________
Subject's Signature Date

APPENDIX C

FOUNDATIONS IN TECHNOLOGY

FOUNDATIONS IN TECHNOLOGY

The University of Montana, School of Education would appreciate your use of these standards as a guide for determining the technology literacy levels of specific individuals considered for a case study. If you care to use more extensive criterion, refer to the International Society for Technology in Education Recommended Foundations in Technology for all Teachers (1998). In addition to using this feedback to select case study participants, the results of this survey will be part of ongoing research and will be analyzed and published. Responses to the evaluation will be confidential.

Questions about this questionnaire should be addressed to Carole S. Robinson, Project Director. Call 6-88-14-90-85 or e-mail csr_france@yahoo.com

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The university educational technology instructor, school of education field placement director, school principal, and/or methods instructor will classify candidates (specific individuals considered for a case study) at a technology literacy level. The evaluator will place participants into the following classifications:

Accumulated Points	Technology Proficiency Classification
88.00 - 70.40	Proficient technology literate
70.30 - 61.60	Nearing proficient technology
61.50 - 52.80	Novice technology literate

Estimate the skills confidence the candidate has to do the following:

I. Basic Computer/Technology Operations and Concepts

Use computer systems run software

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

To access, generate and manipulate data, and to publish results

Not at all	A little	A fair amount	Much	Very much	
0	1	2	3	4	

Evaluate the performance of hardware and software components of computer systems

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

4. Apply basic hardware and software troubleshooting strategies as needed.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

5. Operate a multimedia computer system with related peripheral devices to successfully install and use a variety of software packages.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

6. Use terminology related to computers and technology appropriately in written and oral communications.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

7. Describe and implement basic troubleshooting techniques for multimedia computer systems with related peripheral devices.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

8. Use imaging devices such as scanners, digital cameras, and/or video cameras with computer systems and software.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

9. Demonstrate knowledge of uses of computers and technology in business, industry, & society.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

II. Personal and Professional Use of Technology

1. Use productivity tools for word processing, database management, and spreadsheet applications.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

2. Apply productivity tools for creating multimedia presentations.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

3. Use computer-based technologies including telecommunications to access information and enhance personal and professional productivity.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

4. Use computers to support problem solving, data collection, information management, communications, presentations, and decision making.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

5. Demonstrate awareness of resources for adaptive *assistive* devices for student with special needs.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

6. Demonstrate knowledge of equity, ethics, legal, and human issues concerning use of computers and technology.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

7. Identify computer and related technology resources for facilitating lifelong learning and emerging roles of the learner and the educator.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

8. Observe demonstrations or uses of broadcast instruction, audio/video conferencing, and other distant learning applications.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

III. Application of Technology in Instruction

1. Explore, evaluate, and use computer/technology resources including applications, tools, educational software, and associated documentation.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

2. Describe current instructional principles, research, and appropriate assessment practices as related to the use of computers and technology resources in the curriculum.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

3. Design, deliver, and assess student learning activities that integrate computers and technology for a variety of student group strategies and for diverse student populations.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

4. Design student learning activities that foster equitable, ethical, and legal use of technology.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

5. Practice responsible, ethical and legal use of technology, information, and software resources.

Not at all	A little	A fair amount	Much	Very much
0	1	2	3	4

IV. Estimate the accumulated *skills* confidence points of this candidate.

Technology Literacy Classification Established by Questionnaire Points (circle one)
Responses to the evaluation will be confidential.

Accumulated Points	**Technology Proficiency Classification**
88.00 - 70.40	Proficient technology literate
70.30 – 61.60	Nearing proficient technology
61.50 - 52.80	Novice technology literate

Use Page Back for Additional Comments

APPENDIX D

STUDENT TEACHER TECHNOLOGY BIOGRAPHY

STUDENT TEACHER INTERVIEW PROTOCOL #1

In order to establish a profile of your School of Education educational technology background, I would like to ask you to talk about the following topics. These questions are merely used to focus the discussion. The participant may have the choice responding to this questionnaire by e-mail, written hard copy, audiocassette, or personal interview. In an interview, the researcher may take notes and audiotape (with permission) your responses. Any questions prior to the interview can be addressed to Carole S. Robinson, Doctoral Candidate. Call (406) 721-4388 or e-mail CSR_MT@email.msn.com

Please Note:

1. The responses to the questionnaire will be confidential.
2. The interview questionnaire will NOT affect your semester grade.
3. This interview questionnaire will take approximately 1 hour to complete.
4. This interview questionnaire may be audio taped with the subject's permission.

Technology Biography

In order to establish a technology profile of your technology background, I would like to ask you to comment on the following topics. The questions are merely to focus the discussion

.

1. What computer-based technologies did you use prior to entering School of Education?
2. Describe the technologies used by your School of Education professors while teaching their courses.
3. Describe the technology courses you have taken in your School of Education undergraduate coursework.
4. What part of School of Education coursework modeling technology has benefited you the most and why?
5. The following computer-based technologies may be effectively integrated into an elementary curriculum. How might you use them in your student teaching experience?

- Web authoring
- Multimedia software such as *HyperStudio* and *PowerPoint*
- Word processing and spreadsheets
- The Internet
- Educational software
- Classroom management tools, i.e., electronic grade book
- Electronic communication such as e-mail

APPENDIX E

STUDENT TEACHER TECHNOLOGY PROFILE

STUDENT TEACHER INTERVIEW PROTOCOL #2

In order to establish a true characterization of your personal attitudes and comfort level using educational technologies in your student teaching field placement experience, I would like to ask you to talk as candidly as possible about these topic you will find numbered on this page. These questions are merely used to focus the discussion. The participant may have the choice responding to this questionnaire by e-mail, written hard copy, audiocassette, or personal interview. In an interview, the researcher may take notes and audiotape (with permission) your responses. Any questions prior to the interview can be addressed to Carole S. Robinson, Doctoral Candidate. Call (406) 721-4388 or e-mail CSR_MT@email.msn.com

Please Note:

1. The responses to the questionnaire will be confidential.
2. The interview questionnaire will NOT affect your semester grade.
3. This interview questionnaire will take approximately 1 hour to complete.
4. This interview questionnaire may be audio taped with the subject's permission.

Some of the technologies to keep in mind while recording your feedback is:

- Electronic communication such as e-mail
- Educational software
- The Internet
- Web authoring
- Multimedia software such as *HyperStudio* and *PowerPoint*
- Classroom management software such as electronic grade books and word processing

Technology Attitudes and Comfort Level

1. Based on your experience with the technologies listed above, describe the general comfort level you have about using each of them in your student teaching field placement experience.

2. What contributes to the feelings you have toward using these technologies in your assigned student teaching classroom?
3. What factors either encouraged or discouraged your decision to apply computer-based technologies in your student teaching experience?
4. How important will your assigned cooperating teacher be in determining your attitudes and comfort level in using these technologies in your student teaching experience?

APPENDIX F

STUDENT TEACHER SUCCESS/CHALLENGE

STUDENT TEACHER INTERVIEW PROTOCOL #3

In order to formulate some insight into how you learn, I would like to ask you to talk as candidly as possible about he topics you will find numbered on this page. These questions are merely used to focus the discussion. The participant may have the choice responding to this questionnaire by e-mail, written hard copy, audiocassette, or personal interview. In an interview, the researcher may take notes and audiotape (with permission) your responses. Any questions prior to the interview can be addressed to Carole S. Robinson, Doctoral Candidate. Call (406) 721-4388 or e-mail CSR_MT@email.msn.com

Please Note:

1. The responses to the questionnaire will be confidential.
2. The interview questionnaire will NOT affect your semester grade.
3. This interview questionnaire will take approximately 1 hour to complete.
4. This interview questionnaire may be audio taped with the subject's permission.

Some of the technologies to keep in mind while recording your feedback are:

- Electronic communication such as e-mail
- Educational software
- The Internet
- Web authoring
- Multimedia software such as *HyperStudio* and *PowerPoint*
- Classroom management software such as electronic grade books and word processing.

Success/Challenges

1. Describe how you went about learning various technology applications.
2. Describe your greatest frustration in learning about various computer-based technologies, i.e., the Internet, educational software, multimedia and e-mail.
3. Describe your greatest success in learning about computer-based technology applications in your School of Education course work.
4. Why do you think you were able to achieve this success?

APPENDIX G

STUDENT TEACHER TECHNOLOGY PREPAREDNESS

STUDENT TEACHER INTERVIEW PROTOCOL #4

In order to formulate some insight into your personal Instructional/Information Technology confidence and knowledge base after your student teaching placement, I would like to ask you to talk as candidly as possible about the following topics. These questions are merely used to focus the discussion. The participant may have the choice responding to this questionnaire by e-mail, written hard copy, audiocassette, or personal interview. In an interview, the researcher may take notes and audiotape (with permission) your responses. Any questions prior to the interview can be addressed to Carole S. Robinson, Doctoral Candidate. Call (406) 721-4388 or e-mail CSR_MT@email.msn.com

Please Note:

1. The responses to the questionnaire will be confidential.
2. The interview questionnaire will NOT affect your semester grade.
3. This interview questionnaire will take approximately 1 hour to complete.
4. This interview questionnaire may be audio taped with the subject's permission.

Instructional Technology Preparedness of Student Teachers

This questionnaire/interview is self-reflection and assessment of what technology areas you feel best qualified to use in the classroom.

Professional Productivity

Considering the technology listed below, which do you feel best qualified to use in your classroom methodology.

A. Word processor and graphics to develop lesson plans? Explain your response:
B. E-mail to communicate with colleagues? Explain your response:
C. World Wide Web to retrieve information? Explain your response:
D. Use an electronic grade book? Explain your response:

Problem Solving

Explain how you help students learn to solve problems, accomplish complex tasks, and use higher-order thinking skills in an information technology environment?

Assisting Students with Special Needs

How do you recognize when a student with special needs may benefit significantly by the use of adaptive technology and can work with a specialist to make these facilities available?

Teaching About Technology

Explain how confident you are with your ability and experience to teach your students their age-appropriate information-technology skills and knowledge?

Ability to Use a Range of IT Learning Environments

Describe your experience with working efficiently with students in various IT environments (such as stand-alone and networked computers, one-computer classrooms, labs, mini-labs, and distance education facilities)?

APPENDIX H

COOPERATING TEACHER TECHNOLOGY BIOGRAPHY

COOPERATING TEACHER INTERVIEW PROTOCOL #1

In order to establish a profile of your professional teaching technology background, I would like to ask you to talk about the following topics. These questions are merely used to focus the discussion. The participant may have the choice responding to this questionnaire by e-mail, written hard copy, audiocassette, or personal interview. In an interview, the researcher may take notes and audiotape (with permission) your responses. Any questions prior to the interview can be addressed to Carole S. Robinson, Doctoral Candidate. Call (406) 721-4388 or e-mail CSR_MT@email.msn.com

Please Note:

1. The responses to the questionnaire will be confidential.
2. The interview will NOT affect your employment status.
3. This interview will take approximately 1 hour to complete.
4. This interview may be audio taped with the subject's permission.

Technology Biography

In order to establish a technology profile of your professional teaching background, I would like to ask you to talk about the following topics. The questions are merely used to focus the discussion.

1. What computer-based technologies did you use prior to professional teaching career? How were they used?

2. Describe the technologies used by your School of Education professors while teaching their courses.

3. Describe the technology courses you have taken in your School of Education undergraduate/graduate coursework.

4. Explain the factors that influenced you to pursue or refrain from implementing technology into your classroom curriculum.

5. Describe how you use the following technologies in your classroom:
   - Electronic communication such as e-mail
   - Educational software
   - The Internet
   - Web authoring
   - Multimedia software such as HyperStudio and PowerPoint
   - Word processing and spreadsheets
   - Classroom management tools, i.e., electronic grade book

6. What is the hardest part of teaching with technology?

APPENDIX I

COOPERATING TEACHER TECHNOLOGY PREPAREDNESS

COOPERATING TEACHER INTERVIEW PROTOCOL #2

In order to formulate some insight into your personal Instructional/Information Technology confidence and knowledge base, I would like to ask you to talk as candidly as possible about the following topics. These questions are merely used to focus the discussion. The participant may have the choice responding to this questionnaire by e-mail, written hard copy, audiocassette, or personal interview. In an interview, the researcher may take notes and audiotape (with permission) your responses. Any questions prior to the interview can be addressed to Carole S. Robinson, Doctoral Candidate. Call (406) 721-4388 or e-mail CSR_MT@email.msn.com

Please Note:

1. The responses to the questionnaire will be confidential.
2. The interview will NOT affect your employment status.
3. This interview will take approximately 1 hour to complete.
4. This interview may be audio taped with the subject's permission.

Instructional Technology Preparedness

This questionnaire/interview is self-reflection and assessment of what technology areas you feel best qualified to use in the classroom.

Professional Productivity

Considering the technology listed below, which do you feel best qualified to use in your classroom methodology.

A. Word processor and graphics to develop lesson plans? Explain your response:
B. E-mail to communicate with colleagues? Explain your response:
C. World Wide Web to retrieve information? Explain your response:
D. Use an electronic grade book? Explain your response:

Problem Solving

Explain how you help students learn to solve problems, accomplish complex tasks, and use higher-order thinking skills in an information technology environment?

Assisting Students with Special Needs

How do you recognize when a student with special needs may benefit significantly by the use of adaptive technology and can work with a specialist to make these facilities available?

Teaching About Technology

Explain how confident you are with your ability and experience to teach your students their age-appropriate information technology skills and knowledge?

Ability to Use a Range of IT Learning Environments

Describe your experience with working efficiently with students in various IT environments (such as stand-alone and networked computers, one-computer classrooms, labs, minlabs, and distance education facilities?

APPENDIX J

STUDENT TEACHER FUTURE IMPLICATIONS

STUDENT TEACHER INTERVIEW PROTOCOL #5

In order to formulate some insight for preparing pre-service teachers in effective use of technology in their student teaching field experiences, I would like to ask you to talk as candidly as possible about the following topics. These questions are merely used to focus the discussion. The participant may have the choice responding to this questionnaire by e-mail, written hard copy, audiocassette, or personal interview. In an interview, the researcher may take notes and audiotape (with permission) your responses. Any questions prior to the interview can be addressed to Carole S. Robinson, Doctoral Candidate. Call (406) 721-4388 or e-mail CSR_MT@email.msn.com

Please Note:

1. The responses to the questionnaire will be confidential.
2. The interview will NOT affect your semester grade.
3. This interview will take approximately 1 hour to complete.
4. This interview may be audio taped with the subject's permission.

Future Implications

1. What type of technology was available in your elementary school building? Where was it located? What role did availability have in using technology in your student teaching field placement experience?

2. What role did the following people have in developing your attitudes toward technology used as a teaching tool?

   - Building principal
   - Classroom
   - Support personnel
   - Field placement
   - School of Education professors
   - Cooperating teacher

3. What factors in your student teaching experience, if any, have influenced your any interest in taking more technology courses?

4. Looking to the future, what computer-based technologies do you see as becoming central to elementary school teaching?

5. If you were to do it over, what, if anything, would you have done differently concerning the incorporation of technology in your School of Education educational coursework?

6. If you were going to recommend School of Education technology coursework to incoming elementary education majors, which classes would you recommend and why?

7. Would you like to comment or share other educational technology recommendations not covered by this questionnaire?

APPENDIX K

COOPERATING TEACHER FUTURE IMPLICATIONS

COOPERATING TEACHER INTERVIEW PROTOCOL #3

In order to formulate some insight for preparing preservice teachers in effective use of technology in their student teaching field experiences, I would like to ask you to talk as candidly as possible about the following topics. These questions are merely used to focus the discussion. The participant may have the choice responding to this questionnaire by e-mail, written hard copy, audiocassette, or personal interview. In an interview, the researcher may take notes and audiotape (with permission) your responses. Any questions prior to the interview can be addressed to Carole S. Robinson, Doctoral Candidate. Call (406) 721-4388 or e-mail CSR_MT@email.msn.com

Please Note:

1. The responses to the questionnaire will be confidential.
2. The interview will NOT affect your employment status.
3. This interview will take approximately ½ an hour to complete.
4. This interview may be audio taped with the subject's permission.

Future Implications

1. What type of technology is available in your elementary school building? Where was it located? What role does availability have in using technology in your classroom methodology?

2. What role did the following people have in developing your attitudes toward technology used as a teaching tool?

- Student teacher
- Building principal
- State/federal technology ruling
- Support personnel
- School of Education professors
- Classroom students

3. What factors, if any, with this semester's student teacher experience have influenced your any interest in taking more technology courses?

4. Looking to the future, what computer-based technologies do you see as becoming central to elementary school teaching?

5. What factors, if any, contribute to a teacher continuing to implement a technology-enhanced curriculum?

6. For what reasons do teachers decide not to continue implementing a technology-enhanced curriculum beyond the first year or two?

7. If you were going to recommend School of Education educational technology content areas to future university elementary education majors, what classes would you recommend? Why?

8. Would you like to comment or share other educational technology recommendations not covered by this questionnaire?

APPENDIX L

THE SCHOOL OF EDUCATION 1999-2000 PROGRAM – ABRIDGED

THE SCHOOL OF EDUCATION 1999-2000 PROGRAM: ABRIDGED

The School of Education consists of three departments: the Department of Curriculum and Instruction, the Department of Educational Leadership and Counseling, and the Department of Health and Human Performance. Detailed information may be viewed online at (http://www.umt.edu/catalog/99-00/edcurins.htm).

The School of Education is accredited at all levels by the National Council for Accreditation of Teacher Education, the Northwest Association of Schools and Colleges, and the State Board of Public Education.

Programs in the School of Education are organized to foster the development of a learning community and incorporate three basic themes: integration of knowledge and experience; cooperation among participants; and inclusively, caring and respect for others. Programs at all levels emphasize professional ethics, a commitment to life-long learning, academic competence and skills in higher-order thinking, an appreciation for the integration of knowledge, a sense of self worth, and respect for the uniqueness of the individual and the diversity of cultural heritage. Program features include integrated instruction by course clusters or blocks, faculty collaboration and student cooperative learning, multiple assessment strategies, developmentally sequenced field experiences, and university-school partnership activities.

Program Goals

- Competence in subject matter and an understanding of the integration of knowledge.
- Intellectual skills that lead to reflection and creativity in professional life.
- A sense of self-worth and a respect for others.
- A variety of communication skills.
- A spirit of cooperation and understanding of citizenship in a democratic society.
- A commitment to lifelong learning.

Two educational laboratories are associated with the School of Education: the Preschool Laboratory and the Co-Teach Preschool program. Students who will be teaching the primary grades or who wish to acquire additional skills for working with children with disabilities are strongly encouraged to participate in these laboratory programs.

Program Features

- The university's strong liberal arts tradition provides excellent depth across curriculum areas.
- Secondary students may choose from among 29 teaching majors and minors. They also have the option of completing a master's degree with teacher certification.
- Elementary students complete an integrated, field-based semester of courses prior to student teaching.
- All students complete three separate field experiences, including a full semester of student teaching.
- Students have access to two multi-media computer labs and a Teacher Resource Center (TRC) (see Appendix A for TRC information).
- Two laboratory preschools are available on campus, including one for children with disabilities.
- Eight endowed scholarships are available to teacher education students.

Specific program options within the School of Education are described below.

The Department of Curriculum and Instruction
The Department of Curriculum and Instruction offers the Bachelor of Arts in Education degree and certification/licensure in elementary education and in business education. As well, it offers certification/licensure in a wide range of secondary programs for students who are earning or already have completed the baccalaureate degree in their chosen field(s) of interest. At the graduate level, the department offers the master's and doctoral degrees in curriculum and instruction. Programmatic themes across all levels include integration of instruction, collaborative learning, and respect for the individual.

Teacher Preparation
Students preparing to teach in elementary school complete a major in elementary education. Prior to admission to the Teacher Education Program, usually at the end of the sophomore year, students are considered pre-education majors and are advised by the Academic Advising Office. Upon admission to the program, students are considered elementary education majors and are advised within the department. Students preparing to teach business education at the middle and high school level complete a major in education and are advised within the department. Students preparing to teach any other subject at the middle or high school level will major in the subject area(s) they wish to teach, e.g., English or mathematics. They are advised within their major department and, upon admission to the Teacher education Program, they also are advised within the Department of Curriculum and Instruction. All secondary certification students seek admission to the Teacher Education Program, usually at the end of the sophomore year, and complete course work required for

certification/licensure in their chosen field(s). Applicants for state certification/licensure must: (1) satisfy all course, credit, and degree requirements as outlined below; (2) pass a standardized test as outlined below; and (3) be at least 18 years of age.

Admission to the Teacher Education Program
All students seeking certification/licensure to teach apply for admission to the Teacher Education Program. Admission is limited each academic year to approximately 125 elementary and 125 secondary candidates. Deadlines for application are October 1 and March 1. To be eligible for admission a student must have (1) completed 30 semester credits of college-level work; (2) attained a minimum cumulative grade point average (GPA) of 2.75, including all transfer credits; (3) achieved passing scores on *one* of the following tests from the Educational Testing Service (ETS): Praxis I Academic Skills: PreProfessional Basic Skills Test (PPST); Praxis I Academic skills: Computer Based Test (CBT); or Graduate Record Exam (GRE); and (4) earned at least a C in both an English composition course and an introductory psychology course. In application to the Teacher Education Program, students submit an essay writing sample, document formal experiences working with children and youth, and present recommendations from two faculty members who are familiar with their work as students. Applicants should note that meeting minimum eligibility requirements does not assure acceptance into the Teacher Education Program. The CBT and GRE may now be taken on demand on the UM campus through the UM Testing Service, 243-6257. The admission application and Teacher Education Policy Handbook are available from the UC Bookstore.

Once admitted, students must maintain a minimum GPA of 2.75 each semester in order to continue in the program. Students who interrupt their studies for more than two years will be placed on inactive status and must request reactivation in order to resume their studies.

Students seeking a K-12 endorsement in library media, literacy, or special education must have full admission into the Teacher Education Program or already be a certified/licensed teacher before applying to one of these specialized programs.

Application for Student Teaching
At the end of the junior year students should begin planning for student teaching. Students must meet the following criteria to be eligible to student teach: (1) full admission into the Teacher Education Program; (2) a grade of C or above in courses required for certification; (3) a minimum cumulative GPA of 2.75 and 2.75 in each field of certification/licensure; and (4) consent of the Director of Field Experiences. In addition, elementary education majors must have completed the required courses in methods of elementary teaching, and secondary students must have completed their methods course and at least two-thirds of the courses in their teaching field(s).

Recommendation from the departments in the major and/or minor fields is also a prerequisite to student teaching. Candidates for K-12 certification/licensure must student teach at both elementary and secondary levels. Applications for student teaching are contained in the Student Teaching Packet available in the UC Bookstore. Consult the Teacher Education Policy Handbook for application deadlines and procedures. Internships and practicums in library media, literacy and special education do not substitute for the student teaching semester required for certification in a subject field.

Elementary Education Degree and Certification/Licensure Requirements (Grades K-8)

To qualify for the state elementary teaching certificate/license, candidates must earn a baccalaureate degree from the University or other approved institution of higher education. The degree in elementary education requires a minimum of 128 credits. Students must complete all specific requirements listed below with a grade of "C" or better. None of these courses may be taken as pass/not pass except where that is the only grading option.

Elementary education students must complete a 12-credit area of concentration, selected from one of the following six elementary curriculum categories: (1) English/language arts, including reading/literary analysis; (2) fine arts; (3) health and human performance; (4) mathematics; (5) science; and (6) social science. Degree-holding students and transfer students should seek advice about the substitution of course work completed in a previous major or minor.

Information regarding the options and requirements for the 12-credit area of concentration and all other elementary education degree and certification requirements are outlined in the *Teacher Education Program Handbook*. The *Policy Handbook* and *Application to the Teacher Education Program* are available in the UC Bookstore.

Students who are interested in preparing to teach K-3 are encouraged to take C&I 330 Early Childhood Education; those who are interested in preparing to teach 4-8 are encouraged to take PSYC 240S Child and Adolescent Development.

Curriculum for Elementary Education - First and Second Years & Credits

ENEX 101 3
SCI 225N, 226N General Science 10
LS 151L or 152L Introduction to Humanities 4
PSYC 100S Introduction to Psychology 4
C&I 200 Exploring Teaching Through Field Experiences 2
HHP 233 Health Issues of Children and Adolescents 3
HIST 151H or 152H The Americans 4
HIST 269 Montana and the West 3

MATH 130-131 Math for Elementary Teachers 9
PSC 100S Introduction to American Government 3
NAS Native American Studies course 3

Third and Fourth Years - First and Second Years & Credits
Area of concentration 12
C&I 303 Educational Psychology and Measurements 4
GEOG 281 Geography for Teachers 3
ART 314 Elementary School Art (Prereq., ART 123A) 6
SCI 350 Environmental Perspectives 2
HHP 339 Instructional Strategies in Elementary Health and Physical Education 3
MUS 335 Music Education in the Elementary School (Prereq., MUS 134L) 6
*C&I 306 Instructional Media and Computer Applications 1
C&I 316 Children's Literature and Critical Reading 3
*C&I 300 or 301 Field Experience 1
*C&I 309 Teaching Mathematics: Elementary School 3
*C&I 310 Teaching Social Studies: Elementary School 3
*C&I 311 Teaching Science: Elementary School 3
C&I 317 Teaching Language and Literacy 4
C&I 410 Exceptionality and Classroom Management 3
C&I 407E Ethics and Policy Issues 3
C&I 481 Student Teaching: Elementary 12
Electives and General Education 8
Current Standard First Aid and CPR certificates or HHP 288/289 0-3

* *Elementary Methods Block: During one semester usually just prior to student teaching, students enroll concurrently in C&I 306, 309, 310, 311 and 300 or 301. This blocked format allows for integration of curriculum, modeling of cooperative learning and collaborative teaching, and developmental field experiences.*

APPENDIX M

THE SCHOOL OF EDUCATION 1999-2000 CATALOG COURSE DESCRIPTIONS – ABRIDGED

THE SCHOOL OF EDUCATION 1999-2000

CATALOG COURSE DESCRIPTIONS – ABRIDGED

U = for undergraduate credit only, UG = for undergraduate or graduate credit, G = for graduate credit. R after the credit indicates the course may be repeated for credit to the maximum indicated after the R. More complete catalog information may be viewed online at (http://www.umt.edu/catalog/99-00/edcurins.htm).

DEPARTMENT OF COMPUTER SCIENCE
CS 171 Communicating Via Computers 3 cr. Offered every term. Prereq., previous computer experience or consent of instr. The use of the computer for information presentation and communication; emphasis placed on the use of electronic resources for the access, management, and presentation of information. Credit not allowed for CS 170, Mgmt 170, CS 195 Computer Applications or CS 195 Communicating with Computers and this course.

CURRICULUM AND INSTRUCTION
U 183 Integrated Software Applications and Multimedia 3 cr. Offered every term. Prereq., keyboarding skills or consent of instr. Emphasis on use of integrated application programs, use of multimedia products in teaching, and use of technology in instruction.

U 200 Exploring Teaching through Field Experiences 2 cr. Offered autumn and spring. Prereq., admission to Teacher Education Program. Introductory experiences for students committed to teaching as a profession. Combines a field experience with seminar. Discussion of school curriculum, realities and expectations of teaching, and teacher education program requirements.

U 300 Field Experience/Early Elementary 1 cr. Offered autumn and spring. Prereq., C&I 200 coreq., an elementary methods course. Arranged field experience in an elementary classroom, kindergarten through third grade.

U 301 Field Experience/Mid-Level 1 cr. Offered autumn and spring. Prereq., C&I 200; coreq., an elementary or secondary methods course. Arranged field experience in an elementary or middle school classroom, grades four through eight.

U 303 Educational Psychology and Measurements 4 cr. Offered every term. Prereq., PSYC 100S, C&I 200, and admission to Teacher Education Program. Analysis of fundamental psychological concepts underlying classroom teaching, learning and evaluation. Emphasis on cognition, developmental, and motivational aspects of learning. Basic concepts of educational measurement.

UG 306 Instructional Media and Computer Applications 1 cr. Offered every term. Prereq., C&I 303, BITE 183, or CS 171 or examination. Coreq., for elementary education majors only, C&I 309, 310, 311. Introduction to the use of technology, media, and computer software application in instruction.

U 309 Teaching Mathematics in the Elementary School 3 cr. Offered autumn and spring. Prereq., C&I 200 and 303, and Math 130 and 131. Methods for teaching elementary school mathematics through a child-centered laboratory approach focusing on the use of manipulatives, models, problem solving, and technology. Emphasis on multiple assessment strategies to determine student progress and methods to evaluate elementary mathematics programs.

U 310 Teaching Social Studies in the Elementary School 3 cr. Offered autumn and spring. Prereq., C&I 200 and 303. Foundations and purposes of the elementary social studies curriculum. Elements of lesson design including instructional methods, technology, materials and assessment.

U 311 Teaching Science in the Elementary School 3 cr. Offered autumn and spring. Prereq., C&I 200 and 303, Sci 225 & 226. Introduction to useful ideas, methods, technology and evaluation for teaching elementary school science. Emphasis on planning and presenting hands-on activities.

UG 316 Children's Literature and Critical Reading 3 cr. Offered every term. Prereq., or coreq., C&I 303. Genre survey including a multi-ethnic literature module focus on extensive reading and responding to quality children's literature through listening, speaking, writing, drama, and media activities emphasizes criteria for selection, critical thinking skills, the "whole language" approach, and effective integration of literature into the elementary curriculum.

U 317 Teaching Language and Literacy 4 cr. Offered autumn and spring. Prereq., C&I 303, 316 and consent of instr. Methods of teaching reading, writing, listening, and speaking as effective tools of communication within a developmentally appropriate, technological, integrated curriculum.

UG 330 Early Childhood Education 3 cr. Offered spring odd-numbered years. Prereq., consent of instr. Offered alternate years. Theory and techniques of teaching in pre-school and primary levels of education. Observation and participation in pre-school programs. Recommended for kindergarten and primary teachers.

UG 407E Ethics and Policy Issues 3 cr. Offered every term. Prereq., lower-division course in Perspective 5, C&I 303 and consent of instr. Practical application of ethical principles of the teaching profession. Analysis of the American public school and major policy issues from historical, legal, political, social as well as ethical perspectives.

UG 410 Exceptionality and Classroom Management 3 cr. Offered every term. Prereq., C&I 303. Focus on classroom management and the characteristics and instructional adaptations for exceptional students in the regular classroom. Technological considerations included.

U 481 Student Teaching: Elementary Variable cr. (R-12) Offered autumn and spring. Prereq., consent of Director of Field Services.

DEPARTMENT OF PSYCHOLOGY

U 240S Child and Adolescent Development 3 cr. Offered every term. Prereq., PSYC 100S. An overview of research findings on development from infancy through adolescence, with emphasis on application.

APPENDIX N

RONALD E. MCNAIR SCHOLARS PROGRAM

RONALD E. MCNAIR SCHOLARS PROGRAM

The University Program

The McNair Scholars Program prepares carefully selected undergraduates for graduate study at the doctoral level. The McNair Scholars Program aims to increase numbers of students in doctoral programs from underrepresented groups and thus increase representation of these groups on college and university faculties. The University's McNair Scholars Program identifies qualified undergraduate students, provides them with mentors in their chosen disciplines, and provides a research stipend for students to conduct research, publish their findings, and to present their work at a research conference.

Scholar Qualifications

In order to qualify for the McNair Scholars Program, students must meet the following criteria:

- Completed at least 60 semester credits when starting the program
- Have a 3.0 minimum cumulative UM GPA;
- Qualify as either a first generation college student (neither parent has attained a baccalaureate degree) whose household meets the low-income guidelines established by the U.S. Department of Education; or a member of a group that is underrepresented in graduate education. The U.S. Government currently defines "underrepresented groups" specifically as Native American, Hispanic, and African-American;
- Be committed to complete a post-baccalaureate degree which would qualify one to teach at a post-secondary institution.

Mc Nair Scholars Activities

The University of Montana McNair Scholars Program identifies qualified undergraduate students, provides them with mentors in their chosen disciplines, and provides a $4000 research stipend for students to conduct research, publish their findings, and to present their work at a professional conference. Students are expected to produce a fairly sophisticated research paper as the culmination of their experience.

In addition to the research component of the program, McNair scholars:

- Receive academic and career counseling from the faculty mentor who guides their undergraduate studies and research
- Provided with tutors through the EOP Program, as necessary
- Have access to multimedia equipment
- Provided with information on graduate schools and financial aid
- Have access to GRE and other test preparation software

- Offered seminars and workshops related to graduate studies
- May be funded for research-related travel and/or travel to professional conferences

Scholars are responsible for providing reports of their progress during their research experience, meeting with their faculty mentor on a regular basis, and keeping the program informed about their progress throughout their graduate studies.

Faculty Mentor Component

The most important aspect of the McNair Scholars Program is the faculty mentor/scholar relationship. For the scholar, the benefit of participating in the program depends to a large extent on this relationship. The relationship is designed to encourage, motivate and prepare McNair Scholars for doctoral studies.

Information on the national Ronald E. McNair Scholars Program may be viewed at (http://www.gradschools.com/Diversity/about McNair.html). More information on the University Ronald E. McNair Scholars Program may be viewed at (http://www.umt.edu/trio/mcnair/about.htm).