Introduction

Since 1986, public school personnel throughout the state have been encouraged to integrate computer technology in the classroom. The State Department of Education mandated a computer aided instruction in-service course as part of teacher recertification requirements. For example, The Wyoming State Technology Plan (September, 1997) has within its long-range objectives the need to establish and evaluate integrated technology practices within the public schools. School districts have requested numerous university sponsored extension courses involving new instructional technologies. Almost every district-sponsored staff development plan included some form of teacher in-service for integrating computer technology in the classroom. During this same timeframe, the College of Education implemented computer technology course requirements as part of the undergraduate teacher education program. It is unclear as to what degree schools in Wyoming have integrated computer technologies into their classrooms. Also, it is not known as to whether the College of Education is providing the appropriate support to facilitate the integration of computer technologies in public schools. Other states have begun similar investigations to determine the status of this technology integration such as the effort just begun in Missouri (University of Missouri, 1998).
Theoretical/Literature Base

Computer technologies have been hailed as the most likely innovation to effect change in the public schools (Connick & Russo, 1995). The ability to access information from world-wide sources (Leu, et al., 1997), create simulations with three dimensional effects, manipulate graphic animations and sound, without the need for programming skills on low-cost desktop and laptop computers has unleashed a power to learners that require teachers to relinquish the role of provider of all information. Someone was once quoted as saying “Overhead projectors were used in bowling alleys for 35 years before they were commonly used in the classroom”. It is hoped that computer technology integration is occurring at a better rate than what happened for the overhead projector.

It has been suggested that the role of the teacher in the classroom must change as computer technologies are integrated in the classroom (Bielefeldt, 1997, Plater, 1995, Rowe, 1993). Emphasis has been placed on the teacher as accepting a facilitative role in guiding students through information access and processing, problem-solving, and creative learning projects on the computer in a student-centered classroom rather than the traditional image as the presenter in front of the class. It has also been suggested that teacher-student interaction can be more electronic, such as email, during times other than the official school day similar to the techniques employed in distance education (Lehman, 1995).

Teachers who have effectively integrated these technologies in their classrooms have reported higher levels of motivation, interest in learning, increased problem-solving skills, and improved achievement by the students (Mingus & Grassl, 1997, Rowe, 1993, Sawyer, 1994). Based upon efforts with in-service activities with teachers in Wyoming,
primarily at the elementary school level, it was a natural question to ask if the same motivation level and interest was occurring at the secondary level as well, or whether the integration of computer technologies had occurred successfully in the 9-12 classrooms.

**Objectives of the Study**

The intent of the study was to determine the answers to the following questions:

1. What types and levels of computer technologies are being used by students and teachers?
2. What effect, if any, have computer technologies had on teaching and learning practices in schools?
3. What practices have been successful in promoting successful adoption of computer technologies in schools?
4. Have computer technologies changed the way teachers teach and students learn?

**Procedures**

Because there were limited reports of research efforts focused on the questions listed above, a naturalistic inquiry approach was selected to conduct the study. This approach was selected in order to facilitate on-site observations while schools were in session and to enable unpredicted answers to be followed by additional inquiry during the interviews (Lincoln & Guba, 1985). Selected high schools in Wyoming were contacted requesting permission by the researcher to visit during the Fall, 1998. During the visit, permission was obtained to visit students in classes, study halls, and computer labs to determine their perceptions as to use of computers in their school. The groups were selected on the basis of obtaining a representative sample of ninth through twelfth grade
students and no attempt was made to select or identify individuals on the basis of academic versus vocational discipline areas. In conducting the interviews, the teacher was excused for 20-30 minutes to take a break while the discussions with the students took place. The students enjoyed the fact that a professor from the university was willing to listen to their opinions. In all cases, the students began talking freely. Teachers were interviewed as individuals or small groups of 2-3 persons, using the same set of questions as those for the student interviews. Technology directors and school principals were interviewed separately, again with the same question list as a guide. Teachers, technology directors, and principals were asked to respond based on their particular roles in the school. The data collected from subjects included field notes taken by the researcher during the interviews.

Prior to conducting the interviews, a school was selected to pilot test to develop and refine the interview questions. Through this pilot test procedure, the following open-ended questions were developed for structuring the interviews with both students and teachers:

1. What computer applications do you use at school?
2. Do computer technologies help you learn? If so, how?
3. In what ways do your teachers use computers either for homework assignments or in teaching?
4. What has your school done to help make use of computers possible? Do they need to do more?
5. Do you learn differently because of computers? Do teachers need to change the way they teach because of computers?
To avoid researcher bias and to insure valid interpretations from the data, three techniques were used. First, for each interview, permission was requested and obtained from subjects to tape record the event. In all cases, permission was granted. Second, notes were taken by the researcher and compared with the recordings. Third, a colleague volunteered to randomly select two schools and compare the researcher's notes with the tape recordings. The results from these techniques were used to edit and make any corrections needed in the results narrative.

From the five schools selected for the study, a total of 179 students were interviewed. Twenty-six teachers, and the technology coordinators and building principals from each school were interviewed as well.

Results

The intent of the first interview question was to determine the level of technology used in schools. It was overwhelming to note the consistency in responses by both students and teachers in using word processing the most, followed by information searching. The use of multimedia was extremely limited unless the student was in a class designed for learning those techniques. Drawing/drafting was mentioned by a few students enrolled in those technology-specific classes. One art teacher, however, described at great length how her students use web pages to analyze the different types of art, shapes, use of color, and texture in daily classes on the subject. Another teacher, responsible for yearbook production, listed almost every application available on the server in the school as technology she taught her students to use in the production of the annual.
In response to the second question, students immediately focused on the power of information access from the Internet. They also liked the way computer technologies allowed them to work at their own pace. Several students expressed higher interest levels because computers allowed them to be more creative and “make learning more like exploring.” They preferred that teachers allow them to find information using computers rather than lecture. However, in response to a follow-up question, most all students quickly expressed the need for the teacher to be present to assist them in dealing with frustrations, and providing guidance to help insure success in accomplishing the task at hand.

Most students think that teachers use only word processing and gradebook software. Almost none reported such uses as presentation technology, field data collection, simulations, or illustration purposes. Most teachers interviewed supported the students’ perceptions. A few teachers, however, described heavy uses of the Internet to update their instructional material. Three math and science teachers described how they used programmable hand-held calculators to collect and graph field data from research conducted during out-of-classroom laboratory sessions. It was interesting but not explained why students didn’t mention these applications.

In response to question four, most students were fairly positive toward the school’s efforts. They did have some good solutions to suggest in solving what seemed to be the common problem, computer access. They complained that computer labs were always tied up by scheduled classes and there was no place else to go. Several students suggested that labs be open more often at night for student use. Several students expressed frustration with the school’s reluctance to trust them with Internet and email.
In one school, for example, the policy is to issue email addresses and privileges to all students who achieve a 3.0 grade point average or better. Those students who had not earned the privilege understood the reason but still expressed dissatisfaction in being in the ‘have-nots’ group. In regard to being able to do homework on computers, one student offered an innovative solution; have laptop computers to check out from the library just like books. One student suggested that the school rent computers just like the video stores rent out VCRs and movies. These ideas surfaced in two different schools visited.

Most teachers were happy with the efforts made for hardware acquisition but expressed the need for more applicable software for their respective subject areas. They spent most of the time responding to this question by expressing serious frustration with the lack of quality of in-service and technical support. In-service appears to follow the typical model, “too much tell about it with not enough hands-on training”. In one school however, where the approach has been to train the teacher to teach peers in the building, most teachers stated positive thoughts about the technical support and in-service provided.

Question five elicited most interesting ideas from the students. Most students first began with the fun that computers provided, that learning at their own pace was most ideal, and that computers allowed for more exploring. They also liked the fact that work was easily redone when mistakes were found. One student talked at great length about how computers allowed her to explore instead of just perform only routine tasks. Students thought teachers should relax more about computer technology and admit when they didn’t know how to use some applications. One student said, “I would like to teach them (teachers) how to capture ‘cool stuff’ from the Internet”. Students thought that
teachers overused computers in some classes (i.e. English) but not enough in others. Several students spoke out strongly about some traditional roles that teachers should still do such as present information that is hard to find and help students more with difficult assignments and problems. Only one student expressed this thought, “Teachers should disappear and let me learn all I need to know on the computer.”

Most teachers responded positively to changes that computer technologies may bring about. Most expressed gratitude for the ability to assign their students to search for information on the Internet and know that something would be found. Some teachers expressed desire to integrate computer technologies more if someone would show them what is available, appropriate, and how to use it. One math teacher expressed how the technology allowed him to focus on the exciting real-life problems rather than the laborious arithmetic functions that took all his time before. In his case, the technology used was in the form of hand-held programmable calculators. An art teacher said the only thing holding her back was not having more computers in her room. Two young teachers said they would hesitate a long time to consider leaving to another school because of the strong technology support where they were. A few teachers did express concerns about traditional learning skills such as spelling and handwriting that they thought may be weakened by the use of computers, however the debate that ensued indicated there was not general agreement on this issue. One teacher asked, “When do we say we have changed enough?”

**Conclusions/Implications**

It was most interesting to hear how many students in the various schools expressed the keen interest that computers and connectivity through Internet and email
provides. One student explained, “Using the Internet is like exploring; that’s why it’s so much fun.” It was amazing to hear how many students saw computer technologies as a way to learn on their own. They expressed a concern that many teachers maintain the image that students cannot use any technology teachers don’t understand how to use themselves. One student said, “they should let us teach them (teachers) how to use the computers.” It was obvious from students’ comments that teachers must be more student-centered in their approach and use computer technology to put fun, creativity, and independent responsibility as well as academic challenge back into learning. Another message to teachers was rather clear as well, the primary thought being, to lose their fears about not knowing everything and to give students the opportunity to show what they know. However, teachers should feel a great deal of pride in knowing that students value their primary function as facilitator and mentor rather than attempting to be the source of all knowledge.

The primary theme heard from teachers was that technology was occurring too fast for them to keep up. Over and over again, they expressed concern with inadequate in-service both in terms of quantity and quality. One teacher said, "We need more 'one-on-one' workshops and less of the 'show-and-tell' sessions." A few teachers lamented that they were not adequately informed of the applications available to them. It was encouraging though, to hear how many of the teachers assigned research projects to students to find information on the Internet. Each teacher interviewed was satisfied with their personal access to a computer supplied by the school. After the interviews were officially over, some of the teachers asked what the students were saying about their roles. Teachers were relieved to hear that students expressed the need for teachers to be
present to guide, and facilitate learning, and that their role was important in the learning process even with heavy use of computer technology.

Technology coordinators were as unique as the number of schools visited. One unique practice employed by one coordinator was to conduct most of the inservice through individual and small groups of teachers. The school district hired substitute teachers to release their staff for these in-service activities. One common issue raised by all coordinators was that the workload required to keep the local network functioning often prevented them from conducting as much in-service as they would prefer. Most of the coordinators described their roles as troubleshooters when the problems arose rather than as directors of in-service activities. Only one coordinator, a former teacher, spoke about including teaching strategies as part of the in-service training. Most of the time, the impression was left that the primary focus of the coordinators was on the technology.

By determining the degree to which the integration of computer technology has occurred in schools, we now better understand how to prepare teachers to teach in a way that takes advantage of this technology. Students and school personnel are benefiting from this project in several ways. By reflecting on the computer technology in their lives at school and in the future, they are discussing how they can be more effective in its integration. Teachers were also relieved to hear that students overwhelmingly still expressed the need for teachers’ presence and interaction to effectively learn from computers. Teachers were curious to hear how most students described the desirable teacher-student interaction as facilitative rather than directed instruction. A better understanding of how computer technology should be integrated into pre-service and in-service teacher education will also benefit faculty at the university as well.
References


Approaching a naturalistic study is just great. It is effective and tells us much more than the survey method of collections of data. The author is commended on his approach and interest. The results of this study add to the body of knowledge surrounding computer technologies and student learning. The study will answer questions in Wyoming about the practices of using technologies.

This study will provide a basis for including other technologies into the classroom and in the area of in-service programs that need to be planned and delivered. Pre-service programs will still need to develop a need and justification for the use of computer technologies in the undergraduate program.

The study was well designed and conducted. It was evident from examining the related literature that a good and defensible base had been developed. Many hours of effort in data collection are evident in this study. The methods used are on target and were well planned.

Students offering to teach teachers on the proper utilization of technologies is very frightening to some professional teachers, how do we get them beyond this fear and into the mold of being a facilitator of knowledge? How should we as teacher educators be integrating the use of technology into pre-service preparation programs? Can and should we divide technologies into groups for better training programs? What is the impact of this study and where does it lead the profession?