AN INVESTIGATION INTO THE CURRENT PRACTICES OF FORMAL AND INFORMAL TEACHER TECHNOLOGISTS ON THE USE OF COMPUTERS IN THE CLASSROOM IN AN URBAN ACADEMY SCHOOL AND A PRIVATE ACADEMY SCHOOL

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The purpose of this study was to explore the practices of formal and informal teacher technologists in two school settings: an elite private, high school academy and an urban poor, middle school academy. This investigation included clarifying the role of the formal and informal teacher technologist and investigating the need for both formal and informal teacher technologists. This study also explored the technological differences between the public academy middle school and the private academy high school. Two formal and eight informal teacher technologists were interviewed face-to-face three times, each using the transcendental phenomenology research design. Each teacher technologist was also observed at least once in classroom and teacher training sessions.

The results of this study revealed (1) the role of the teacher technologist was a fast technology problem solver; and (2) although students and teachers used technology, the schools lagged in adequate technology and/or teacher training; (3) the teacher technologists used the Internet to build and evaluate curriculum; (4) most students used tool software centered around project-based activities; (5) teacher technologists trained other teachers to be collaborative risk-takers in using technology; (6) teacher

technologists shared what they learn with students and other teachers; and (7) students could be student-learners or student-teachers and teachers could be teacher-learners.

Four conclusions were reached: technology and constructivist teaching are compatible; technology is a tool; new approaches to professional development are needed; and hardware and software should be standardized for maximum use. Additionally, both schools in this study were evolving the role of the formal teacher technologist. It was recommended that (1) the schools employ at least one fulltime formal teacher technologist whose main role is to assist teachers in technology classroom incorporation, (2) the schools form teams of informal teacher technologists, (3) and the public middle school academy purchase one laptop for each student to use anytime, anywhere.

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> He never taught a lesson in a classroom…He had no tools to work with, no blackboards, maps or charts…He used no subject outlines, kept no records, gave no grades, and His only text was ancient and well-worn…His students were the poor, the lame, the deaf, the blind, the outcast – and His method was the same for all who came to hear and learn…He opened eyes with faith…He opened ears with simple truth, and opened hearts with love, a love born of forgiveness…a gentle man, a humble man. He asked and won no honors, no gold awards of tribute to His expertise or wisdom…and yet this quiet Teacher from the hills of Galilee has fed the needs, fulfilled the hopes and changed the lives of many millions…for what He taught brought heaven to earth and God's heart to all. (Anonymous, n.d.)

First, I would like to give honor and praise to my Lord and Savior Jesus Christ, the greatest teacher. I am especially grateful to my mentor, Gloria Contreras for her time and the professional mentoring she provided to me as I attempted this daunting task. I am grateful to my husband, Jesse and my babies, Deigh, Trenishia and Laurenzo, for their support. Thanks to my dissertation committee for their input and Sue Young for transcribing thirty interviews. Many thanks to my mother and late father for setting a foundation in the early years of my life. Thanks to the participants in this study who allowed me to see them as they really are in their classrooms. Thanks to my friends and family for keeping me grounded!

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CHAPTER I

PURPOSE, BACKGROUND AND RESEARCH QUESTIONS

This is an investigation of the practices of both formal and informal teacher technologists in a public middle school academy and a private high school academy to clarify their roles within these two college preparatory programs. This research discusses the current responsibilities of teacher technologists in two schools that emphasize technology learning. Applying the techniques of the phenomenology research method (Moustakas, 1994; Lester, 1999; Schutz, 1967; Berger & Luckmann, 1966), this researcher observed and interviewed 10 teacher technologists to reveal what they do in a typical school day, how they practiced using technology for the teacher and for the student, how they trained other teachers, how they related technology professional development to the curriculum, and how the student-teacher relationship has been altered by technology.

The purpose of this study was to employ a phenomenological approach in order to obtain first hand observation of teacher technologists at work. This involved gaining entrance into the two academy school institutions to ascertain how the teacher technologist functions in each of those settings. According to Berger & Luckmann (1966), how people function in an institution, i.e., their roles, represent the institutional order. The analysis of roles is of particular importance to the sociology of knowledge because it reveals the "mediations between the macroscopic universes of meaning objectivated in a society and the ways by which these universes are subjectively real to individuals" (Berger & Luckmann, 1966, p. 73). The sociology of knowledge involves analyzing the day-to-day happenings of a phenomenon. In this study, the analysis of the role of both formal and informal teacher technologists resulted from interviewing and observing the 10 selected participants.

A phenomenological study is concerned with gathering information about a particular event in order to gain an understanding of the phenomenon from the viewpoint of the participants in the study (Lester, 1999). This attempt to understand reality from the participants' viewpoint requires that the researcher engage in numerous interactions with the participants through face-to-face interviews, observations, and document analysis (Lester, 1999). Therefore, the objectives of this study consisted of 1) interviewing the 10 participants face-to-face three times each in their school settings, 2) analyzing each of the transcribed interviews, 3) observing each participant as he or she presented a lesson for a period of at least 85 to 90 minutes, 4) observing each of the formal teacher technologists as they presented both in the classroom to students and as they trained other teachers, 5) and collecting and analyzing documentation from the participants of their use of technology in the classroom. The private school academy teacher technologists presented technology portfolios that included documentation of and examples of how they were using technology and on-line resources in the classroom. The public school academy technologists presented samples of lesson assignments, training curriculum and on-line resources.

This study revealed seven main findings. First, the role of the teacher technologist was seen as being a fast technology problem solver for school staff and students, being prepared to use technology, being knowledgeable of how to use technology in the classroom, and sharing technology information with students and teachers. The traditional role of the campus technology coordinator as defined by Moursund (1992) has been expanded to include both formal and informal teacher technologists. A formal teacher technologist received a stipend for providing campus technology assistance to faculty, staff and students whereas the informal teacher technologist also provided assistance to faculty, staff and students but did not receive a stipend. Both formal and informal teacher technologists in this study spent time acquiring the skills they needed to use technology in the classroom and willingly passed on those acquired skills to students and other faculty while staying abreast of the curriculum for their discipline. Other teachers and staff on these two campuses sought the technology expertise of these teacher technologists throughout the day. The teacher technologists were expected to provide technology assistance immediately, even during class times.

A second finding is that both students and teachers were actively engaged participants in the teaching and learning process using technology, but the schools still lagged in adequate technology and/or adequate teacher training. The 10 teacher technologists and their students used technology in the classroom for purposes of lecturing, class discussion, research, note taking, and journaling. In the public middle school academy, although the teacher technologists rated themselves as enthusiasts in using technology for teaching and learning, the school lacked adequate laptop technology for students to use both in and out of the classroom. Both schools lagged in providing adequate professional development. At the public middle school academy only the formal teacher technologist reported attending a conference in the past three years. At the private high school academy, the formal teacher technologist reported the need for re-evaluating the current campus' technology training program.

Third, teacher technologists used the Internet to research, build, present, organize, and evaluate curriculum. The teacher technologists readily instructed students on using the computer for Internet research in chemistry, environmental science, language arts, math, computer literacy, biology, art, and history classes. The teacher technologists used the Internet to design lesson plans, and to insert information, graphics and web links to various sites. Lessons were presented to students using data projectors, televisions, and VCRs connected to computers to project

Internet files. Lessons were organized around Internet sites. Teacher technologists either printed out Internet information and handed them out to students or had students visit the Internet sites during class time. Several teacher technologists used the Internet for evaluative purposes. On-line quizzes were constructed in two ways: the quiz was on the website and students could take it on-line; or the quiz was printed and given to the students. Several teacher technologists used e-mail to provide feedback on assignments to students.

Fourth, most students were using tool software on computers in the classroom with the lesson centered around project-based activities. In this study the teacher technologists were accomplished users of tool software such as Microsoft Word, Excel, PowerPoint, and the Internet Explorer and assigned student work using those tools. Students were observed using these tools in the teacher technologists' classrooms. Project-based activities using tool software included groups of students in art exploring the school campus and taking digital photographs that could later be downloaded into graphics file. Students conducted research using the Internet and created brochures using Microsoft software.

Fifth, teacher technologists trained other teachers to be collaborative, risk-takers in using technology in the classroom. The teacher technologists modeled for other teachers how to take newly learned technology skills and apply them in the classroom even if it takes several tries to master the seamless use of technology in teaching and learning. These trained teachers, in turn, challenged students to turn out quality products. The teacher technologists cited that they met with other teachers informally during concurrent planning times or even during class time in emergencies. Teachers were allowed to seek the emergency assistance of the 10 teacher technologists in this study, especially when they were just beginning to use new technology in the classroom.

Sixth, whether attending a conference, in-house training, or taking an on-line web course, teacher technologists emphasized sharing with other teachers and/or students as soon as possible. A recurring theme with the teacher technologists was that it was important to share and use new technology immediately with the students and other teachers, so that the training efforts would not be lost because of other pressing school initiatives.

Seventh, students functioned as student-learners or student-as-teachers whereas teachers functioned as teacher-learners. The teacher technologists in this study saw students as both student-as-teachers and student-learners in their classroom. Students readily became student-as-teachers to share their knowledge of using technology with other students and the teacher technologists. The teacher technologists, as well, were comfortable with taking on the role of teacher-learner and allowing students to teach them technology skills.

Thus, this study revealed how the 10 teacher technologists of two very distinct schools, one elite and one poor, modeled the effective use of technology across the curriculum in the classroom. This study, using qualitative methodology, led the investigator directly to the classroom where best practices were demonstrated by the teacher technologists according to standards.

Background

A decade ago Moursund (1992) clarified the role of a fulltime technology coordinator on every K-12 school campus. Moursund especially promoted the need for a technology coordinator whose main role was to function separately as a support to the teachers and administration. However, technology has rapidly evolved with the use of the Internet, and today 95% of schools and 72% of the classrooms in the United States are connected to the Internet. Consequently, there is an overwhelming need not only to employ a full-time technology coordinator, known as a formal teacher technologist in this study, but also to designate assistance with informal teacher technologists who perform some of the same duties as the formal teacher technologist (CEO Forum, 2003; Kohler, 1995).

According to Russell (2002) the International Association for the Evaluation of Educational Achievement reported that 87% of schools in the United States have a designated technology coordinator although only 6% of them have a fulltime position dedicated to the duties of technology coordinator (Russell, 2002). However, another 49% of those schools have fulltime teachers who also are technology coordinators, and 32% have technology coordinators who also have other primary duties such as principal or media specialist.

The impetus for this study originated with this researcher's desire to shed light on the current practices of teacher technologists who have been traditionally referred to as technology coordinators. It seemed important to document how the position of technology coordinator has evolved out of necessity to that of formal teacher technologist. This is especially necessary since of the 87% of schools who do have technology coordinators, half are also fulltime teachers (Russell, 2002). The formal teacher technologist is a classroom teacher who has experienced successes in implementing technology in the classroom and can skillfully train other teachers to be successful with computers. Having occupied the position of formal teacher technologist in the early 90s, this researcher had the opportunity to experience first-hand how this role transitioned from coordinating the *then* few technology demands in the building to modeling and training other teachers how to use and integrate technology in the classroom. In the early 90s, in the urban middle school campus where this researcher was a computer literacy teacher, campus technology was relegated to one lone computer literacy lab crammed with 25 or more Commodore 64 computers. Another 6 to 12 Apple personal computers were located in the industrial technology classroom and the library. On that campus, each teacher had access to an IBM compatible desktop computer that most teachers were afraid to turn on. There was little incentive for teachers to invest in learning to use the computers other than the excitement of what this invention was destined to become as reported by the computer teachers. Knowledge of the Internet was uncommon, and teaching telecommunications to students consisted of having them gather around *one* computer in the classroom connected to Fort Worth, Texas' Star-Telegram STARTEXT bulletin board service (STARTEXT, 1994). This service could be likened to an on-line, text-only local newspaper, offering very similar types of information such as local weather, travel information, and the ability to send and receive e-mail to others connected to the same service.

The main focus for a computer literacy teacher was to teach basic computer skills to students and assist the principal in long-range campus technology planning, including ascertaining how to get teachers to use the *one* computer in their classrooms. Very few teachers were interested as perhaps most teachers saw the computer as just one more district initiative that would not last or lacked the time commitment necessary. If using computers was not included as part of the curriculum and instruction for their particular discipline, then the consensus among teachers was that computers were an add-on and a nuisance to learn. Such teacher attitudes as were reflected among teachers in the early stages of computer acquisition on this campus were examined in a study of Indiana's Model Applications of Technology project (1989-90). The results of this study indicated that changes in teachers' instructional use of computers depended on the hardware configuration at the school and teacher attitudes about technology. After using the computers for two years, one group of teachers treated the computer project as an "extra" and found computer use to be routine, sometimes boring and remotely related to the curriculum whereas another group of teachers made great strides in finding ways to meaningfully integrate computer use into their curriculum and their daily instruction. They looked for new ways to teach (cited in Sivin-Kachala & Bialo, 2000, p. 103).

The urban school district where this researcher was teacher technologist responded to this need to provide new ways for teachers to use technology in the classroom by initiating a district teacher technologist program. The program began in 1993 by training one selected teacher technologist from each campus. Currently, the teacher technologist program in this district is in its tenth year of implementation and continues to focus on the challenging task of training teachers in classroom technology implementation (Red Book 0203, 2003). In this program formal teacher technologists have been offering introductory courses such as Introduction to the Macintosh, Introduction to Windows, PowerPoint Integration, How to Teach Keyboarding, and How to Teach Word Processing. Courses on how to integrate various software into the curriculum have been offered, including Amazon Trail and Science Integration; Cruncher and Math; and Print Shop and Language Arts Integration (Redbook 9596, 1996). Training courses in the year 2003 included how to use the Internet, Group-wise e-mail, and on-line grade book software.

This study articulated how teacher technologists as practitioners integrated this software and other software such as Microsoft Office's Word, Excel, PowerPoint, and Internet Explorer package into the classroom. Woods (2000) revealed that the formal teacher technologist takes on three primary roles on a school campus: troubleshooter, resource/answer person, and *integration advisor*. As integration advisor, the teacher technologists must to be able to demonstrate how technology integration is carried out in a practical fashion in the classroom. In this study the private school academy's formal teacher technologist offered several technology courses to teachers, including Introduction to PowerPoint, Using Outlook as an Organizational tool, and STELLA! Flowcharting for Math/Science. The informal teacher technologists were invited to make guest appearances at the technology training classes to demonstrate to teachers how they used the software in the classroom.

With this rapid increase of computer hardware and software on campuses, the traditional workload of the technology coordinator now is shared with both formal and informal teacher technologists. These are teachers who embrace the many uses of technology and incorporate technology in their classrooms. They give critical technology assistance to other teachers and students and are resourceful in providing answers to technology questions, in addition to using technology as part of instruction their own classrooms. These teachers realize that teaching and learning are dynamic functions, grasping that there are many ways of knowing. They use technology as a tool to accommodate the many styles of learning (Gordon, 2000). These teachers are models for other teachers on the successful use of computers in classrooms. Unlike related studies that have solely explored the role of the technology coordinator or formal teacher technologist, this study explored the day-to-day practices of both the informal and formal teacher technologist, allowing them to articulate their current experiences.

Research Questions

In a phenomenology study, the grand tour question is a broad statement of the question being examined without specific reference to the existing literature, followed by sub-questions (Creswell, 1994). The following grand tour question and sub-questions were the basis for guiding this study.

Grand Tour Question

What do you see your role as teacher technologist to be?

Sub-questions

- What is a typical school day for you as the teacher technologist?
- How do you incorporate technology into your curriculum as teacher?
- How do you incorporate technology into your curriculum for the student?
- How do you train other teachers?
- How do you use professional development to incorporate technology into the curriculum?
- How does student computer expertise alter the teacher-learner relationship?

The grand tour question guided the context of this study, which was to explore the role of the formal and informal teacher technologist in using technology in the classroom. Each sub-question guided the exploration of the role of the formal and informal teacher technologist by examining how the 10 teacher technologists used technology on a typical day, how they incorporated technology into the curriculum for the student and as a teacher, how the teacher technologists train other teachers and develop professionally, and how student expert knowledge of technology alters the teacher-learner association. The study was not limited to these questions, but they began the process of this investigation.

Key words are defined in the Definition of Terms section as they are critical for an understanding of how the 10 teacher technologists in this study used computers in the classroom. These vocabulary expressions also helped to define the role of the formal and informal teacher technologist within the context of the two school settings.

Definition of Terms

1. A formal teacher technologist is a designated teacher in any discipline who receives compensation, is a leader in promoting technology and in teaching others to use technology, and

works with other teachers and students at the local campus. The formal teacher technologist is also referred to as technology coordinator; therefore these two terms are used interchangeably in this study.

2. An informal teacher technologist is a teacher in any discipline who is a leader in promoting technology and models and teaches others to use technology in the classroom.

3. A teacher technologist classroom observation refers to the researcher's spending 85 to 90 minutes in each teacher technologist's classroom or training room as a researcher-observer. The teacher observation included typing observation notes by the researcher on her laptop computer. Notes included physical layout of the classroom, movement by teacher and students, comments by the teacher and student responses, and use of computers by the teacher and students during class time.

4. A teacher technologist interview refers to the researcher's conducting three face-to-face contacts with each teacher technologist: a 30 to 90 minute (in all cases except one which was much longer) preliminary interview; a 15 minute pre-classroom observation interview; and a 15 minute post-classroom observation interview. Four of the post-classroom interviews were conducted via e-mail.

5. A phenomenological method is the recording and analyzing of a specific experience or phenomenon through the researcher's own consciousness. The researcher describes an internal awareness of an external object or experience. The teacher technologist phenomenon in this study involved examining the practices of 10 teacher technologists by tape recording interviews, observing classroom computer applications, and collecting documentation from each of them. These practices were analyzed through the researcher's interpretation of them.

6. A technology portfolio refers to the collection of documentation such as lesson assignment handouts, lesson plans, and student samples turned in on disk and in notebooks to the director of technology by the teacher technologists at the private high school academy. This documentation depicts how teacher technologists incorporated technology in the curriculum for the teacher and the student. Throughout the academic school year 2001-2002 teachers were required to turn in the documentation to the director of technology as a record of self-reported progress using classroom technology.

7. The public middle school academy is one of nine middle school academies in a large urban independent school district located in a large metropolitan area of the southwest for seventh- and eighth-grade students with a strong interest in science and the environment. Students have the opportunity to reach higher standards in science and mathematics. The school takes a hands-on approach to learning and takes learning beyond the school doors, with emphasis placed on language and mathematics (Middle School Handbook, 2003).

8. The private high school academy, Saint Angela Academy (pseudonym), is a private four-year Catholic college preparatory school for young women in grades 9 - 12.

9. The computer literacy lab at the public middle school academy is comprised of 28 networked computers used by the formal teacher technologist as a classroom to teach Computer Literacy courses to students. The lab is shared with other teachers for student-assigned computer projects.

10. The Teacher Technologist Program, since its inception in 1993 in the urban public school district, was designed to provide a direct connection between each campus in the district and the district's Instructional Technology Department. The campus principal selects a teacher technologist (referred to as formal teacher technologist in this study) whose responsibilities

include promoting the effective and efficient integration of technology throughout the curriculum. The campus teacher technologist is responsible for, but not limited to, the following tasks: support for infusion of technology, the sharing of expertise through campus and district wide teacher training, electronic inventory updates of campus hardware and software, and liaison for hardware support staff. The campus teacher technologist is compensated a minimum stipend of $2000 each school year.

11. Anytime Anywhere Learning with Laptops is a Microsoft Education Program designed to promote the use of laptop computers by students and teachers in schools. The focus of Anytime Anywhere Learning is that students and teachers who use laptops can extend their learning experiences to anytime or any place (Microsoft, 2000).

12. School Technology and Readiness (STAR) Profiles are four levels of educational indicators: early (low) technology, developing (mid) technology, advanced (high) technology, and target technology. These categories identify a school's profile for integrating technology throughout the curriculum. The STAR profiles also match educational benefits to the level of technology integration in each profile category.

Chapter One provided the purpose, background and research questions for this study. This exploration of how formal and informal teacher technologists were practicing the use of computers in the classrooms provides insight from the perspectives of these 10 selected teacher technologists across six disciplines. Chapter Two further explores the literature about the role of the teacher technologist and how this role is affected in four instructional areas of influence: teacher as guide and student as expert, constructivist learning model, technology availability, and professional development and teacher training.

CHAPTER II

REVIEW OF LITERATURE

This review of literature is divided into two major sections. The first part includes literature related to the role of the teacher technologist in the use of computers. The second part of this review relates to four areas of instructional influence: teacher as guide, student as expert; the constructivist model; technology availability; and professional development and teacher training.

The Role of the Teacher Technologist in the Use of Computers

A key reference on the role of the teacher technologist at the K-12 level is David Moursund's (1992) The Technology Coordinator, published by the International Society for Technology in Education (ISTE), one of the leading educational technology associations. The book uses interviews conducted with a school district computer coordinator, a large school district computer coordinator, a rural county computer coordinator, a small school district computer coordinator, an urban county computer coordinator, a small high school technology coordinator, and a middle school computer coordinator to expound on the roles and experiences of technology coordinators who use technology on K-12 campuses.

Moursund's (1992) interviews conducted in 1984 set the standard for establishing a technology coordinator position on the K-12 school campuses. Several questions were asked: "What is the most exciting part of your computer coordinator job? What role do you play in helping the school/district reach its computer education goals? Describe what your school/district is doing in computer education. What do you consider to be the most important qualifications necessary to do your job well?" (p. 85). As this study was concerned with the role of the technology coordinator (also referred to as the formal teacher technologist in this study) on the

K-12 campus, particular attention was paid to Moursund's interactions with the middle and high school technology coordinators. From his interaction with technology coordinators the following list of 13 responsibilities of the technology coordinator were identified as being the most crucial duties.

- Provides immediate help to teachers and students
- Plans for long-range school and district technology integration
- Addresses technology-related curriculum articulation questions
- Develops short and long-range plans for implementation goals
- Helps teachers develop technology-related materials and lessons
- Provides computer related in-service education and training
- Responsible for school hardware, software and other materials
- Has technology budget responsibilities
- Acts as a resource for a wide range of technology questions
- Assists in teaching computer-based subjects
- Develops and implements evaluation procedures
- Assists school non-teaching personnel with technology use
- Maintains personal professional growth to keep up with the field

This study sought to identify the most pressing current duties of the formal teacher technologist in accordance with Moursund's findings of duties performed by technology coordinators. Of the 13 possible duties of the technology coordinator listed in his study Moursund stated that "a regular classroom teacher with no release time to do technology coordinator work cannot reasonably be expected to spend substantial time performing duties on the list in addition to teaching duties" (p. 28). However, in this study formal teacher technologists perform the duties of the technology coordinator and teach classes. This investigation was able to view the current duties of teacher technologists in the light of how technology use is currently practiced in the classroom, revealing that paramount service of formal teacher technologists is to provide immediate technology assistance to teachers, administrators, staff and students.

Kohler (1995) conducted a survey to determine the perceptions of building level technology coordinators within the state of Florida. As a result of surveying 67 district level computer specialists as well as 75 technology coordinators from selected schools and their principals, Kohler recommended that "each district should develop policies and procedures to enable every school to have the assistance of a technology coordinator, either on a full or part time basis" (p. 107). Kohler explored the perceptions of the technology coordinator's campus duties by surveying district computer specialists, principals and technology coordinators about their duties as being sole or shared responsibilities. Interestingly, what the district computer specialists reported as shared roles between themselves and the technology coordinators, the technology coordinators reported as sole responsibilities. For example, 32 and 34 percent, respectively, of district computer contacts and principals, compared to 96 percent of the technology coordinators, perceived "working with teachers to provide technology articulation within the school" as the sole duty of the technology coordinator (Kohler, 1995).

Denise Woods (2000) conducted a qualitative study in which she assumed the role of the technology coordinator in an elementary school campus. The results of her study revealed that the technology coordinator takes on three primary roles: troubleshooter, resource/answer person, and integration advisor (Woods, 2000). The role of troubleshooter involves responding to requests from teachers and students concerning hardware and software problems, such as solving a problem with a printer that does not print. The role of resource/answer person involves helping teachers and students on the use of a specific feature in a particular software tool, such as showing someone how to create a bookmark on the Internet. The role of integration advisor involves the technology coordinator's suggesting ways to incorporate technology into the curriculum, such as how to introduce word processing to kindergartners (Woods, 2000). From observing and interviewing 16 teachers at an elementary school, Woods reported that 59% of the requests from teachers and students were troubleshooting concerns, 37% of the requests were resource/answer concerns, and only 4% were integration type requests, indicating the need for a full time technology coordinator (Woods, 2000). Whereas Woods' study was conducted at an elementary campus and she assumed the role of the technology coordinator, this present study interviewed and observed two formal teacher technologists who operate in the same role as does the technology coordinator at a middle school and high school campus.

Computer Integrated Instruction (CII) and Computer Assisted Learning (CAL)

One of the duties of the technology coordinator is to "address technology-related articulation questions" (Moursund, 1992, p. 28). This entails knowing how to use computers in the three major categories, especially instruction: for research, such as using computer software to analyze quantitative data; for administration, such as using the computer to take attendance or disseminate principal's weekly announcements; and for instruction, using the computer to teach a computer programming or computer applications. Instructional use of computers also incorporates computer-integrated instruction (CII) and using the computer as a delivery system for computer assisted learning (CAL) (Russell, 2002; Moursund, 1992). Technology coordinators should be strong in the area of instructional uses, especially computer assisted learning and computer-integrated instruction (Russell, 2002). This present study investigates teacher technologists' use of computers for CII.

The Technology Coordinator and the Use of Computer Integrated Instruction (CII)

Computer integrated instruction involves being able to use the computer as a generic tool, subject specific tool or learner centered tool (Moursund, 1992; Russell, 2002). The role of the technology coordinator may include instructing students and other teachers about the use of computers for these purposes.

Using the computer as a generic tool entails learning course content by using telecommunications software such as the Internet, a word processor, database, computer graphics, presentation software such as Microsoft's PowerPoint, or any other interdisciplinary tool (Moursund, 1992). Using the computer as a generic tool can be accomplished at all grade levels. A technology coordinator should teach students word processing skills in grade school but also allow for students to develop those skills every time a writing exercise is assigned to maximize the usefulness of the computer as a writing tool. According to Moursund (1992), students who are taught word processing skills must be encouraged to practice those skills on a regular basis throughout the school's curricular agenda. Frequent practice of student writing on the computer encourages faster typing and skillful writing; serious writers become used to word processors and will use them every time they write because they recognize that they can type faster than they can write by hand (Moursund, 1992).

Subject specific tools are designed for use in specific content areas such as music and math software. The role of the technology coordinator is not to know the specifics of every possible subject offered in a school setting but rather to be able to show teachers and students how to use the tool. It is the responsibility of the technology coordinator to use the subject specific software in the classroom (Moursund, 1992). Technology coordinators may determine whether or not content software is used in the classrooms. They use tools they themselves have comfortably mastered. They attend sufficient professional development and training to help other teachers with this process and to provide support as these tools are integrated into the curriculum (Gordon, 2000).

The technology coordinator may need to instruct teachers and students on the use of learner centered tools designed for projects and discovery-type learning such as Logo and authoring programs such as hypermedia software (Russell, 2002). Currently used learner centered tools are software such as Microsoft's FrontPage or Hypertext Markup Language (HTML) authoring to allow learners to construct web pages for the Internet. Using these tools involves a considerable amount of invested time. When students are taught to use these tools by technology coordinators and computer science teachers, the tools are useful for building content for various disciplines, but other subject classroom teachers decide whether or not students will be allowed to use learner-centered tools to construct assignments in their classrooms (Moursund, 1992).

The Technology Coordinator and the Use of Computer Assisted Learning (CAL)

The technology coordinator in some schools must be knowledgeable and trained in the use of integrated learning systems or computer assisted learning. Computer assisted learning may involve using drill and practice or simulation software on one computer but often involves a school’s or district’s investing in computer software that is installed on a server in a computer lab. Students come to the lab for instruction on the computer. If a teacher, clerk, or aide is not trained specifically to operate the system, the duties of running a CAL system fall to the technology coordinator. Such duties may include updating courseware, maintaining the system, or serving as the liaison for other teachers who may wish to use the system in their classrooms (Moursund, 1992).

In this present study, both formal and informal teacher technologists used CII for classroom technology. Teacher technologists decided when to integrate technology activities into the lesson and selected the software that was used to do so. Most of the software tools used by teacher technologists were generic software tools such as Microsoft Word, the Internet Explorer, and PowerPoint. Subject specific software used by the math and science informal teacher technologist at the private high school academy were Geometer's Sketchpad and STELLA.

Four Areas of Instructional Influence

This literature examination also explored four instructional in which the practices of formal and informal teacher technologists have impacted K-12 technology classroom use: teacher as guide, student as expert; constructivist learning; technology availability; and professional development and teacher training. This present study asked the following questions to investigate the prevalence of technology classroom practices pertaining to these areas: How do you train other teachers? How do you use professional development to relate technology to the curriculum? How do you incorporate technology into your curriculum as teacher? How do you incorporate technology into your curriculum for the student? How does student computer expertise alter teacher-learner relationship?

Teacher as Guide, Student as Expert

The introduction of personal computers into the classroom since the 1980s has changed on how teachers teach and how students learn (Clark, 2000). Rockman *ET AL* (1998) reported teachers' and students' perception of non-traditional roles when students have laptop computers.

The students become as knowledgeable as the teacher in using the computer. As argued by Civello (1998), computers in the classroom have “de-centered the high school English teacher; she or he is no longer at the physical or intellectual front of the class” (p. 1).

Some schools employ students as “TechSpurts” or technology experts to help teachers learn to use technology in the classroom (Maurer & Davidson, 1999; Gordon, 2000). Researchers argue that the formal didactic, lecture, and demonstration paradigm is not effective for the more complex learning necessary for classroom technology use (Maurer & Davison, 1999; Clark, 2000). When students learn technology along with teachers, they blossom in the expert role and become teachers of technology themselves (Maurer & Davidson, 1999). This phenomenon does not diminish the need for the teacher in the classroom; rather learning opportunities expand for both student and teacher (Civello, 1998). According to Civello (1998), “My students still used my knowledge and expertise, but in collaboration with rather than as a substitute for their own efforts” (p. 5).

With the de-centralization of the teacher as lecturer-expert in the classroom, Rockman *ET AL* (1998) observe that 41% of 144 teachers surveyed reported that the amount of lecturing has decreased since laptop computers have been issued to students. Rockman *ET AL* (1998) also report that the teacher’s role has changed from “director of learning to facilitator of learning” (p. x). The authors note that students spend more class time in computer-using classrooms engaged in collaborative work, “asking each other questions and depending on their peers for information, ideas and editing, as well as for technical help” (p. ix). Compared to non-laptop using students, students using laptops work more independently, express themselves more creatively, produce quality research projects with improved research and analytical skills, and prepare and deliver more presentations and speeches (Rockman *ET AL*, 1998).

Constructivist Learning Model

A report published by the Software Information Industry Association states that the traditional, information-transfer model of teaching and learning in the classroom has given way to the constructivist approach, primarily because of long-term and frequent student use of computers and the Internet in the classroom (Sivin-Kachala & Bialo, 2000). The constructivist learning model holds that "we can only know what we have constructed ourselves," within the social environment in which the learning takes place (Yager, 1991, p. 54).

The use of constructivist teaching and learning along with using computers in the classroom is no coincidence. According to Rakes, Flowers, Casey and Santana (1999), technology can provide the avenue for constructivist teaching. Influences of the constructivist learning model include using problem-oriented activities, allowing for collaboration with other students and the teacher, using creative formats, seeking out student ideas before the teacher shares her ideas or before studying from the textbook (Rakes, et al., 1999; Yager, 1991).

Technology in the classroom provides the means for constructivist teaching and learning opportunities (Rakes, et al., 1999). Some of these opportunities are described by teachers and students in a laptop study conducted by Rockman *ET AL* (1998). For example, students obtain more experience "preparing and delivering presentations" (p. x), participate in twice as much project-based instruction as do non-laptop students, and "have to make more decisions, especially pertaining to research, because of the vast amount of information available to them" (p. 38). These opportunities allow students to become independent learners, take ownership of their learning, and take responsibility for producing a quality project. Teachers facilitate or guide the instructional process by allowing students to be responsible for their own learning. Teachers and students learn and work together (Mauer, 1999; Yager, 1991).

Instructional characteristics that can be readily recognized in a classroom, centered around constructivist teaching and learning, as cited by Roblyer (1996), include problem-based learning relevant to student interests; the use of visual formats, such as multimedia equipment; the use of resources, such as electronic books and laptop computers; collaboration; learning through inquiry; and qualitative assessment using portfolios and performance measures. Roblyer (1996) contends that previous research addressed whether or not to use technology in the classroom, whereas many studies now "assume the presence of technology" (p. 12) and now address questions such as: How can technology be used to enhance collaboration? What is the impact of technology on the way a classroom functions? How does student use of technology affect student approaches to problem-solving tasks?

McAdoo argues in *The Digital Classroom* (Gordon, 2000) that what often holds students back is not the technology but the reluctance of teachers to engage in constructivist teaching and learning compatible with student computer activities. Students who are capable of navigating the Internet or conducting research and using primary sources for information that would be available only to the teacher in a traditional information-transfer classroom may pose a threat to the conventional teacher (Gordon, 2000). Not so for star teachers of students of poverty, Haberman (1995) argues; star teachers today "work very hard at assigning less and less as the year progresses; in the course of their year with students, they develop more and more ways of involving the pupils in the determination of their own assignments" (p. 5). Haberman (1995) offers that even in teaching students from impoverished backgrounds, the use of technology in the classroom provides a useful strategy for engaging students in constructivist activities:

> A teacher with knowledge of computers and music has adapted a program so that the children in her class can create their own music, fully scored, by composing and

> harmonizing even the simplest melody. The children begin to write poems and rap to their music. They soon compose so much that they decide to put on a class opera that depicts their lives in and out of school. The class improves its reading and writing skills markedly. They learn more music, including some advanced skills of composition. They improve their oral language. Incidental learnings involve their ability to work more cooperatively and to persist in long-term tasks that require a month of continuous effort (p. 35).

According to Kemp (1997), educational technology has demonstrated a significant positive effect on achievement in major subject areas in preschool through college, including special and regular education. Sivin-Kachala & Bialo (2000) report evidence that students who use word processing software in combination with writing instruction and who write via the Internet or e-mail improve their writing significantly more than do students who do not use these technology tools. Nix (cited in Sivin-Kachala & Bialo, 2000) find that fourth-grade students who had been e-mailing other students at another school performed better in persuasive writing than did other students not using e-mail. Funkhouser and Djang (cited in Sivin-Kachala & Bialo, 2000) report that high school students using software for algebra and geometry scored significantly higher on mathematics tests than did comparable students who did not use the software. "Teachers find that technology's chief benefit is its use as a tool to support student thinking and productivity" (Waxman & Walberg 1999, p. 300).

Technology Availability

Availability of computers is essential to students' and teachers' use of them in the classroom (Clark, 2000). In a laptop study, conducted by Rockman *ET AL* (1998), comparing laptop users to non-laptop users (students who use desktop computers), teachers stressed that easier access to the laptops made them more beneficial than classroom desktop computers or computer labs. The major benefit of laptops over desktop computers is their portability, i.e., students can use the computers anytime, anywhere (Rockman *ET AL*, 1998).

According to a report by the National Center for Education Statistics (2000), in 1998 the number of private school students per instructional computer was eight to one, and the number of public school students per instructional computer was nine to one for public schools with the highest concentration of poverty students, and six to one for public schools with the lowest concentration of poverty students (NCES, 2000; NCES, 2001). How many schools have access to the Internet? In the United States 60% of classrooms in public schools with the highest concentration of poverty are reported to have Internet access, compared with 82% of classrooms in schools with the lowest concentration of poverty (NCES, 2001).

The idea that merely ensuring those schools from poor communities have the same ratio of computers to students as do schools from rich communities as a confident way to achieve equity is a myth according to Kleinman (Gordon, 2000). Students from poor schools are more likely to use computers for mundane drill and practice and integrated learning systems whereas their counterparts from wealthier schools use the computers for constructive learning. In the former situation the computer controls the student. In the latter situation the student controls the computer (Clark, 2000; Gordon, 2000; Mecklenburger, 1990; Sutton, 1991). Closing the digital divide is not just about placing computers in the classroom; it is also about training teachers to build classroom content with the appropriate use of technology in mind and providing them with appropriate professional development (Clark, 2000; NCREL, 2002).

Professional Development and Teacher Training

Tailoring professional development to meet the needs of the local school faculty keeps the focus of the school's goals for technology in the forefront (NCREL, 2002). The teacher technologist leads in training and modeling how to use technology in classroom lessons (NCREL, 2002). Studies analyzed by the Software Information Industry Association report that "students of teachers with more than 10 hours of training significantly outperformed students of teachers with five or fewer training hours" (Sivin-Kachala & Bialo, 2000, p. 10).

In working within the school as a technology coordinator, Yu-mei Wang's (2000) research on the role of technology coordinators' training teachers in the use of computers offers an extensive look at the three phases of technology training. A review of a 1998 second year laptop study is included. The Rockman *ET AL* research company surveyed 144 middle and high school teachers and 450 students on skills and learning strategies using laptop and desktop computers in the classroom; shadow observations and interviews were conducted also (Rockman *ET AL*, 1998). (Rockman *ET AL* is the name of the research firm).

Wang (2000) claims that professional development to train teachers in the use of computers for the classroom involves three phases: familiarization, that is, diminishing teachers' fear of breaking the computer and showing teachers how the various components of the computer operate; utilization, that is, spending time showing teachers how various software and hardware are useful for both administrative and classroom learning and allowing them time to practice using computers; and integration, which involves training teachers how to integrate the computer as a tool for both teacher- and student-centered use.

Kleiman (cited in Gordon, 2000) dispels the myth that once teachers learn the basics of computers, they are ready to be effective users of technology in the classroom. According to a study of Apple Classrooms of Tomorrow (ACOT), teachers experience five stages of "instructional evolution" when using technology (Gordon, 2000). Stage one is the entry stage, at which point teachers are learning how to master the new tool. Stage two is the adoption stage, when teachers are beginning to explore how they may use the technology in their classrooms without making any drastic curricular changes, such as having students use the word processor. Stage three is the adaptation phase, where computer use has been integrated into the traditional classroom and students begin to use the computers more frequently. Stage four is the appropriation stage, during which teachers understand how the technology can be used seamlessly in a classroom environment. Finally, at stage five, the invention stage, teachers begin experimenting with non-traditional teaching methods such as project-based learning and students begin engaging in collaborative activities and independent learning (Gordon, 2000; Rakes, et. al., 1999).

Each of the studies cited in this review reveals the importance of the presence of the informal and formal teacher technologist on the local K-12 campus. Moursund's book (1992), The Technology Coordinator, provides a comprehensive look at the technology coordinator's role at the district as well as the local K-12 level.

The four areas of instructional influence explored in this review include teacher as guide, student as expert; constructivist learning model; technology availability; and professional development and teacher training. These four areas surfaced as pertinent themes addressed throughout this research on the use of technology in the classroom. In this researcher's classroom observations and interviews with formal and informal teacher technologists, teachers were allowing students to be the technology experts in the classroom while they provided guidance. The constructivist teaching and learning theme was observed as teachers allowed students to move around the room and work with each other or independently on classroom and project assignments. Some individual or groups of students called upon the teacher technologists in this study whereas other students collaborated with each other. The Rockman *ET AL* (1998) laptop study focused on the comparison of teachers and students who used laptop computers and teachers and students who used desktop computers. The results of this study indicated that the roles of the teacher and student change when students have laptops; teachers become consultants and facilitators, and students become collaborators and directors of their own learning as in constructivist teaching and learning (Rockman *ET AL*, 1998). As in the Rockman *ET AL* study, this present study focused on the voice of the teacher technologist and how computers, regardless of the type, are used in these classrooms. This present study elaborated upon the four areas of instructional influence as they pertain to the use of computers in the classroom. Operating within these constructs, informal and formal teacher technologists ensured that their main role included the successful incorporation of technology in the classrooms.

The review of literature shows that when computers were integrated into classrooms in the 80s and early 90s, Moursund's (1992) research established the standards for the role of the technology coordinator (also known as formal teacher technologist in this present study). His study entailed interviewing numerous technology coordinators who identified 13 expansive responsibilities of the technology coordinator, including assisting in teaching computer-based subjects. However it also revealed the need for refocusing the traditional role of the technology coordinator to that of the formal teacher technologist whose main responsibility is to train teachers in the challenge of effectively using technology in the classroom. With much more technology on school campuses since the 80s, it reveals the need for recognizing other teachers as informal teacher technologists who also informally assist teachers in successful classroom technology application. This review pointed out four instructional areas in which these selected teacher technologists influence effective classroom technology application: teacher as guide, student as expert; constructivist learning model; technology availability; and professional development and teacher training. The next chapter on methods and procedures describes how this study focuses on formal and informal teacher technologists operating across those four areas of instruction.

CHAPTER III

METHODOLOGY AND PROCEDURES

This study employed qualitative methodology to investigate the current classroom computer practices of teacher technologists. The phenomenological approach enabled the researcher to pose the following questions to 10 teacher technologists.

- What do you see your role as teacher technologist to be?
- What is a typical school day for you as the teacher technologist?
- How do you incorporate technology into your curriculum as teacher?
- How do you incorporate technology into your curriculum for the student?
- How do you train other teachers?
- How do you use professional development to incorporate technology into the curriculum?
- How does student computer expertise alter the teacher-learner relationship?

This researcher interviewed and observed the participants as they taught classes across six subject areas and conducted teacher training. Employing a qualitative design also enabled the researcher to narrate and represent the technologists' perspectives. This chapter is divided into five sections: Theoretical Framework, the Role of the Researcher, the Selection and Description of the School Sites, the Participants, and the Research Methods and Data Analysis Procedures.

Theoretical Framework

The study of phenomenology was founded by Edmund Husserl who described this type of research as allowing the researcher to experience a phenomenon, recording and analyzing it, through the researcher's own consciousness--that is, the researcher's state of internal awareness of an outside object or phenomenon (Gall, et al., 1996). According to Clark (1994), "what appears in consciousness is the phenomenon. The word *phenomenon* comes from the Greek *phaenesthai*, to flare up, to show itself, to appear" (p. 26). This framework also encompasses Clark Moustakas' (1994) views on transcendental phenomenology, Alfred Schutz's (1967) ideas on interpreting meaningful actions of participants in a study, and Peter Berger's and Thomas Luckmann's (1966) ideas on the exploration of everyday, socially constructed knowledge.

The major purpose of this study involved the exploration of the role of the teacher technologist, with face-to-face interviews and observations. One of the theoretical foundations of this study is that reality is socially constructed, also referred to as the sociology of knowledge (Berger & Luckmann, 1966). The sociology of knowledge is concerned with what people know as reality in their daily lives. This entails exploring commonsense knowledge that is taken for granted as just how things are, encompassing the fabric of what societies in this life are all about (Berger & Luckmann, 1966). According to Lester (1999), this knowledge involves exploring people's motivations and actions and wading through the assumptions that are taken for granted.

Berger & Luckmann (1966) further expound that the reality of every-day commonsense knowledge is shared through social interactions. The best of these interactions is face-to-face in that each participant in the interaction is able to see the other as "fully real" (p. 28). Even if the persons involved in such interactions are hypocritical about their intentions or hidden meanings, it is more difficult to sustain such a pattern of hypocrisy face-to-face over a period of time (Berger & Luckmann, 1966). Additionally, having face-to-face encounters with each participant, according to Alfred Schutz (1967), enables the researcher to "directly experience the participants' social realities and their subjective experiences" (p. 142) which is at the crux of phenomenological research.

According to Schutz (1967), a researcher's interpretations can be both objective and *essentially subjective and occasional*. The researcher can be objective in interpreting the participants' perspectives if the interpretation "binds its meaning merely by its appearance-content of sound and can be understood without regard to the person uttering it or the circumstances of its utterance" (Schutz, 1967, p. 33). An *essentially subjective and occasional* interpretation is so "when it is such that its occasional and actual meaning must be oriented with respect to the speaking person and his condition" (Schutz, 1967, p. 33). Phenomenological research supports a researcher's objective and subjective interpretations through face-to -face interactions where both participant and observer are engaged in a social milieu (Silverman, 2001). Face-to-face interactions constitute the most recommended way to gather information about a particular phenomenon which involves direct knowledge from those who are a part of the phenomenon. Face-to-face interactions allow the researcher to readjust her subjective interpretations by mirroring, asking and validating those interpretations with the participant (Schutz, 1967).

Schutz (1967) offers three indirect approaches to interpreting the actions of the participant through face-to-face interactions: (1) The researcher can search her memory for actions that are comparable to the participant's actions, putting herself in the participant's stead and portraying from that a general principle concerning the action. (2) With no prior knowledge of the participant's behavior to which the researcher can make reference, the researcher can use knowledge of the normal behavior of the participant for a particular phenomenon and make deductions from this knowledge. (3) As a last resort, when the researcher has no known knowledge of the participant's behavior, the researcher can observe, make inferences, and continue to ask the participant if such actions were interpreted as intended by the participant. According to Schutz (1967), though the interpretation of a participant's motives and actions may be complicated and unreliable, if the researcher "has some way of gaining access to the expressive schemes of the participants in the relationship" (p. 176), face-to-face interactions are the most profitable way to discover these meanings.

Moustakas (1994) explores face-to-face interactions further with the concepts of transcendental phenomenology, offering this methodology as the key to knowledge acquisition. Whereas the empirical researcher seeks to carry out a totally abstract, detached, neutral investigation, the phenomenological researcher seeks to experience, to become empathetically one with the phenomenon being researched (Moustakas, 1994). "Transcendental phenomenology is a scientific study of the appearance of things, of phenomena just as we see them and as they appear to us in consciousness" (Moustakas, 1994, p. 49).

The concern in using this methodology is to seek meaning of the phenomenon being studied. How does the researcher accomplish this? According to Moustakas (1994), the researcher can analyze such meanings by applying the major processes of transcendental phenomenology: *epoche*; phenomenological reduction; and imaginative variation and synthesis.

Epoche is a Greek word meaning to stay away from or abstain (Moustakas, 1994). Since the root of the phenomenological research method involves self-reporting, Moustakas (1994) defines *epoche* as the first role of the researcher in gaining entrance into true understanding of a phenomenon, staying away from the biases of "'scientific' facts, the knowing of things in advance, from an external base rather than from internal reflection and meaning" (p. 85). In this sense, the researcher alone has to free herself from any prejudgments by acknowledging their existence, then come to the study with a fresh, "undetermined determinability" (p. 87) to engage empathetically with the participants of the study.

> I return to the original nature of my conscious experience. I return to whatever is there in memory, perception, judgment, feeling, whatever is actually there. Everything that appears in my consciousness becomes available for self-referral and self-revelation. The loneliness of such presence, of such consciousness, enables me to target my energy so that I am attending to just what appears and nothing else. The challenge is to silence the directing voices and sounds, internally and externally, to remove from myself manipulating or predisposing influences and to become completely and solely attuned to just what appears, to encounter the phenomenon, as such, with a pure state of mind. (Moustakas, 1994, p. 88).

The process of phenomenological reduction involves, first, bracketing, that is returning to the topic and root of the investigation; everything else in the investigation rests solely on the research questions. For each participant, all data statements are gathered, reflected upon, and reduced to non-overlapping singular horizons (textural meanings or invariant constituents of the phenomenon). These horizons are organized into themes; then the horizons and textural meanings become textural descriptions of the phenomenon (Moustakas, 1994).

The next step in analyzing the data is applying Imaginative Variation, that is seeking meaning through imagination, looking at the phenomenon from varied perspectives, arriving at a structural description that answers the question: "How did the experience of the phenomenon come to be what it is?" (p. 98). Imaginative Variation helps the researcher construct structural themes from the textural descriptions organized in the phenomenological reduction step. "Through Imaginative Variation the researcher understands that there is not a single inroad to truth, but that countless possibilities emerge that are intimately connected with the essences and meanings of an experience" (p. 99).

Synthesis is the final step in the phenomenological research method, engaging the combination of both textural and structural meanings into a representative meaning of the phenomenon (Moustakas, 1994, p. 100). Synthesis creates a fused description of the phenomenon as it is in a particular place and time. The researcher provides the representative meaning of the phenomenon as it is constructed from what has been provided by the participants in the study.

In order to best address the research questions guiding this study, the researcher used a phenomenological research method. A phenomenology research design seeks to understand experiences offered by unique others, with consideration for the researcher as interpreter of those experiences; the researcher is aware of her or his own beliefs and values pertaining to those experiences (Jaeger, 1997)

Moustakas (1994) asserts that the researcher can analyze such meanings by applying the major processes of transcendental phenomenology: *epoche*, phenomenological reduction, and imaginative variation and synthesis. This study used the following transcendental phenomenology research design outline to analyze the interviews, observations, technology portfolios, training logs and other documentation (Moustakas, 1994):

The researcher developed individual *textural* and *structural* descriptions of each of the participants' interview responses for each of the research questions guiding this study. The individual *textural* descriptions involved the individual transcribed interview statements voiced by each participant. The researcher conducted the following process for each of the following guiding research questions.

This researcher revisited each of the interviews by listening to the audiotapes on the cassette tape player in her car on the way to and from school, the store, church, the beauty salon, at any given opportunity. This researcher kept a pencil and pad with her at all times to record any recurring words used by each participant.

To construct the *textural* descriptions, the researcher opened the transcribed interview for each participant in Microsoft Word on her laptop computer and manually looked at the response to each guiding interview question and any probing questions that pertained to the guiding question. Each statement was examined and compared to the next statement. If two statements expressed the same thought, one was eliminated. The remaining statement was kept and compared to the next until one unified textural description was obtained. This process was repeated for each participant's interview transcript (Moustakas, 1994).

The *structural* descriptions were constructed by using the themes written down during the textural process. *Structural* descriptions involved the researcher's applying the structure of "time, space, bodily concerns, materiality, causality, relationship to self, or relationship to others" (Moustakas, 1994, p. 99). The researcher used the imaginative variation process to develop *structural* descriptions; the researcher sought possible meanings "through the utilization of imagination, varying the frames of reference, employing polarities and reversals, and approaching the phenomenon from divergent perspectives, different positions, roles, or functions" (p. 97).

In constructing *structural* descriptions for each guiding research question for each of the participants, this researcher viewed all documents collected from each participant. Each of the documents was examined closely. The documents in electronic form included the technology portfolios and lesson handouts; these were viewed and examined on the computer screen while simultaneously constructing the *structural* descriptions.

The researcher used empathy and imagination from her own experiences as a teacher technologist. As a current teacher in the private school environment and as a former teacher technologist in a school in the urban school district, she was able to empathize and apply understanding to what each participant articulated. Before applying this imaginative variation however, she listened very carefully to each audiotape several times, listening with as little pre-thinking or background thinking as possible to construct the structures or themes from what the participants were saying.

The researcher developed composite *textural* and composite *structural* descriptions. After producing individual *textural* and *structural* descriptions for each participant, the researcher painted a composite *textural* and composite *structural* description of the phenomenon. The themes discovered from each of the participant's individual textural descriptions are studied "in depicting the experiences of the group as a whole" (Moustakas, 1994, p. 138) and made up the composite *textural* description. The composite *structural* description portrayed how the participants as a group experienced the phenomenon.

For the composite *textural* descriptions the researcher revisited each of the individual *textural* descriptions and constructed a one-voice compilation of the 10 teacher technologists as a group. The researcher printed out each of the *textural* descriptions and read and re-read them, making pencil and pen notations in the margins of similar themes expressed by each of the teacher technologists. Each statement in the composite *textural* descriptions represented the transcribed words of the teacher technologists.

For the composite *structural* descriptions the researcher revisited each of the individual *structural* descriptions and constructed thematic meanings from each. Each of the individual *structural* descriptions was printed out. The researcher spent much time reading and re reading each description and thinking about what each participant was saying. Pen and pencil notations were made in the margins during this reflection process. This part of the analysis involved applying the process of imaginative variation and the researcher's own interpretations of the individual *structural* descriptions.

The researcher developed a synthesis of *textural* and *structural* meanings and essences of the experience. In this phase of analysis the researcher constructed both *textural* and *structural* meanings into a vivid presentation, explicating core themes that emerged. The researcher offered the essence of the experience, the phenomenon as meaning "that which is common or universal, the condition or quality without which a thing would not be what it is" (Moustakas, 1994, p. 100). It is a "concatenation of appearances" as offered at a particular time and place from the vantage point of the researcher, "following an exhaustive imaginative and reflective study of the phenomenon" (p. 100). These synthesized *textural* and *structural* meanings are presented as findings in this study.

The Role of the Researcher

The researcher adopted an interpretive role in this study and revealed her values, assumptions and biases (Gall, et al., 1996). This researcher's experiences as a formal teacher technologist 10 years ago were reflected in the interpretation of the data. The nuances, the jargon specific to this discipline, and the frustrations and joys were accepted with familiarity. The researcher was an informal teacher technologist in an urban middle school from August 1989 until June 1991 and a formal teacher technologist from August 1991 until June 1993. After three years of teaching computer literacy classes, the researcher became a district instructional specialist, working very closely with 27 middle school formal teacher technologists. As an instructional specialist the researcher facilitated the selection of software and hardware requested by middle school formal teacher technologists and kept track of the training received and conducted by middle school formal teacher technologists. During this study the researcher served as a computer science teacher, department chair, and an informal teacher technologist in a private school environment.

The researcher's awareness of the challenges experienced by both formal and informal teacher technologists in both an urban school and a private school setting was considered a benefit in developing positive relations with participants in this study from those settings. This researcher has experienced the challenges faced by teacher technologists working in a poor, urban school environment. In addition, the researcher's position in the affluent private school of this investigation has permitted her to contrast the technologist's position and challenges in the two environments.

This researcher brings certain biases to the study, having worked closely with teacher technologists and also by occupying that role informally during this study. The researcher's biases may have affected her interpretation of the experiences of other teacher technologists.

One of the researcher's biases was to question whether or not a teacher technologist is using software adequately to enhance student thinking or just as a disciplinary incentive to keep students busy or occupied. One of the researcher's challenges as instructional specialist in the urban district was to request that informal or formal teacher technologists not allow students to use computers as toys, for playing mindless computer games. One solution to this challenge in the urban school district was to purchase well-designed software that was every bit as vivid and interesting as computer games.

Another bias of this researcher is that poor students may not have as many opportunities to use the computer as a tool in constructing, designing, and creating their own projects as do their wealthier counterparts. This researcher is a strong proponent of project-based learning for all students. Project-based learning along with the constructivist teaching model allows students to learn for the sake of learning and to build on *any* knowledge they may currently have. It further encourages them to seek out what they need to know in order to complete the project (Purcell-Gates, 1995).

Selection and Description of the Sites

This study was conducted on two school campuses: a seventh- and eighth-grade public, middle school academy housed within a regular middle school, and a private, all-girls, ninth- through twelfth-grade high school academy. The two campuses are located within 15 minutes of each other although the public middle school academy is located in a poor industrial neighborhood in the heart of an large urban city and the private high school academy sits among tall, stately homes hidden by numerous mature trees and gated fencing in the northern part of the city.

The middle school academy is a public school, part of a large urban school district. Students are admitted to the school based on standardized test scores, elementary school grades, and recommendations. More than 90% of the students are bussed to the school from their neighborhoods. The public middle school academy is located across the street from a newly refurbished housing project in a poor neighborhood near the industrial section of the city. The school is housed between a tiny Baptist church on one side and small, wood-framed houses on the other. The building looks as much a part of the area as do the other old buildings. Old paint and bricks from another era still adorn this school. Only the newly painted stripes in the parking area in front of the school stand out as a new improvement. The public middle school academy is housed within a regular school campus. A metal detector flanks the entry doorway. A teacher is usually seated at a table next to the detector to check in students and visitors. To the right of the front entrance, the public middle school academy section begins. The public middle school academy's main hallway has a stark look, except for the personal touch of mismatched potted plants dotting the area and a huge lonesome fish tank at the very end. The classrooms bustle with activity. Most of the classrooms are small and filled to the brim with wall-to-wall materials, books, equipment, and bulletin board decorations.

One hundred and seventy-one students attend the public middle school academy. The school population consists of 63 African Americans, 76 Hispanic Americans, 26 European Americans, 4 Asian Americans, and 2 are Native Americans. More than 90% of the students who attend the middle school academy participate in the free or reduced lunch program. Students wear a relaxed uniform of navy polo shirts and khaki pants. The faculty consists of 16 teachers, one counselor and one administrator at this public middle school academy. Of the teachers, 50% are female and nine of the teachers are European Americans, five are African American, one is Hispanic American and one is Native American. The average class size is 10 students per instructor.

According to the Texas Education Agency's accountability data reports for the public middle school academy, 98% of the students attending the academy in the spring of 2002 passed the state's standardized Texas Assessment of Academic Skills (TAAS) test in reading (159 of 161 students). Ninety six percent passed the math section of TAAS (155 of 160 students).

Ninety five percent (71 of 74 students) passed the writing section of TAAS (Texas Education Agency, 2003).

Classes begin at 8:25 a.m. and the school day ends at 3:25 p.m., with a 30-minute lunch break each day. The school operates on an alternating modified block, three-bell schedule as shown in Table 1. The school ends each week on Fridays. Class time alternates between 30 to 90-minutes. Students attend all seven classes on Fridays.

Table 1

Bell One: Mondays and Wednesdays			
1st Period	8:25	-	9:55
2nd Period	10:00	-	11:00
Lunch	11:05	-	11:35
2nd Period	11:40	-	12:10
3rd Period	12:15	-	1:45
4th Period	1:50	-	3:25
Bell Two: Tuesdays and Thursdays			
Advisory	8:25	-	9:10
5th Period	9:15	-	10:45
6th Period	10:50	-	11:10
Lunch	11:15	-	11:45
6th Period	11:50	-	1:00
7th Period	1:05	-	2:35
Tutorials/Enrichment	2:40	-	3:25
Bell Three: Fridays			
Breakfast	7:50	-	8:17
1st Period	8:25	-	9:15
2nd Period	9:20	-	10:10
3rd Period	10:15	-	11:05
Lunch	11:10	-	11:40
4th Period	11:45	-	12:35
5th Period	12:40	-	1:30
6th Period	1:35	-	2:30
7th Period	2:35	-	3:25

Students at the middle school academy have access to computers in a standard configuration computer literacy lab of 28 networked computers and four printers. The school has also purchased a laptop e-buddy system comprising 37 battery-operated laptops and 2 mothership configurations, each on a huge cart that has slots for recharging the laptops, network access, a television, videocassette recorder, and a computer. This cart can be pushed from room to room and is checked out by teachers to use in their classrooms. Each teacher has access to a networked desktop computer in the classroom and to a personal school e-mail account. The school also has purchased 25 wireless Dell laptops that have enough disk space to run only Windows 98 and Office 2000. One hundred twenty RCA Softbook miniature laptops sit in a locked closet, purchased to load student textbook files so that students do not have to carry such a heavy load of textbooks. The Softbooks are designed for just that purpose, to hold textbook information.

This public middle school academy was selected, first, because the formal teacher technologist at this school has been a formal teacher technologist since the inception of the Teacher Technologist Program in the school district. According to the program, a campus teacher technologist is a one-year appointment, and the formal teacher technologist there has served in this role now for the past 8 years on two middle school campuses.

The private high school academy is an independent, all-girls Catholic school located in the heart of an upscale community with huge towering homes and generous spacious, landscaped properties. The gated campus composed of several red brick buildings sprawls across several acres of lawn divided by a long, meandering driveway. The school's lone, fulltime security employee sits in a guardhouse on the driveway mechanically waving at everyone who enters.

The buildings are quaint, especially inside. Upon entering the main building, visitors encounter a rotunda area with Queen Anne style seating. A receptionist sits in a room to the right at the entrance prepared to greet visitors with the gentility of one who has been trained well in hospitality. Both walls of the main hall of the main building, are lined with framed photographs of each year's graduates, dating back to the first graduating class in the 1800s, 128 years ago. Most of the classrooms are small and compact. Some have been remodeled to increase classroom space. The average classroom student-to-teacher ratio is 11 students per instructor.

The school day begins in homeroom at 8:50 a.m. for students and 7:45 a.m. for teachers, counselors, and administrators. School ends at 3:35 p.m. each day for students. The regular class time is 85 minutes. The school operates on a modified block schedule in which there are several schedules: a regular bell schedule (as shown in Tables 2 and 3), a late arrival bell schedule, and a Wednesday Advisory/Class Meeting schedule.

The regular bell schedule class period times rotate each day for two weeks. To accommodate the school's Catholic traditions of whole-school liturgies and various assemblies, there are morning and afternoon assembly bell schedules.

Seven hundred and ninety five girls were enrolled for the academic year 2002-2003. The ethnic background of the student body reflected 6% Asian American, 2% African American, 10% Hispanic American, 77% European American and 5% other ethnicities. Seventy-six percent of the girls are Catholic and 24% are of other religions. More than 85% of the students who attend this school pay the full tuition of $8,050 with 14% of the students receiving scholarship assistance.

Seventy-five teachers make up the faculty at the private high school academy. Their ethnic composition includes 3 African Americans, 5 Hispanic Americans and 67 European Americans. Fifty-nine of the teachers are female. The private high school academy's college preparatory curriculum includes English, mathematics, social studies, theology, science, foreign language, fine arts, physical education, computer science, health, speech and debate courses. Advanced placement classes are offered in English, mathematics, social studies, computer science, science, foreign language, and fine arts areas. Approximately 45% of the junior and senior girls are enrolled in advanced placement classes based on faculty recommendations. In 2001, 75% of the girls taking the college advanced placement exams scored three or above out of a possible five points.

The school is in its sixth year as a pioneer school in laptop technology for students in the classroom. All students now have personal laptop computers that they can use anywhere, in and out of school.

Table 2

The Private High School Academy's Regular Bell Schedule – Week 1

Week 1					
	Mon.	Tues	Wed.	Thurs	Fri.
8:00-8:45	Dept Meeting	Tutoring	Advisory Day Schedule	Academic Council/ New Teacher Mtgs.	Level Meeting
8:50 – 9:00	Home-room	Home-room		Homeroom	Homeroom
9:05- 10:30	1st Period	5th		8th	3rd
10:35 – 12:35 **LUNCH** A lunch 10:35-11:05 B lunch 11:20-11:50 C lunch 12:05-12:35	2nd	6th		5th	4th
12:40 – 2:05	3rd	7th		6th	1st
2:10 – 3:35	4th	8th		7th	2nd
3:40 – 4:00	Tutoring	Tutoring		Tutoring	Tutoring

Table 3

The Private High School Academy's Regular Bell Schedule – Week 2

Week 2					
	Mon.	**Tues**	**Wed.**	**Thurs**	**Fri.**
8:00-8:45	Dept Meeting	Tutoring	Class Meeting Schedule	Tutoring	Level Meeting
8:50 – 9:00	Home-room	Home-room		Homeroom	Homeroom
9:05- 10:30	7th Period	2nd		1st	5th
10:35 – 12:35 **LUNCH** A lunch 10:35-11:05 B lunch 11:20-11:50 C lunch 12:05-12:35	8th	3rd		2nd	6th
12:40 – 2:05	5th	4th		3rd	7th
2:10 – 3:35	6th	1st		4th	8th
3:40 – 4:00	Tutoring	Tutoring		Tutoring	Tutoring

Each year incoming freshman students purchase a new laptop package that includes a Toshiba laptop model featuring up-to-date processor, hard drive, cd-rom (compact disk – read only memory), and dvd (digital video disc) capabilities. The laptop is preloaded with Microsoft Windows and Office XP Professional software. Also, each laptop comes with a four-year system guard warranty, a four-year on-site maintenance plan, wireless networking on the school campus, access to "hot spare" laptops for temporary use, and a laptop carrying case. The 2002-2003 laptop cost per freshman girl amounted to $2,810. The school has a computer lab of 16networked computers in the computer science department and 10 networked computers in the library.

Since the inception of the laptop program at this private academy school, training teachers in the use and application of computers in the classroom has been a major staff development component to ensure application of computers throughout the curriculum. The formal teacher technologist for this school served as the key informant as to how this teacher training has developed and how laptops are currently being used in the classrooms from her perspective. The informal teacher technologists provided a current account as to how the use of technology in this program is working from their perspectives.

Participants

Ten participants engaged in this exploration of the role of the teacher technologist. Each of them willingly cooperated and provided a reflection of themselves and their position in regard to what is currently happening relative to the integration and use of computers in their classrooms. Each participant is identified in this study by a pseudonym as shown in the demographics chart in Table 4. Each of the pseudonyms used in this study to identify the participants was provided by the participants. The ethnicity and gender of each participant is listed as recorded by each participant in Table 4. The 10 selected teacher technologists taught a variety of subjects. Only one of them taught computer literacy. Seventy percent of the participants held advanced degrees and 70% held membership in professional organizations within their discipline. The teacher technologists in this study taught an average of five 90-minute classes on an alternating block schedule, averaging two to three classes per school day. The number of years of teaching experience spanned from 3 years to 39 years. Participants with the least amount of teaching experience were 7SeatRulz (3 years) and Maria Rodriguez (4 years). Participants 7SeatRulz, Mkad, Sally T. Smith and Genny J. Matt reported 60 to 100 clock hours of technology training in the last three years.

Table 4

Pseudonym/ Formal or Informal Teacher Technologist	Ethnic Origin/ Gender	Degree Level	Subject	Number of Years in Teaching	Number of Clock Technology Training hours in 3 Years	*Professional Organizations Belong to	Number of Conferences Attended in the past three years
Participants from the Public Middle School Academy							
Mkad, Formal	A Male	Masters	Comp. Literacy	39	75-100	TCEA	4
Gdad, Informal	White/ Male	Masters	Algebra/ Math 8	25	10	------------	5
Sophia Loren, Informal	Texan/ Female	Masters	Env. Science	9	12	------------	2
Participants from the Private High School Academy							
Bailey Ma, Formal	-- /Female	Masters	U.S. History	28	100+	NCSS ISTE	5
7Seatrulz, Informal	African Am./ Female	Bachelor	Chem I/ Chem II	3	100+	ACS AICHE NTSA	5
Ara B. Jaamz, Informal	African Am./ Male	Masters	Eng I/ Eng III	9	2	NCTE	1
Sally T. Smith, Informal	Caucasian/ Female	Masters	Design/ Painting/ Digital Art/AP Studio Art	9	90	NAEA TAEA DVAC	3
Genny J. Matt, Informal	White/ Female	Bachelor	Algebra I/Algebra I Honors	20	60+	NCTM NCSM	3
Sam, Informal	Caucasian/ Female	Ph. D.	Biology/ Biology Honors	12	12	CSPI AAAS	3
Maria Rodriguez *Informal*	Latina/ Female	Bachelor	Latin Am Studies/ World History	4	12	NCSS TCSS	3

*Abbreviated Professional Organizations as listed are: NCSS – National Council for the Social Studies; ISTE – International Society for Technology Educators; ACS – American Chemical Society; AICHE – American Institute of Chemical Engineers; NTSA – National Science Teachers Association; National Council for Teachers in English; NAEA - National Art Education Association; TAEA – Texas Art Education Association; DVAC – Dallas Visual Art Center; NCTM – National Council for Teachers in Mathematics; NCSM – National Council of Supervisors in Mathematics; CSPI – Center for Science in the Public Interest; AAAS – American Association for the Advancement of Science; TCSS – Texas Council for the Social Studies; TCEA- Texas Computer Education Association

Research Methods and Procedures for Data Analysis

Using phenomenological research methodology, this study focused on the everyday, classroom experiences of 10 teacher technologists and their perspectives on the use of technology in the teaching and learning environment. The following methods were used to collect data for answering each of the questions guiding this study.

First, to answer the question "What do you see your role as teacher technologist to be?" the researcher interviewed each teacher technologist and asked this question as part of the preliminary interview.

Second, to answer the question "What is a typical school day for you as the teacher technologist?" the researcher observed each of the teacher technologists in the classroom teaching a lesson. The two formal teacher technologists were also observed in a teacher training setting. The formal teacher technologist from the public middle school academy was shadowed for one-half day and was also observed training another teacher one-on-one in his classroom. The formal teacher technologist from the private high school academy was observed training in two teacher training sessions. One of the informal teacher technologists from the private high school academy was observed training in one teacher training session. The researcher recorded on her laptop all of the classroom observations during the observation time. Notes from the observations were used in the analysis of this question. The shadow visits and classroom observations included notes about any events, spurious happenings and information useful for the study. Notes from the teacher training sessions were used in the analysis of this question. Based on the observation data collected, the researcher constructed an analysis of each of the 10 teacher technologists. Each participant was given a copy of the analysis and asked to verify its correctness for course content and classroom dynamics observed by this researcher.

To further flesh out a more representative answer to this question, the researcher asked each teacher to complete an online School Technology and Readiness survey (Appendix A). This survey provided a more realistic picture of the school's environment in the area of hardware and software availability. Whether or not a school has sufficient usable technology is key to the way a teacher technologist uses technology in the classroom.

Third, to answer the question "How do you incorporate technology into your curriculum for you as teacher?" the researcher interviewed each teacher and asked this question as part of the preliminary interview process.

Fourth, to answer the question "How do you incorporate technology into your curriculum for the student?" the researcher interviewed each teacher and asked this question as part of the preliminary interview process.

Fifth, to answer the question "How do you train other teachers?" the researcher interviewed each teacher and asked this question as part of the preliminary interview process.

Sixth, to answer the question "How do you use professional development to incorporate technology into the curriculum?" the researcher interviewed each teacher and asked this question as part of the preliminary interview process.

Last, to answer the question "How does student computer expertise alter the teacher-learner relationship?" the researcher interviewed each teacher and asked this question as part of the preliminary interview process.

This researcher interviewed teachers, observed teachers, collected documentation, and took extensive notes. Several times throughout this study e-mail was used to confirm dates and times for classroom observations. E-mail was used five times to conduct the post-interviews for five of the teacher technologists. The post-interview questions were e-mailed to them, and they responded via e-mail with the results.

The process of data analysis began as soon as the first interview was transcribed. This researcher set up a process whereby as soon as the interviews were complete for a participant, she delivered the tape to the hired transcriber. The transcriber then completed the transcriptions in a very timely fashion. This researcher picked up the transcriptions each week and delivered the next set of tapes. If there was a conflict with the schedule, the transcriber e-mailed the transcriptions to the researcher.

A pilot test of the interview instruments and classroom observation skills was conducted with one of the informal teacher technologists in May 2002. The researcher pilot-tested the grand tour and sub-questions in several interviews with him and also sat in on two of his classes to test out the observation instrument used in this study (Appendix B). The pilot observations helped the researcher to determine where to sit and observe and whether the researcher could observe and type observations using a laptop computer. The pilot study also allowed the researcher to practice skills of observing, listening and recording in a dynamic environment.

A pilot test of the School Technology and Readiness survey was conducted in a doctoral studies class focusing on project-based learning in which this researcher was enrolled. This researcher, along with a team of classmates constructed a paper and cd-rom, “The Real Problem with the Digital Divide,” in which this researcher conducted a mini-study using this instrument to survey four technologists in four schools concerning their views on the use of technology (Cowan, et al., 2000). In this class, three teacher technologists and one Director of Technology from four schools were asked to complete the survey. Each of them viewed it as a useful instrument for developing a comprehensive technology plan for schools. This questionnaire

(Appendix A) has been pilot tested by two teacher technologists from the private school academy and is recommended by the CEO Forum as a tool to determine whether a school is technology-ready in terms of hardware, software, and training (CEO Forum, 2000).

The researcher very easily gained entrance for selecting a formal teacher technologist at the public middle school academy by contacting technology instructional specialists in the urban school district. Each of the specialists is responsible for the teacher technologist program at the high school, middle school or elementary school level. This researcher e-mailed each of them, stating an interest in the present study and asking whether they could supply names, e-mail addresses, and schools of formal teacher technologists whom they considered to be representative teacher technologists.

The urban school district has a formal teacher technologist program in place that is directly operated by the instructional specialists on a day-to-day basis. They train the teacher technologists, order software and hardware, and maintain records of formal teacher technologists who participate in the program each year. Each school year, each campus principal has an opportunity to select a formal teacher technologist and submits that selection to the district instructional specialist. Each of the specialists e-mailed this researcher the names of several formal teacher technologists in the district who are experienced users of classroom technology. One of the middle school formal teacher technologists who surfaced was known to the researcher from past work relations. The researcher contacted this formal teacher technologist and asked him to participate in the study. He agreed and also provided names of four other informal teacher technologists at the school who might participate also. The researcher submitted a letter to that building principal, asking permission to interview, observe, and collect data from the five middle school teacher technologists in the urban school district. The building principal approved the study. At the onset of the study, five of the teacher technologists, one formal teacher technologist and four informal teacher technologists from the public middle school academy agreed to participate. However, only the formal teacher technologist and two informal teacher technologists actually committed to the study from this school. The two participants who decided against participating in the study cited lack of time and too many other duties as their reasons. One of those participants was a department chair and stated that she had too much to do. The other participant stated that she did not have the time to complete the questionnaire.

The researcher also gained entrance into the private school to enlist the other seven teacher technologist participants. The building principal, academic dean, and the director of technology approved the conduct of the study at this campus. Although the school did not have an institutionalized teacher technologist program in place, the school had one appointed formal teacher technologist who was a classroom teacher and also served as the key teacher trainer in classroom technology implementation. She offered technology courses that teachers could attend before or after school throughout the school year. Since this formal teacher technologist worked very closely with other teachers in the building to help them design tailored computer uses for classroom projects, the researcher sought her suggestions for the other six informal teacher technologists for the present study.

Data collection interviews and observations for this study were initially set to occur during four weeks in the months of October and November 2002. However, although all participants were scheduled during this time frame, the observation and interviews of participant Maria Rodriguez were rescheduled for the first week of December because of unforeseen conflicts. At the onset of the study, each teacher technologist was asked to complete the Teacher Technologist Questionnaire (Appendix C). The Teacher Technologist Questionnaire is a modification of a questionnaire used in the Rockman *ET AL* (1998) laptop study. Permission was granted to modify and use the instrument for this study.

The Teacher Technologist Questionnaire elicited background demographic information about the teacher technologists in the first section. The second section included questions pertaining to teaching responsibilities and general practices for using computers, such as number of classes and students, class time length, and the use of computers by the teacher and students. The third section involved the procedural use of computers in the classroom, and section four explored the use of software tools.

Each teacher technologist was also asked to visit the website address http://www.ceoforum.org/starchart.cfm, and click on the K-12 STAR chart link to complete the School Technology and Readiness questionnaire. Each teacher technologist was asked to print out a copy of the results and give them to the researcher during the observation and interview visits. In this study the STAR results were used to explore further the teacher technologists' perspective on the presence of technology on the campus in the areas of hardware and Internet access, software content, professional development, and the integration and use of computers.

Each of the teacher technologists was given a memo (Appendix D) concerning the collection of data for the study along with an attached informed consent form, a link reference to the STAR online questionnaire, an attached copy of the Teacher Technologist Questionnaire (Appendix C). Each teacher technologist was contacted and asked to provide a preliminary interview time of at least 30 to 45 minutes, a pre-observation interview time of at least 15 to 30 minutes, a full classroom teaching observation period (which was 90 minutes for the teacher technologists at the public middle school academy and 85 minutes for the teacher technologists at the private middle school academy); and a post-observation interview time of at least 15 to 30 minutes.

All classroom observations were typed concurrently with the observation times. The researcher keyed in observation notes on her Toshiba Satellite laptop computer, saved all observation files in a *Data Collection* folder on the hard drive, and saved a back-up copy to a floppy disk.

All of the interviews were audiotape-recorded using Sony 60-minute noise reduction cassette tapes. At the onset of this study, this researcher used a borrowed Panasonic voice activated system minicassette recorder RQ-L319. During the course of a preliminary interview with participant Genny J. Matt, the tape recorder stopped working, and another interview time had to be rescheduled. The researcher purchased a Radio Shack voice activation VOX cassette tape recorder to record the remainder of this study's interviews. The following three interview instruments were used to guide the interview process.

1. Preliminary Interview - First Set of Interview Questions for Teacher Technologists (Appendix E). These questions included the grand tour and sub-questions and explored each teacher technologist's experience with computers in the teaching and learning environment.

2. Pre-observation Interview - Second Set of Teacher Technologist Interview Questions (Appendix F). These are questions that were asked prior to an observation time with each teacher technologist. The questions address what a teacher technologist does to prepare the lessons that day: How will the computers be used in the classroom that day? Did she use the computer to prepare the lessons? Will she use the computer to present the lessons?

3. Post-observation Interview -Third Set of Teacher Technologist Interview Questions (Appendix G). These questions were asked at the end of an observation time with each teacher

technologist. The purpose was to find out whether the teacher technologist believed the goals of technology use in the classroom were accomplished according to her plans. Each of the three interview formats above has been adapted with permission from the Rockman *ET AL* (1998) laptop study on the use of laptops in the classroom.

Each formal teacher technologist was observed additionally as he or she trained other teachers. The formal teacher technologist from the public middle school academy was shadowed for half of a day and was observed training another teacher on a one-on-one basis. Several visits were made to the public middle school academy. The formal teacher technologist provided current teacher training logs and training materials. The researcher attended and observed three of the private high school academy formal teacher technologist's one-hour, before-school teacher training classes*: Philosophy of the Laptop program, PowerPoint and Word – Making Comic Strip Style Animations*, and *Web Quest*. Bailey Ma, the private high school formal teacher technologist was observed in the classroom during a 90-minute class. She provided access to the electronic documents used in the teacher training classes and to a technology portfolio document about her use of technology in and out of the classroom.

For participant Sophia Loren at the public middle school academy, the pre-observation interview, the classroom observation, and the post-observation interview were completed on the same day. For Mkad, informal teacher technologist at the public middle school academy, the researcher made three visits: one visit to conduct the preliminary interview and one for the pre-observation interview during the participant's planning time and lunch hour and another visit to observe the participant in the classroom. The post-observation interview questions were e-mailed to this participant.

Table 5

Teacher Technologist Interview and Classroom Observation Schedule

Participant	Interview/Observation Times	Researcher's Time
Bailey Ma	Preliminary Interview – 10/28/02 Pre-observation Interview – 11/01/02 Classroom Observation – 11/14/02 Post-observation interview – 11/14/02	$9^{\text{a.m.}}$ (student holiday) 1^{st} 5^{th} via email
7SeatRulz	Preliminary Interview – 10/24/02 Pre-observation Interview – 10/24/02 Classroom Observation – 10/30/02 Post-observation interview - 11/4/02	8^{th} 8^{th} 7^{th} 7^{th}
Ara B. Jaamz	Preliminary Interview – 11/6,8/02 Pre-observation Interview – 11/6/02 Classroom Observation – 11/7/02 Post-observation interview – 11/8/02	8^{th} 8^{th} 4^{th} 7^{th}
Sally T. Smith	Preliminary Interview – 11/11/02 Pre-observation Interview – 11/13/02 Classroom Observation – 11/14/02 Post-observation interview – 11/14/02	4^{th} 2^{nd} 7^{th} 8^{th}
Genny J. Matt	Preliminary Interview – 10/31/02 Pre-observation Interview – 11/5/02 Classroom Observation – 11/6/02 Post-observation interview – 11/6/02	4^{th} 4^{th} 5^{th} 5^{th}
Sam	Preliminary Interview – 11/25/02 Pre-observation Interview – 11/26/02 Classroom Observation – 11/26/02 Post-observation interview – 11/26/02	7^{th} before school 4^{th} via email
Maria Rodriguez	Preliminary Interview – 12/5/02 Pre-observation Interview – 12/5/02 Classroom Observation – 12/6/02 Post-observation interview – 12/6/02	4^{th} 4^{th} 7^{th} via email
Mkad	Preliminary Interview – 10/30/02 Pre-observation Interview – 10/30/02 Classroom Observations –10/30,11/2/02 Post-observation interview – 11/1/02	$8^{th\ and}$ 5^{th} $8^{th\ and}$ 5^{th} $8^{th\ and}$ 5^{th} $11^{\text{a.m.}}$ (student holiday)
Sophia Loren	Preliminary Interview – 11/8/02 Pre-observation Interview – 11/8/02 Classroom Observation – 11/11/02 Post-observation interview – 11/11/02	$7^{th\ and}$ $8^{th\ periods}$ $7^{th\ and}$ $8^{th\ periods}$ Researcher took day off 11/11/02 Researcher took day off 11/11/02
Gdad	Preliminary Interview – 11/11/02 Pre-observation Interview – 11/18/02 Classroom Observation – 11/18/02 Post-observation interview – 11/18/02	Researcher took day off 11/11/02 Researcher's school on special schedule – morning off11/18/03 e-mailed questions, no reply

Both Sophia Loren and Mkad from the public middle school provided classroom materials documents and website links to electronic materials used in the classroom.

At both schools, the researcher coordinated interview and class observation times with the 10 teacher technologists as shown in Table 5. Each of the participant's interviews was scheduled during the researcher's and participant's school planning times. Each of the participant's classroom observations was scheduled during a time when the researcher did not teach a class. Classroom visits were made at the beginning of class time, and the researcher stayed for the duration of the class period until the teacher technologist signaled to the class that class had ended.

Methods for Verification

This study addresses the issue of internal validity through the process of triangulation. Several methods have been used to gather the data: observation, interviews, and questionnaires. In addition extensive documentation of the process of this study since its inception has been recorded in the form of field notes, both handwritten and electronic, and the documented material has been dated. Using several methods of data collection allowed corroborative evidence to surface (Gall, et al, 1996). The researcher then looked at the patterns that surfaced in the data and compared those findings with existing themes in the literature.

This study addresses the issue of external validity through the process of reviewing other studies on the use of technology by both formal and informal teacher technologists in the light of four instructional areas: teacher as guide, student as expert; constructivist learning; technology availability; professional development and teacher training; and examines how technology is used in this study in the light of the existing research.

The researcher has also collected documentation about the role of the teacher technologist and current use of computers in the classroom. For example, at the private high school academy each teacher was expected to build a technology portfolio highlighting technology training taken to increase technical proficiency and the integration of technology into the curriculum. The technology portfolio documents collected from each of the teacher technologists have been analyzed to provide information about the current use of technology in the classroom. Documents validating technology course offerings have been collected from both schools. Also, signed documents validating teacher attendance at several technology training sessions offered by the formal teacher technologists in each of the schools have been collected and studied.

The Teacher Technologist Questionnaire and interview instruments used in this study borrowed questions from the Rockman *ET AL* (1998) study on laptop technology with permission. Only the qualitative investigative questions were used to further this study's investigation. These instruments, along with the School Technology and Readiness on-line questionnaire (STAR), were pilot-tested before using in this study. The School Technology and Readiness on-line questionnaire is a self-assessment tool developed in 1996 and validated by the CEO Forum, a collection of CEOs, executive directors, and general managers in the education and computer industry representing Dell, IBM, Apple, America Online, the National Education Association, and the National School Board Association. The STAR questionnaire was used in this study to assess the technology integration level of the schools from teacher technologists' perspective.

In conclusion, this study explored the role of the formal and informal teacher technologist using a phenomenological research design. This design best allows for a thorough exploration of the use of computers in the classroom by teacher technologists. Data analysis using the process of phenomenological reduction provided insight into the every day uses of technology and the role the teacher technologist.

CHAPTER IV

RESULTS AND DISCUSSION OF FINDINGS

The data analysis in this chapter responds to each of the research questions guiding this study:

1. What do you see your role as teacher technologist to be?
2. What is a typical school day for you as the teacher technologist?
3. How do you incorporate technology into your curriculum as teacher?
4. How do you incorporate technology into your curriculum for the student?
5. How do you train other teachers?
6. How do you use professional development to incorporate technology into the curriculum?
7. How does student computer expertise alter the teacher-learner relationship?

For research questions 1, 3, 4, 5, 6 and 7, the process of phenomenological reduction is applied. Each of those questions was analyzed providing individual textural and structural descriptions as well as composite textural and structural descriptions. For research question 2, observation notes to describe a typical day for the teacher technologist at the school were analyzed along with an analysis of the School Technology and Readiness questionnaire results. A synthesis of findings and discussion of each question is provided based on classroom and training observations, viewing the documents and the 10 teacher technologists' responses to the research questions. Last, a chapter summary is provided.

Research Question 1: What do you see your role as teacher technologist to be?

Analyses of participant responses for research question one are organized as follows: private high school academy – Bailey Ma, 7SeatRulz, Genny J. Matt, Ara B. Jaamz, Sally T. Smith, and Maria Rodriguez, Sam; public middle school academy – Mkad, Gdad, and Sophia Loren.

Individual Textural Analyses on the Role of the Teacher Technologist

Bailey Ma *(Bailey Ma, identified herself as a female formal teacher technologist at the private middle school academy. She has been teaching 28 years. She has a master's degree and teaches U. S. History. Bailey Ma has had more than 100 clock hours of technology training in the past three years. Bailey Ma belongs to two professional organizations and has attended five conferences in the past three years.)*

> Just like I do with my students, my role is to be a guide on the side. I'm always trying to come up with some ideas and solicit concepts from the teachers. I ask, 'What is it that you want me to be able to help you do?' I meet with teachers. I glance at and listen to what they are doing. I talk to them about it and ask what they are offering. I'll offer different classes based on what I get as feedback. But sometimes I do not. Someone wanted to do video feed editing. Although it's a fun thing to do I wondered when they would use video editing in the classroom. It's a nice thing, but I don't think we will be using a lot of video editing.
>
> The other thing is that I ask 'What are you going to do to get those kids involved?' In most of my classes for teachers I teach basic PowerPoint and then say that it is something that they could challenge their kids to do. For example, I teach animation and then ask 'How would you create a project where your kids could animate?' I do one

about my dog Bailey going to the beach. Big deal. And I could make a child's book out of that. But what would be better is if I took that and translated it into what one of my students did. I stole the idea from one of my students. She did a storybook about being General Grant's horse wandering around a camp during the Civil War, and it was a demonstration of how soldiers lived. And there is the lesson that she did through the mechanism of PowerPoint.

So I'm trying to get teachers to think that way, to be able to say 'You don't have to be the 100% super PowerPoint guy or Word guy' but basically you think of good learning strategies where technology can enhance what you do. They say, 'I can't do all this and do technology too.' Well they shouldn't. The technology should be a vehicle for the curriculum. If it's not, then it's a waste of time. I mean it's just doing cute bells and whistles and cute Power Points of little dogs romping on the beach. Well who cares? How often and what percent of teachers actually go back and incorporate that? It's hard to say. I've asked people to e-mail me about how it came out. I think what happens around here is that they get pulled in so many different directions to do so many things. My biggest problem is that I don't know if we are getting adequate support from on high. Whenever I have a lesson, I ask teachers to please show me some examples of student work. And some have. Percentage wise, I would say 10%. I would love to say more than that are actually trying. There are a lot of people who will pay me lip service and say things, but when they really get out there, many of them turn it into a lecture tool. But then again, we have teachers that have not been taught to be teachers. We have a lot of people coming from business. They think it's a great way to be able to get home at 3:15 every day. They have been encouraged to think that way. What do you do? There are a lot of things that you are up against the wall on. I know they try real hard, but one of the things that is really hard for me is that they expect technology to come in a nice package where they don't have to do much. My role is not to be the provider of all pieces of junk that you need, but to teach you how to fish instead of handing you the fish. They don't think they have time to learn how to fish right now. I don't think they take time to think it through. I don't just think up these little projects in my class. During the summer I drive around and I write down ideas.

A lot of folks think that delivery of the lesson is the most important thing, so if I can just get that lecture out then they've got it. The kids have to get in there and get their hands dirty on the information, just like any of us. If we are going to do something, we have to get in there and get our hands dirty and do it. We have a lot of lecture people here. That's the way they learned in college. I hear people say 'I'm so glad to be in the classroom now instead of in the business world so I can lecture.' And I think, 'So your students can all be bored.'

Today has been everything from trying to repair a scanner to working with a teacher on how to do copies on the copy machine. I signed people up for classes. Reminding them, for example, this afternoon I'm doing a class on Philosophy of Laptop. That will be a discussion, and maybe a couple more people will understand why we do what we do in laptops. We offer those classes free of charge. We offer them in the mornings. Once or twice a week I do a 7:40-8:40 class. Once a week I do an afternoon 4:00-5:00 class. I also have to prep for those classes and find the materials for those teachers, create something and get it posted. I hear 'I can't print; I need this; I need to get this loaded; I can't figure out why my Auto-grade isn't working; my classes have disappeared; can you help me find this; I can't get the test bank to come on.'

In technology, we just say that we 'multi-task.' If I'm really working on something, I focus in, and it's very hard for me to stop. And that's been one of the hardest things I've had to learn to do, is to be able to just draw a line on something, stop, go take care of something somebody needs. You have somebody like one of the technology assistants who is out there chasing me for ink cartridges. Or trying to figure out why logging in won't work. A lot of the things that I want to be able to do, looking at incorporating technology, those are what I try to run the formal classes on.

I help one of the other technical support staff with technology problems. She'll come in and she'll send me an e-mail and go 'Do you have any idea how to do this?' Her e-mail comes, and then she walks across the hall to see if there is an answer. Sometimes she'll come in and say, 'I don't know what this is.' We'll sit there and try and hammer out a solution to a problem.

Then you get the phone calls. I also take care of the insurance issues on laptops. So I get parent phone calls about 'My daughter said she didn't break her screen, but then the guy said that the screen is broken. I'm not going to pay the deductible, and what are you going to do about it, and if you try and sue me, then…' I said, 'I'm not going to sue you, but this is the way that the policy is and this is what we do, and I'm terribly sorry your daughter's laptop screen is broken, but I didn't break it either.'

Administratively, I get 'we can't get our calendar working. We need to get the mail out.' My main thing is working with teachers, but there are times that somebody has got to go over there and show them how to use their projection device so that they can have their Board meeting, and that kind of thing.

7SeatRulz *(7SeatRulz identified herself as an African American informal teacher technologist. She has been teaching for three years. She has a bachelor's degree and teaches Chemistry I and Chemistry II courses at the private high school academy. 7SeatRulz has had more than 100 clock hours of technology training in the past three years. 7SeatRulz belongs to four professional organizations and has attended five conferences in the past three years.)*

> One role is to teach other teachers what I'm doing and have them understand what I'm doing in my class. For the teachers who do not use the technology that I have, my role is to teach them how it could be used in their classes. I try and help them to see the benefits. I make myself available if they want to learn to do that; they can come find me and ask me questions. I gave copies of the computer programs to the different teachers. I let the teachers play with the computer programs.
>
> And also with respect to the students, getting them to know how to have a basic understanding of these programs, how to use them so that this way when they go to college or when they go to other classes they can figure out a way to use those programs in those classes. Some of the programs that we use are mainly Chemistry programs but others can be used for other science, math disciplines, for any discipline.

Genny J. Matt *(Genny J. Matt identified herself as a white female informal teacher technologist at the private high school academy. She has been teaching 20 years. She has had over sixty clock hours of technology training in the past three years. She has a bachelor's degree and teaches Algebra I and Algebra I Honors courses. Genny J. Matt belongs to two professional math organizations and has attended three conferences in the past three years.)*

My number one goal is that I can use technology seamlessly, in that it is not any big deal for a student to open up their computer laptop as a notebook as it is to open up their notebook, where technology can be a seamless part of the classroom just like a notebook and it's not a big deal. The students can use whatever tool is the best tool to do the job that they want done and to give them the skills to do that.

I think the big thing is to share. We are notorious for sharing and those kinds of things, and if I find something that really works, then I do my best to make sure that other teachers are aware that this is a tool that can be used and how it relates to what we are trying to do. I would hope that I could also use other teachers as a resource to help me in the same way.

When I walk into the building in the morning, one of the first things I do is log on to my computer and check my e-mail and respond if I have time. I will also then pull up my lesson plan for the day and see if I need to print anything off or get anything copied. I usually do that a day in advance or two days in advance, but I would be working on that for the next day. I usually get things ready for the day. I'll try to identify what tools we are going to use for that day. Am I going to use the graphing calculator and the overhead? Is it work done on the board? Is it going to be something done with the computer? I make sure those materials are there and ready to go. I make sure everything is hooked up and things are ready to go for that day. If I'm using the television projection device, I'll make sure that's all set up. In my room the equipment is there, but I just need to make sure that it's set the way it needs to be set. Like today when I walked in, I wasn't able to use my desktop computer for what I was going to do, so I had my laptop and I connected it to the television. I have an older laptop. It does not have a big memory in it like the new ones do, but it's very functional. I use it quite a bit. I use it at home if I need to do something at home.

When I present my lesson, I'm usually trying to change from one mode to another mode to another mode; we may do problems on the board and then when we do something with the calculator I'll move to that, and then sometimes we'll do something with the laptop. And we're moving from one thing to another to another.

Ara B. Jaamz *(Ara B. Jaamz identified himself as an African American male informal teacher technologist at the private high school academy. He has been teaching for nine years. He has a master's degree and teaches freshmen English I and junior English III courses. He has had two clock hours of technology training in the past three years. Ara B. Jaamz belongs to one professional organization and has attended one conference in the past three years.)*

A good teacher technologist is flexible because technology doesn't always work. And because it doesn't always work, you have to anticipate what you do if it doesn't work. I mean if you get to the class and there's no electricity, what are you going to do? Not teach class? No. You have to be able to turn whatever you were going to do electronically into something that's physical, tangible, and palpable. So preparation time is really important.

You have to kind of know what you're talking about. I mean even though the students have XP now, I have a good idea of what program to use to get a certain thing done. I have a good idea of where you might want to go to fix something that might be wrong. My students know I know so they don't try anything funny. And they know I know what the task bar is and what auto hide is. And since they understand that I have knowledge of that, they usually behave when it comes to goofing off, not being on task. I told them one day that I wanted them to fix things that automatically start when they boot up. Knowing what you're talking about makes you good. It kind of earns their respect.

At the freshmen level, it's to get them over the novelty stage to get them to use their computer as electronic paper rather then this sort of indescribable, intangible toy. It's to help them become better technology users. A teacher technologist helps students understand that technology is a tool and not a toy. It's a good toy too now, no question. You have to teach freshmen the way it's done. 'Can we take notes on our computer?' 'No, because I really want you to be inside the book today. The only thing I want you to have is a book and a pencil. We have to do some things the old fashioned way.'

And so a lot of times we don't use the computer. And when we do use it, I need it to be efficient. Taking your computer out can't take 25 minutes. "Get it out quickly, boot it up, and be ready." If I can help freshmen become more serious about academics when it comes to the computer, I feel like I am doing my job now.

Sally T. Smith *(Sally T. Smith identified herself as a Caucasian female informal teacher technologist at the private high school academy. She has a master's degree and teaches Design, Painting, Digital Art and AP Studio Art courses. She has had 90 clock hours of technology training in the last three years. Sally T. Smith belongs to three professional organizations and has attended three conferences in the past three years.)*

I think a good teacher technologist is someone who, at least is a facilitator. I don't necessarily have all of the information, but I can certainly give what knowledge I have of technology and maybe trigger other ideas or thoughts or tools. I feel like a facilitator more than a teacher because often these students are even ahead of me.

I can just give them a different perspective maybe or a different point of reference.

I can open doors for the girls, but I don't feel that I have enough technical skill that I could consider myself by any means a formal technologist. Technology just happens too fast. There's too much new stuff and these girls are sharp and on top of it.

Maria Rodriguez *(Maria Rodriguez identified herself as a Latina female informal teacher technologist at the private high school academy. She has a bachelor's degree with 18 hours toward a Masters degree and has been teaching for four years. She has had 12 clock hours of technology training in the past three years. She teaches Latin American Studies and World History. Maria Rodriguez belongs to two professional organizations and has attended three conferences in the past three years.)*

I think it is someone who keeps trying to learn to find out more and more effective ways to incorporate technology into the content area. Someone who is willing to ask for help. The role of the teacher technologist involves someone who is willing to learn from the students.

My role is to engage the students using whatever technology tools I can. I've tried to train them the minute they come in to turn their laptops on and get started. But they gotta plug in and they gotta start up and somebody's got a problem and there's some noise…it's a whole process. So there's the whole startup process. Then it's the 'I can't find this and I can't find that.' And then somebody breaks down and they have to interrupt the whole class to let everybody know that their computer is…so I think that overall I'm loosing, like I said earlier, five to ten minutes a class on computer problems. But you know what? They are teenagers, so this has just become another way for them to distract us. It's really not the computer's fault. It's the kids we are with. It's something else. I think sometimes we forget developmentally where these kids are, you know? They are supposed to get us off track. It's their job.

The truth of the matter is that we need more technology personnel. I ended up speaking to several other people who have laptop schools or who are on their way to having it. Well too late for that. The next thing is that they have a person who is solely dedicated to not just what our formal teacher technologist does with the classes, but solely dedicated to facilitating faculty use of the web, who is doing either research for them, helping them out, helping them set up web sites, all of those kinds of things…somebody who is dealing specifically all the time with our concerns, and is helping us not just with the problems, but also with the improvements. I want somebody who is going to take me to the next level, who is working with me to improve and take my class to the next technology incorporation. It's more of like an advisor almost. Like this one school has this guy and that's his whole job. He's like their web master. He just works with the teachers on creating their web sites, but also projects and how to incorporate them on to the web and all of these fabulous things.

<u>Sam</u> *(Sam identified herself as a Caucasian female informal teacher technologist at the private high school academy. She has a Ph.D. and teaches Biology and Biology Honors courses. She has had 12 clock hours of technology training in the past three years. Sam belongs to two professional organizations and has attended three conferences in the past three years.)*

The teacher technologist is someone who uses it appropriately as a tool and not an end-all, be-all. Someone who picks the projects that will involve and engage the students in the process. Someone who has everything work, who is not always the teacher. It is totally and completely dependent upon support because if I cannot get this supported I cannot get any other teacher to use it. Offer support meaning tech support, both in the hardware and in the technical day-to-day tools that are required to do what needs to be done. Without knowing their business, I don't know what the problem is. It could start with just telling me what the problem is and communicating. I don't expect someone to be in two places at one time, but when I start from the get-go and ask, 'Is this feasible and if I try to implement it, will there be support?' And I'm told yes and then there's not…

<u>Mkad</u> *(Mkad identified himself as a male formal teacher technologist at the public middle school academy. He has a master's degree and has been teaching for 39 years. Mkad teaches Computer Literacy and has had 100 clock hours of technology training in the past three years. Mkad belongs to one computer professional organization and has attended four conferences in the past three years.)*

My role as teacher technologist is to know everything. I'm expected to know everything about computers. And they get very upset if I don't know. In a small school, it's fine, but if there are more than twenty kids in the classroom, it's just too much and then it should totally be teacher tech. I listen to the teacher cry because she forgot to turn the computer on and can't work. Or I have to go there and help her print out grades that are due right now. Look like a miracle worker. All I did was common normal everyday things. Today in second hour, I have been interrupted in my classroom five times by other teachers. Problems like 'the computer won't print.' Little things. Some are really technical, like 'How do I make the columns when I'm typing?' So I have to have a visual in my mind when I start saying 'click here, click here, and this is what you'll see.' I can tell you what you see on the screen without looking. I've done it so many times for so many years that it has become natural.

Teachers come into my classroom and sit down on the computer and show me. It doesn't interrupt the teaching. The flow keeps right on going. I spend 25% of my time helping teachers and administrators and 75% of my time with students. If I can't give them an immediate answer, I just tell them that they will have to wait until I'm finished with what I'm doing. If I'm making a presentation to students in class and I want to make a point, I may say 'I'll be done in a minute' and I may say 'I'll be there in five minutes' or I may tell them on the phone what to do. With small classes, I can move in and out and the kids won't even know that I'm gone. I'll come back and they are still working and no one is playing around and they don't even know that I went out the door.

Students meet me at the metal detectors when I come in the mornings. They are already asking if I'm going to be coming into the lab. They are asking me for lunch passes and enrichment passes, which I don't give out until a certain time, during my second hour just before lunch. The computer lab is pretty much in demand every day. Sometimes a teacher brings their whole class, too, when I'm having class so I may be at one side of the room teaching and they are on the other side doing their work. There is only one little rule. You bother me and the whole class has to go. And it has only happened once in three years.

My first hour of the day is my technical hour. Whatever I do as a tech I'm supposed to do then, but it doesn't work that way. It doesn't happen until afterwards.

I have reports that I have to send downtown. I check my e-mail and see what they want me to do. If someone wants something done, they say 'drop by, I can't do something' or 'show me this, show me that.' I just go into their classrooms, and if they don't want me there I'm not coming back. It's 'take me when I'm there or else' because I don't come back. Sometimes I actually show the whole class how to do something on their computer in the classroom. It's little mini-showings, little in-class showings.

<u>Gdad</u> *(Gdad identified himself as a white male informal teacher technologist at the public middle school academy. He teaches Algebra and eighth grade Math classes. He has a master's degree and has been teaching for 25 years. He has had 10 clock hours of technology training in the past three years. Gdad does not belong to a professional organization and has attended five conferences in the past three years.)*

I see my role as teacher technologist to just to keep up with the technology.

Stay abreast of what's offered. Knowledge. Experience. I currently use technology to help students understand math concepts.

<u>Sophia Loren</u> *(Sophia Loren identified herself as a Texan, female informal teacher technologist. She teaches Environmental Science at the public middle school academy. She has a master's degree and has been teaching for nine years. She has had 12 clock hours of technology training in the past three years. Sophia Loren does not belong to a professional organization and has attended two conferences in the past three years.)*

I see the role of teacher technologist as one that makes other teachers feel welcome in the computer lab. So many computer tech people are people who are computer savvy, and look down their noses at others and they are cold. The abruptness I've experienced from people, you know, 'I've already explained this to you twice, Mrs. Sophia Loren,' that type of thing.

Our formal teacher technologist here is just so generous with his time. He is generous with his computers. He is generous with the equipment. He understands that the computers belong to the district and not to him.

I want the children to feel comfortable with using technology. I don't want the students to be fearful of the computers. The people in my age group are afraid of it.

They're afraid of breaking it. They're afraid of getting a virus. They're afraid of doing something wrong. They're afraid of making the teacher technologist mad, you know all the things that go along with something that you don't feel comfortable with. But I think these children feel very comfortable with using it.

Composite Textural Analysis on the Role of the Teacher Technologist

Both formal and informal teacher technologists presented the role of the teacher technologist as one who shares time, expertise and resources with other teacher technologists and students.

A teacher technologist is one who is generous with time and equipment.'

A teacher technologist "stole" an idea from one of her students to use in teaching animation techniques in Power Point to other teachers. A teacher technologist gives "copies of a computer program to different teachers." She makes herself "available if they want to learn to do that" and "they can come find me and ask questions."

"We are notorious for sharing and those kinds of things, and if I find something that really works then I do my best to make sure that other teachers are aware that this is a tool that can be used and how it relates to what we are trying to do." A teacher technologist shared his classroom Computer Literacy lab space with another teacher's class: "…so I may be at one side of the room teaching and they are on the other side doing their work." "I see the role of the teacher technologist as one that makes other teachers feel welcome in the computer lab."

Another role of the teacher technologist was to be prepared to do both teacher technology training and technology in the classroom.

A teacher technologist's role is to "prep for training classes" and "find the materials for those teachers, create something and get it posted." A teacher technologist is "someone who picks the projects that will involve the students. Someone who has everything work, who is not always the teacher."

Teacher technologists in the classroom need to check technology equipment to see whether its working properly and "identify what tools will be used that day."

"I pull up my lesson plan for the day and see if I need to print anything off or get anything copied. I usually do that a day or two in advance. I make sure everything is hooked up and things are ready to go for that day." " I go around and load software and fix computers." "You have to be able to turn whatever you were going to do electronically into something that is physical. Preparation time is really important."

The role of the teacher technologist has been defined by participants to be one who facilitates learning.

"Just like I do with my students, my role is to be a guide on the side. I'm always trying to come up with some ideas and solicit concepts from the teachers." "I think a good teacher technologist is someone who, at least is a facilitator, because often these students are even ahead of me." "I can just give them a different perspective maybe or a different point of reference." The teacher technologist is "someone who engages the students in the process." "My role is to engage the students using whatever technology tools I can. Teachers come into my classroom and sit down on the computer and show me." One teacher technologist described his role as facilitator as being fluid, being able to move from his classroom of students to helping teachers in their classrooms: " the flow keeps right on going. I can move in and out and the kids won't even know that I'm gone. I'll come back and they are still working."

Individual Structural Analyses on the Role of the Teacher Technologist

Using the process of imaginative variation, accounting for each participant's story of their experience as a formal or informal teacher technologist, this researcher constructed an individual structural analysis for each participant's perspectives about their role as an informal or a formal teacher technologist.

Bailey Ma

Bailey Ma's structures surrounding the role of the formal teacher technologist are expressed as the fast-lane problem solver of technical challenges teachers experience each day, managing the skill of multi-tasking, offering training in the use of technology as a facilitative tool in the classroom, and promoting teachers as facilitators of learning rather than lecturers.

As the fast-lane problem solver of technical challenges, Bailey Ma experienced being called upon by fellow teachers and other technicians. She had to offer a quick solution for a scanner in need of repair. She also had to assist teachers who wanted her to do the actual work of searching for curriculum on the Internet. She worked with other technicians, helping them to "hammer out a solution to a problem." She was "on-call" for administrative meetings, assisting with setting up the technology or trouble-shooting technical problems experienced at a Board Meeting.

Bailey Ma expressed the challenge of multi-tasking. She saw one of the roles of the formal teacher technologist as being able to prioritize tasks that demand "right-now" solutions.

She described a typical day as sitting down at her desk to plan for technology training classes, only to be interrupted by teachers and staff asking for immediate technical assistance.

Offering technology training to teachers for the use of technology in the classroom as a facilitative tool was an underlying structure in the role of the formal teacher technologist, as articulated by Bailey Ma. Bailey Ma wanted each teacher to grasp the idea that technology is a "vehicle for the curriculum." That is, teachers should engage in reflective thinking on how a technology tool can be used to promote learning in the classroom. Bailey Ma expressed that her role as formal teacher technologist is "just like I do with my students, my role is to be a guide on the side. I'm always trying to come up with some ideas and solicit concepts from the teachers. I ask, 'What is it that you want me to be able to help you do?' I meet with teachers. I glance at and listen to what they are doing. I talk to them about it and ask what they are offering. I'll offer different classes based on what I get as feedback. But sometimes I do not."

Bailey Ma's role as formal teacher technologist is to promote the use of technology for facilitative teaching and learning. Teachers who only use technology for PowerPoint lectures are boring the students even with the technology. Her role as formal teacher technologist was to assist teachers with uses of technology in the classroom that involve greater student hands-on participation and use of technology for learning.

<u>7SeatRulz</u>

7SeatRulz's structures underlying her role as informal teacher technologist included participation in training other teachers on the use of technology in the classroom, interdisciplinary collaboration with peer teachers, flexibility in communicating with other teachers on the use of technology in the classroom, taking the time to allow teachers to explore the uses of technology in the classroom, and teaching students how to incorporate technology into learning.

7SeatRulz expressed that one of her roles, as informal teacher technologist was to work with training other teachers on how to use particular software in their classrooms. Her especial interest was in sharing with teachers the uses of the STELLA software package. STELLA is a dynamic tool used to allow students to construct knowledge and understanding units in any discipline.

7SeatRulz's role as informal teacher technologist was a collaborator with other teachers, along with taking the time to engage in this process. Teachers were free to come to her with questions and ideas. She distributed copies of the STELLA software and engaged teachers in seeing the benefits of using it in their classrooms. She collaborated with a math teacher; each of them has used the software in their classrooms and discussed with each other their experiences with using the software.

7SeatRulz expressed her role as informal teacher technologist as helping students become familiar with software. Students become confident users of technology when they use technology across the disciplines. They benefit when the software is used in a variety of classroom environments, reinforcing their technology skills so "when they go to college or they go to other classes, they can figure out a way to use those programs in those classes."

Genny J. Matt

Genny J. Matt's underlying structures delineating the role of the informal teacher technologist included making the use of technology in the classroom seamless, sharing technical resources with other teachers and making sure the technology tool used in the classroom is working properly and ready to use.

Genny J. Matt's number one goal as a teacher technologist was to use technology seamlessly in the classroom. As she stated, "It should not be any big deal for a student to open up their computer laptop, the same as they open up their notebook." She saw the role of the teacher technologist as being able to determine which technology tool is the best one to use to solve the problems. She saw the teacher technologist as one who presents lessons in several different modes, going from one mode to the other with ease: using the graphing calculator and its projection device, using the laptop computer to project a lesson on the television screen, and using the whiteboard to further expound on solutions.

Genny J. Matt expressed that the role of the teacher technologist is to share resources. When a teacher technologist discovers "something that really works" then it should be the job of the teacher technologist to make sure other teachers are aware of the tool and its usefulness. Other teachers should be given the opportunity to see how it relates to what is being taught in the classroom. She shared that this exchange is two-way. She saw herself as sharing her technical expertise with teachers and expects them to help her in the same way.

Another underlying structure of the role of the teacher technologist was to make sure the technology tools used in the classroom are working properly and ready to use. Genny J. Matt sees the role of the teacher technologist as being prepared. She expressed that she identifies the technology tools she will be using in her classes the day before. The day of those classes, she then makes sure those materials are there, hooked up and ready to use.

Ara B. Jaamz

Ara B. Jaamz's major underlying structures for the role of teacher technologist were to be knowledgeable and help students understand how to use technology as a tool in the classroom.

Ara B. Jaamz articulated, “You have to kind of know what you’re talking about. I mean even though the students have Microsoft Windows XP now, I have a good idea of what program to use to get a certain thing done. I have a good idea of where you might want to go to fix something that might go wrong.”

A teacher technologist should be able to help students use the technology to get the lesson done with as few interruptions as possible. Ara B. Jaamz expressed that students are less likely to “try anything funny” if a teacher technologist is knowledgeable of what Microsoft Window’s desktop auto-hide feature on the taskbar does. A student could use this feature to hide programs that are open on her computer which may not be useful for the lesson, such as having AOL’s Instant Messenger chat program running during class time. A student would be less likely to be off-task when using the computer in the classroom when the teacher technologist is aware of how students may use such features of the computer environment.

Sally T. Smith

Sally T. Smith’s role as teacher technologist was to be a facilitator to students. She especially emphasized the necessity to offer a different perspective or ‘point of reference’ to students, but also stressed that she does not have to know everything to offer them an opportunity to use the technology. She expressed that she encourages students to explore ideas. She shared that she can certainly give what knowledge she has of technology and “maybe trigger other ideas or thoughts or tools.”

Maria Rodriguez

Maria Rodriguez expressed the role of teacher technologist as the engagement in continuous learning, and being able to help students to appropriately use technology in the classroom.

Maria Rodriguez's role as teacher technologist involved being open to new ideas and techniques for using technology in the classroom. She expressed that a teacher technologist should be willing to learn from others as well as to train others. The teacher technologist should be willing to ask for help as well as be willing to receive help from students.

The role of the teacher technologist should involve helping students use technology appropriately in the classroom. Students should be trained the "minute they come into the classroom, to turn on their laptops and get started." Maria Rodriguez expressed that the computer "startup" procedure in the classroom needs to be clarified. Students need clear instructions on how they will be expected to start their laptops in the classroom. Maria Rodriguez talked about the constant interruptions due to the computer start up process: "somebody's breaks and they have to interrupt the whole class to let everybody know that their computer is not working properly. I'm loosing five to ten minutes a class on computer problems."

Sam

Sam's role as teacher technologist consisted of someone who chooses appropriate technology-based curriculum projects, offers teachers both hardware and software support, and communicates effectively with teachers.

Sam articulated, "the teacher technologist is someone who uses it appropriately as a tool and not an end-all, be-all. Someone who picks the projects that will involve and engage the students in the process." She expressed that the teacher technologist should be able to flesh out problems and "have everything work." However, the teacher technologist does not necessarily have to be a teacher.

Sam talked about the need for the teacher technologist be supportive in both hardware and software tools. The teacher technologist must be able to articulate what is required to get a technology project completed. She especially expressed the need for such support on a daily basis.

The teacher technologist should be willing to communicate with others when there is a problem that requires more research or knowledge before being able to offer solutions. "Without knowing their business, I don't know what the problem is. It could start with just telling me what the problem is and communicating. I don't expect someone to be in two places at one time, but when I start from the get-go and ask, 'Is this feasible and if I try to implement it will there be support?' And I'm told yes and then there's not…"

Mkad

Mkad expressed his role as teacher technologist as being knowledgeable of both computer hardware and software, being available to teachers at any time during school hours, and allowing students to use the computers in the lab as much as possible.

Mkad expressed, "My role as teacher technologist is to know everything. I'm expected to know everything about computers. And they get very upset if I don't know."

His role as the teacher technologist was being able to troubleshoot hardware problems, such as problems with the printer. He expressed having to show teachers "how to make columns" when they are typing. Mkad expressed, "So I have to have a visual in my mind when I start saying 'click here, click here, and this is what you'll see.' I can tell you what you see on the screen without looking. I've done it so many times for so many years that it has become natural."

Mkad's role as formal teacher technologist means he had to be at the "beck and call" of both teachers and administrators for technology assistance. He expressed that because the school is small, he can be flexible going in and out of the classrooms to work with teachers. Teachers came to his classroom and got help or he went their classrooms. “Today in second hour, I have been interrupted in my classroom five times by other teachers. Problems like ‘the computer won’t print.’ Little things.”

Mkad’s role as teacher technologist was someone who allows students as much access as possible to the computers in the computer literacy lab. Students were able to get lunch and enrichment passes from him each day, guaranteeing them a seat. Mkad expressed that his role is to allow students the computer time to work on class-assigned projects. He also allowed teachers to bring their classes to the computer lab. Teachers must be able to come in with their classes, without interrupting his computer literacy classes: “The computer lab is pretty much in demand every day. Sometimes a teacher brings their whole class too when I’m having class so I may be at one side of the room teaching and they are on the other side doing their work. There is only one little rule. You bother me and the whole class has to go. And it has only happened once in three years.”

Gdad

Gdad’s role as teacher technologist meant he had to keep up with the technology. He expressed exercising this role by searching the Internet for math curriculum supplements in his Algebra class and for other math teachers.

He also shared that his role as teacher technologist included using technology to help students understand math concepts. He searched the Internet for handouts that could be downloaded and printed for students.

He expressed that the teacher technologist should be knowledgeable of how technology can be used in the classroom.

The teacher technologist should gain experience in using technology in the classroom.

Sophia Loren

Sophia Loren expressed the role of the teacher technologist as one who has compassion for teachers in the adoption phase of learning how to use technology, being flexible, and one that makes other teachers feel welcome in the computer lab. “So many computer tech people are people who are computer savvy, and look down their noses at others and they are cold. The abruptness I’ve experienced from people, you know, ‘I’ve already explained this to you twice, Mrs. Sophia Loren,’ that type of thing.”

“Our formal teacher technologist here is just so generous with his time. He is generous with his computers. He is generous with the equipment. He understands that the computers belong to the district and not to him.

I want the children to feel comfortable with using technology. I don’t want the students to be fearful of the computers. The people in my age group are afraid of it.
They’re afraid of breaking it. They’re afraid of getting a virus. They’re afraid of doing something wrong. They’re afraid of making the teacher technologist mad, you know all the things that go along with something that you don’t feel comfortable with. But I think these children feel very comfortable with using it.”

Composite Structural Analysis on the Role of the Teacher Technologist

The formal teacher technologist is challenged to do an effective job of using technology in the classroom and also to assist other teachers and staff in their myriad uses of technology both in and out of the classroom. The teacher technologist is pulled in several different directions all at once. The job of trying to do several tasks at once is daunting.

The teacher technologist appears to be on-call during school hours, more than anyone else.

Anyone seems privileged at any given time during school, to "pop in" to the teacher technologist's classroom or office workspace. Most times teachers and staff have questions or concerns that more often than not seem to demand immediate answers concerning specific hardware or software knowledge.

The teacher technologist is expected to provide the definitive solution to other teachers' technology needs.

For example, the same teachers who teach English would not tolerate for a moment another teacher approaching them in the middle of teaching a lesson or even while planning a lesson to ask, "Would you please help me write this report for the Academic Dean? My grammar is not the best and I need to submit this by the end of this class period! *You* (emphasis added) are the only one who can help me with this!"

The teacher technologist is expected to know everything about any software or hardware, even though there are as many software titles and hardware components developed as there are books and media in some libraries.

A librarian is not expected to have read every book in the school's library. She is however expected to have basic, general knowledge of books and their categories and to be able to show the patron where to go to find a book. She may even have a preference for certain books and may have expert knowledge of books of a certain genre. She doesn't have to know anything about the book the patron is looking for. She simply directs the patron to the book, the patron finds the book and checks it out of the library.

The teacher technologist is a problem-solver, almost a miracle worker.

If the projection device for the board meeting is not working, the teacher technologist had better have a back-up projector waiting in the wings or hopefully know (and remember) the technical nuances of that particular model. For example, a model may require that it be connected to the computer first before turning it on; the computer is turned on last. Otherwise, no picture shows on the overhead screen. This may not be the case for another model. A different model the teacher technologist may have worked with just yesterday had a completely different set of instructions for its use. These and similar experiences are echoed by the teacher technologists in this study on a daily basis.

Each of the participants in this study shared a unique perspective on how computers are used in their classrooms and how they carried out the role of formal or informal teacher technologist in their classrooms.

Research Question 2: What is it like in a typical school day, as a formal or informal teacher technologist in your school building?

Analyses of participant responses for research question two are organized as follows: public middle school academy – Mkad, Gdad, and Sophia Loren; private high school academy – Bailey Ma, 7SeatRulz, Ara B. Jaamz, Sally T. Smith, Genny J. Matt, Maria Rodriguez, and Sam.

A Typical Day for Teacher Technologists in their Classrooms

<u>Mkad</u>

Mkad has been in the teaching profession the longest of the 10 participants. He was the only teacher for the required computer literacy course that every student takes at the public middle school academy and he was also the formal teacher technologist for the campus. Mkad taught five computer literacy classes to 31 seventh graders. When asked to rate his current level of enthusiasm for using computers in the classroom, he rated himself as a level seven enthusiast out of a possible seven.

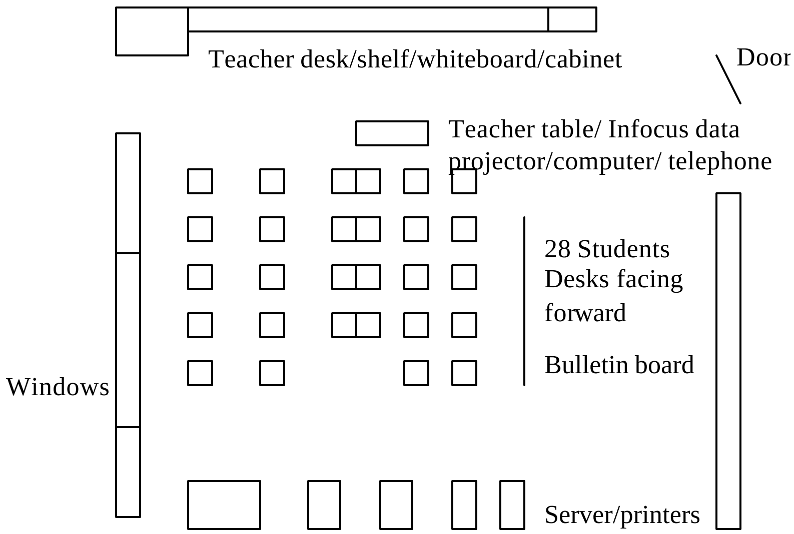
His duties as formal teacher technologist included assisting with the teacher laptop program. The district was in the beginning phase of implementing a teacher laptop program, in which every teacher from 50 initially selected schools would be issued a laptop upon proof of passing the district's technology proficiency exam. The public middle school academy is one of the 50 selected schools. On the day that this researcher visited the campus to shadow Mkad, the principal had just informed him that he had the task of making sure all teachers in the building took the exam, which he administered periodically. All teachers in the building have been assigned a school e-mail account. The district alerted Mkad that a computer virus could enter the e-mail system through attached files. Mkad sent the following memorandum to the teachers, with the principal's endorsement:

> <u>TEACHERS</u>:
>
> This is a copy of an E-mail that has an attachment! Do not use your AOL or ANY OTHER form to get your E-Mail!!!!!!!!!!!!! Do not place it on your computer!!!!!!! Do not place AOL Massager [sic] on your desktop. Do not open attachments. A virus can pass into our GW-Mail system!
>
> They can and do read your E-Mail!!
>
> There is a virus going around that will read you [sic] address book and send letters to all of these people.
>
> Thank you
>
> Mkad

Mkad's classroom was the only computer lab in the school, a small room crammed to the brim with 28 student computers and four printers as shown in Figure 1.

Figure1

<u>Mkad's Classroom Configuration</u>



The room was well lit and equipped with a Novell Network server along the back wall. The server allowed students to go online and use the Internet, e-mail and other online features. A fan was blowing in the far left corner of the room. Windows facing the school's courtyard adorned one wall the length of the room and a long bulletin board with an abundance of information on it lined the other side of the room. The www.google.com website address was posted as a huge banner on the bulletin board.

The hallway directly in front of Mkad's class was flanked with colorful sample work done by his Computer Literacy seventh graders and one eighth-grade enrichment. The eighth grade enrichment class's curriculum included desktop publishing, web publishing, multimedia and digital graphics. For research projects assigned in their Environmental Science class, students created brochures in the computer lab featuring Jane Goodall, Theodore Roosevelt and

Diane Fossey. Mkad allowed students from those classes to come and use the computers, sometimes permitting the teacher from those classes to come with the students, while he sat in for that teacher.

The day that this researcher shadowed Mkad, students came to the lab during their lunch to use the computers to work on their science fair projects. They formed Mkad's lunch bunch classes. Mkad had created a lunch-advisory-enrichment pass system, where students could come and get passes from him in the mornings, permitting them to come in at lunch or during their enrichment or advisory periods and use the computers in the lab. Each pass had an assigned computer station number. Mkad gave out a limited amount of passes each day depending on the number of computers available for use.

In Mkad's computer literacy classes, students used Microsoft Office 2000 products such as Word, PowerPoint, Excel, and Access. The room was equipped with an Infocus data projector and overhead screen. When this researcher observed Mkad teaching a seventh grade Computer Literacy class of five girls and five boys, Mkad began the class by handing out the instructions for the lesson. He demonstrated the lesson in less than five minutes, using the Infocus data projector. Students were instructed to create an address book table in Microsoft Access. After creating the address book, they were instructed to circulate the room from computer to computer and add their information to each other's address books, then after building five names, save the information and print a copy in report format. Students were free to talk to each other and Mkad. Mkad circulated the classroom, helping students who asked for it. They had 15 minutes to construct the table, using a template. Questions were asked back and forth regarding the assignment. Students easily worked on the assignment. Several students worked together while students who preferred working on the assignment unaccompanied worked quietly on their computers.

An eighth grade student came in and asked to use one of the computers in the back of the room. Mkad directed the student to an available computer station. A teacher came in with a request. Mkad left to go to the teacher's room and returned in ten minutes. Students continued to work on the assignment.

Mkad returned to the classroom and used the overhead to demonstrate how to use the report wizard and print it. He asked students to build their reports and print them to the color printer. He got up to go and get the printed report from the printer located in the back of his classroom and showed it to the students. Students were mobile in Mkad's classroom. After students got the five names and addresses, they ran the report wizard, printed to the color printer in the back of the classroom and got up to retrieve the documents. Some students were gathered around the printer in the back of the classroom, other students were in the front of classroom with Mkad while he reviewed specifications of the assignment on the overhead. Some students were seated. Students were calm, yet seem excited about what they were doing.

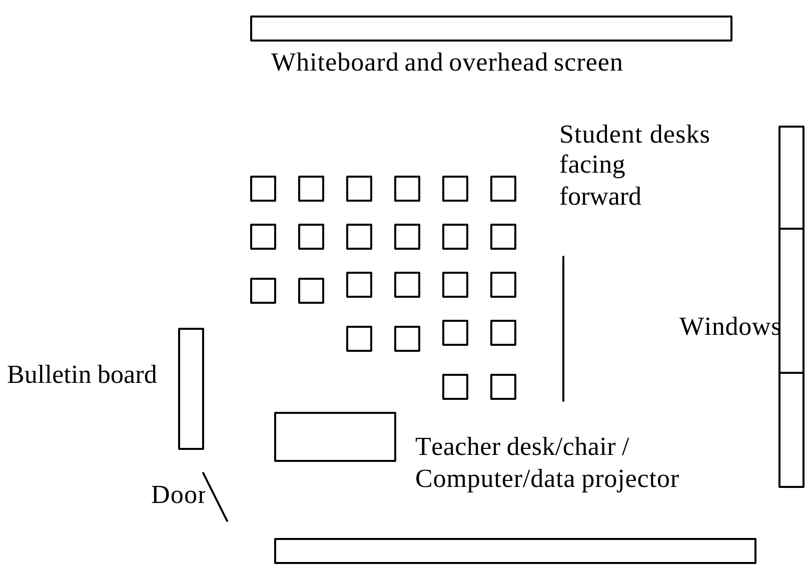
<u>Gdad</u>

Gdad, a white male teacher introduced himself to this researcher while she was visiting with Mkad. He was not originally a selected participant in the study, but offered to participate per the urging of Mkad, as a replacement to a previously selected participant who decided not to continue with the study for lack of time. Gdad reported that he has been a teacher for 25 years. He taught three Algebra and two eighth grade Mathematics courses to a total of 96 students at the public middle school academy.

When asked to rate his level of enthusiasm for using computers in the classroom, Gdad rated himself as very enthusiastic, on level six out of a possible seven levels. He has only been using computers for classroom use since September 2001. Gdad's tiny classroom at the public middle school academy was located at the far end of the building, right next to an outside dumpster. The room was arranged in a typical classroom formation of student desks facing forward as shown in Figure 2. Gdad's room contained a bulletin board with a grading chart on it with grading standards of 40% for class work, 40% for tests, and 20% for homework; 70 to 100% was passing. On the same board was a posted flyer that read "Follow Rules Don't Interrupt Be Polite Say Please and Thank You." The windows had shades pulled down over them, with an eagle mascot on one shade. There was also a poster with formulas for time, pressure, area, perimeter, weight, circumference, volume, interest rate and miles per gallon on one window shade. Another window shade had a gigantic poster of the Texas Instruments TI-83 calculator on it, along with computer sheets of graphics.

Figure 2

<u>Gdad's Classroom Configuration</u>



Samples of student work covered the wall behind Gdad’s desk. The blackboard was flanked on either side by cabinets and shelves with algebra books, a dictionary, and Glencoe videos. One of his cabinet doors had the district’s “One From Many Cultures” poster of students dressed in clothing from various cultures. On Gdad's desk sat a Dell computer monitor along with computer’s hard drive perched on top of it. He had placed a table next to the desk with file folders and papers stacked on it.

On his desk was also a Proxima Ultra light DS2 data projector connected to the computer. On the day this researcher observed Gdad in his classroom, he used the Microsoft Paint program along with a WACOM pen and touch screen connected to the USB (universal serial bus) port of the computer. He used the pen to circle important steps to constructing and solving equations as he was demonstrating to his students on the overhead. The WACOM pen took the place of the keyboard mouse. Gdad also used a splitter cable that allowed him to see what he was doing on his computer monitor as well as project that image through the data projector to the overhead screen.

Gdad reported that students in his classes work as a whole class 55% of the time, work independently 40% of the time and do group work 5% of the time. On the day that this researcher observed Gdad in an Algebra class of 19 eighth graders, 6 girls and 13 boys, Gdad alternated between whole group instruction and informal collaboration between groups of two to three students per group. The lesson for the class this researcher observed centered on solving equations using the substitution method.

Gdad began the class by introducing students to examples of systems of equations, typing in the equations in a Microsoft Paint document projected on the overhead screen. Gdad went back and forth between painting an X and Y graph on the screen and typing in the steps to solving the equations, talking and showing students how to solve the equations. Students watched the overhead and wrote down the steps as he demonstrated them.

Gdad's classroom is located on an outside wall that is very close to railroad tracks behind the building. As he taught, a loud, long train passed by at 8:55 a.m. Gdad continued teaching and students did not seem distracted by the noise. He asked students to take out their Prentice Hall Algebra practice workbooks and turn to page 97. He asked students to copy number 6 on page 97: $x + 2(y) = -7$ and $x = 7 + 23$. Some students groaned as he said, "Yeah, it got hard in a hurry, but it is real do-able." He typed in the equation on the computer as it projected to the screen in front of the students. Gdad got up from his desk in the back of the room and walked up front to point to the problem on the overhead screen. He picked up a student's book and went back to his desk in back to continue with the problem. Two students had their calculators out. All students had their notebooks and workbooks out and were working on the problem. Gdad went back to his computer and told students how to solve the equation. Using his paint tool, he told students to underline parts of the equation, as he underlined it in red. He used a text tool in Microsoft paint to continue solving the equation step by step. He told students they were "99% done" and used the circle tool to circle what was left of the equation. He pulled out another text tool and continued constructing the next step of the solution. Gdad used his mouse pointer to point to parts of the equation as he questioned students. One student asked, "How can we use this?" Gdad responded that it would be used in the system of equations and continued to show the class how to set up the solution for the equations.

Gdad asked students to copy down number 10: $2(x) + y = 4$ and $y = 4(x) +1$. He cleared his screen and typed in the new problem. He got up and went to the front of the room, pointing to the equation on the screen. He said he wanted to show students how to do the substitution method on paper, and then he would show them how to do it on the graphing calculator. Gdad allowed students time to solve the problem; they talked with each other, asking questions such as "How did you get that?" A student asked Gdad, "On number 10, do you have to get the variables by themselves?" Gdad went over to check the student's work. He then asked the whole class if they have a value for "x."

Throughout the lesson, there was lots of noise right outside the window, as if someone was loading a huge garbage dumpster or unloading it! The class was engaged in the lesson, collaborating, not paying any attention to the constant din of noise that seemed to shake the outside wall. Gdad walked back to the computer and typed, as a student provided answers:

$2(x)+ 4(x) + 1 = 4$

$6(x) + 1 = 4$

$6(x) = 3$

$x = .5$

Gdad drew another text box using the text tool and typed (.5,3). He asked students to copy down problem number 13: $x + y = 4$ and $2(x) + 3(y) = 9$. Gdad typed it in and asked students what was the first thing they needed to do to solve it, as he got up and went around his desk and used his finger as a pointer to the equation. His finger made a shadow on the screen as he intercepted the projection image's stream of light molecules coming from the projection device on his desk. Gdad walked back to his computer and typed $2(4 - y) + 3(y) = 9$.

Gdad told students he would now use the distributive law and asked "What is two times four and what is two times y?" He typed $8 – 2(y) + 3(y) = 9$.

Gdad used his underline tool in paint to underline in red $2(y) + 3(y)$ to show students that they needed to add like terms. He grabbed another text tool and typed $8 + y = 9$ and $y = 1$.

He demonstrated the substitution for “x = 4 – y” substituting “1 for y”, making “x = 3.” A student stated that he still didn’t understand. He told Gdad he got lost at “8 + y = 9.”

At that point, Gdad told all students to stop collaborating and to copy down number 14: 3(x) + y = 3 and 9(x) + 2(y) = 7. After students copied the problem, Gdad asked students what should he do first to solve. A student replied, “Isolate.” Gdad, now at the front of the room with the workbook, told students what to do to solve the equation. He told them to “move the 3(x) to the other side, so y equals 3 – 3(x).” He then told students to “box in 3 – 3(x).” Gdad asked students what should he do next. One student replied, “Substitute what y is.” He told students to type 9(x) + 2(3 - 3(x)) = 7. Then as he circulated the room, he asked students to “multiply the parenthesis out of there” to get 9(x) + 6 - 6(x) = 7. Gdad went back to his computer, drew a new text box in paint and typed in the equation 9(x) + 6 – 6(x) = 7. He asked students if they had the “look going on like what is on the screen:” 3(x) = 1 therefore x = 1/3. He asked, “Who has this solution?” Most of the class raised their hands. Gdad asked students to “circle the 1/3 and plug it into the equation y = 3 – 3(x).” He used the scribble drawing tool in Microsoft paint to circle “1/3” and point it to the “x in 3x” and to do the substitution. Gdad drew another text tool with the answer “ y = 3.”

Gdad raised the overhead screen and asked students to copy number 26 as he wrote it on the white board: x + 2(y) = 8 and x = -2(y) + 8. Then he told students to watch what he does on the white board. A student helper came into the classroom with yellow slips of paper to pass out to students. A huge noise interrupted outside. Gdad waited while the student helper passed out yellow slips to students. He wrote x = -27 + 8 and x = -2(y) + 8 and he wrote the infinity symbol (8) on the board to show them how many points can cross a line equation.

Gdad told students to copy number 30: y = -3/4(x) + 1 3(x) + 4(y) = 10.

He asked students “Is this in a(x) +b(y) = 0 form?” Some students replied, “Yes.” Gdad asked students “What is the slope of the line? Do you remember how to take the slope of a line?” He wrote on the board m = -A/B. He plugged in y = -3/4x + 1 and 3(x) + 4(y) = 10. He drew the two lines on the board along the x and y-axis and showed that the two lines were parallel. Students continued to work. As they worked the problems, he circulated the room and assisted students individually.

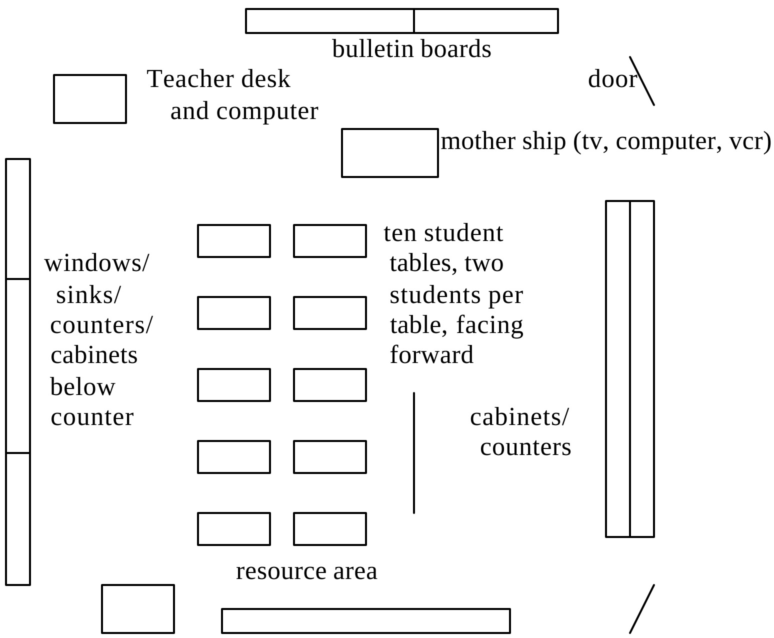
<u>Sophia Loren</u>

Sophia Loren, who described herself as a female Texan, taught five seventh grade Environmental Science classes. She rated herself as a very enthusiastic user of computer technology in the classroom; on a scale of one to seven, she rated herself as a seven. Sophia Loren reported using computers to prepare and teach lessons for all of her classes. When this researcher met with Sophia Loren, she was very focused on getting her students to complete their Science Fair projects that were due in early December. It was a requirement that students use computers to complete the assignment.

Sophia Loren’s science classroom and lab was richly decorated on one wall with counter lab cabinets topped with 3-d posters of students’ work. Each of the cabinet doors along one side of the room featured plant and flower posters on them. Sinks, lower cabinet spaces and windows formed one wall. A computer that was not hooked up sat atop one of the counters, along with a lonesome-looking fish tank. Another wall contained a bulletin board of ecosystem projects and another bulletin board that displayed descriptive student flyers, paper decorations, and the school’s mission statement: “on time, on task, on a mission and excellence without an excuse!” The teacher displayed her credentials on the wall behind her desk. The front of the classroom wall consisted of two bulletin boards, a teacher area with two computers; a door to another storage room with microscopes, a television and videocassette recorder and other science equipment in it. Students sat at tables two-by-two facing one of the teacher's desk areas as shown in Figure 3.

Figure 3

<u>Sophia Loren's Classroom Configuration</u>



When this researcher visited Sophia Loren's classroom, she started instruction outside the classroom, as students were lined up against one side of the hallway; she instructed them that they would be using the e-Buddy miniature laptop computers and reminded them to follow the rules for using the laptop. Students then filed into the classroom. Students were instructed they would be working on their research projects. Students were instructed by Sophia Loren to use the e-Buddy laptops to access Microsoft Word to type up their research reports and to use Microsoft PowerPoint to construct their Science Fair presentations. She admonished them that they might research the Internet, but they could not use the computer to look for Sponge Bob and other off-task websites.

Sophia Loren had on a red jacket, a red sweater, and a red bow in her hair pulled back at the nape of her neck. She also had on a black skirt, black stockings and black flat shoes. The outfit was stunningly complete with red earrings and glasses perched on the end of her nose. A student was "dinging" his computer, making it repeat the same sound over and over again. He had his hand raised to get the attention of Sophia Loren and began calling her "Miss."

There was a continuous blinking sound of the computers, as they were still plugged into the chargers. She passed out the e-Buddy laptop computers, asking if there was an expert in the classroom. Most of the students raised their hands. Fifteen minutes of class time was spent having students log on. There was a *Mothership* computer on a cart up front that housed the server from which students log onto the Internet. The *Mothership* housed a computer, videocassette recorder and television. The television was used to project the computer screen images to it. The e-Buddy laptops were half the size of the average laptop, about the size of an average one-half sheet of an 8-1/2 x 11 piece of paper. Sophia Loren told her students that it is really important that they memorize their district assigned computer user names and passwords. Sign on was the first six letters of the student's last name and the first letter of their first name, along with the student's district identification number. Some students turned on their laptops with relative ease and were online searching the Internet while some were having problems getting their computers to "boot up."

Students were sitting side-by-side, two-by-two, and were able to collaborate with each other. One student deduced that his laptop needed a battery; perhaps that was why it would not turn on. Sophia Loren put a new battery in it. A student seated in front of the student Sophia Loren was assisting, held his laptop in the air and Sophia Loren asked him to please not hold the laptop up in the air; to please just let her know verbally. Students were very quiet about their work on the computers. Each student ended up being able to use an e-Buddy. All students were finally able to get their computers to load the Microsoft Windows desktop 15 minutes after class began. Sophia Loren again instructed the students that they were to use the computer to do research for their science project. The same student whose computer needed a battery asked for another battery. Sophia Loren attached a new battery to the front of his laptop.

A student asked if he could access the Internet. Sophia Loren told him not until he had constructed his problem for the science fair project. Sophia Loren asked if everybody had a computer that was working. The same student whose computer had already had two batteries replaced responded that his computer will not start. Sophia Loren passed him another computer. Another student was having a problem with his computer also. Students chatted quietly as they were absolutely engaged with the computer and the conversations seemed to be focused on the assignment. Students asked questions related to the assignment or the computer. One girl asked another, "What does 'bcc' mean?" Another student asked another, "What are you doing? You've already gotten started; I haven't started yet!"

Sophia Loren was in the front of the classroom, going through the remaining computers, looking for a battery that was charged. A student raised his hand and asked what type of font and size did she want for the project. Sophia Loren replied that it needed to be a font size of 20 to 24 for the show board and a font size of 12 to 14 for the paper itself. Another student was looking for the Dallas agriculture website, sounding frustrated that it would not come up on her computer. Sophia Loren told her to go use her teacher desktop computer. Another student asked, "Do we have to have an agenda to go with the source?" Sophia Loren's reply was. "Yes, indeedy." One student was visiting www.google.com. Another student was constructing her paper in Microsoft Word. A student was looking for a specific website to access and Sophia

Loren instructed her to go to www.google.com to search for the website. A student asked how long did the research paper have to be. Sophia Loren replied, "Two to three pages, double spaced, size 12 font."

Once students found information for their science topics, they were allowed to print it to a printer in Mkad's computer lab. A student sent a website page on chlorine. Sophia Loren stopped to tell students they cannot cut and paste from the Internet and put it into their research papers. She explained that they were to print the resource and use it in writing their research papers. Sophia Loren circulated the room to help students find actual topics.

The student who had the most computer problems, finally was able to get a working computer. Students were relaxed enough in the classroom to speak pleasantly back and forth. Students sent their typed agendas to the printer in Mkad's computer lab. Two students asked whether they could retrieve the printed pages. Sophia Loren allowed them to go as long as they had their planners with them to show as hall passes to the hall monitor. Another student asked if he could go also. Sophia Loren told him that two people had gone already, to wait until they returned to the classroom. Sophia Loren was moving back and forth, helping students either with technical computer problems or with specific content questions. Sophia Loren reminded students that they were not there to entertain themselves, but to work feverishly to get the science fair project going. A student found a pair of lungs that had been severely damaged with smoking. Sophia Loren exclaimed "How cool!" Four other students got up to go see the pair of lungs on the student's computer. The student printed out a copy of the lungs and gave to this researcher (Figure 4). A student visited a peyote drug website. Sophia Loren told her she needed to get on a different website.

Figure 4

<u>A Pair of Damaged Lungs (Renal 063.jpg, 2002)</u>

The e-Buddy laptops crashed from time to time. Sophia Loren circulated the room offering replacements. She replaced each with another. A student asked to retrieve his printout. Sophia Loren asked him why didn't he get the student who had just left to pick up his work.

A student shared that her daddy got her the interview for her project. He worked at a water plant and promised to interview the scientist at the plant for her so she could use the information in her science fair project. She commented that she was pleased except her daddy's handwriting looked like "chicken scratch."

Sophia Loren reminded students of creating a flyer poster. She instructed students not to change the laptop screen savers, nor save to the C drive, and not to touch the e-Buddy screens. "They are very, very fragile," she stated. Students seemed to have rapport with Sophia Loren. They shared openly with her. A student asked what if he could not finish his report during this class period. Especially since students could not save to the C drive, how would they be expected to complete the assignment? Sophia Loren responded that the student should print what he completes in class. Sophia Loren helped another student, telling her she was to write her paper about Ph, about plants, about what happens if they get too acidic. She told her to read up on the subject, using journals or the Internet, and to interview someone on the topic. Several students called on one student quite frequently to help them with their computers. He was very helpful, and seemed knowledgeable of the computers.

A student asked about the fetal alcohol syndrome. Sophia Loren told the student she would have to do research to find out how much a mother could drink before the alcohol got to the baby. Another student blurted out that a mother could not drink at all and Sophia Loren responded that the student was correct. A student was interested in knowing what was the alcohol content of a Virgin Mary. Sophia Loren told the student to do the research and find out the trimester week in which a baby would be affected by alcohol. She told the student to conduct a ten-question survey of fifty women to find out whether women are aware. She instructed the student to ask a mixture of people, not just adults, but teenagers also. A student said that she had a brother who was a nurse who worked in a rehabilitation place who could complete the questionnaire for her. Sophia Loren told the student she would write a note to her brother to ask him if he would help construct the questionnaire.

Another student asked if he had to print all 75 pages of information he found on his topic on the Internet. Sophia Loren told him to print two to three pages only. A student needed assistance with his e-Buddy. Sophia Loren asked if another student could assist him. A student asked about not being able to get a copy of his printed work. Another student told him that the Phaser 860 printer had not been working all day, that he would have to print to another printer.

Sophia Loren looked at a student's printed resources and told her the information was adequate, but not to copy it into her paper as it was. She told the student she needed to write it in her own words.

A student told Sophia Loren that the computer was giving a message that Microsoft Word had been removed or is inaccessible. A student was yet concerned about not being able to print off all 75 pages of his resource. Sophia Loren told him that he would get her in trouble if he printed all 75 pages, especially to the Phaser 860 printer, which is an expensive color printer. She had the student change to print one through four pages, telling him he was "cooking with Crisco" and to click "OK" on the printer dialogue screen. Another student asked about his science procedure; his report was only one page. Sophia Loren instructed him to type up two or three pages. A question was asked about interviewing. "Do we have to"? Sophia Loren responded that they have to interview at least one person. Another student called out to Sophia Loren that Microsoft still didn't work.

Most students printed off their resource from the Internet and were trying to load Microsoft Word, but several were finding that Word was not installed on their e-Buddies. Questions shifted to the procedure for the research. Sophia Loren explained the procedure and how to arrive at a hypothesis, asking students to think of a city that has more chlorine in its water than other cities. She reminded students about this previous problem and how she arrived at the hypothesis. She instructed students to word the hypothesis as "Plano will have less chlorine in its water than Dallas, Mesquite or Arlington." Another student asked questions about how to reword his hypothesis on soil.

An official from the district walked into the classroom and asked to check on the condition of the science lab. Sophia Loren told him she had five working sinks and showed him the power, gas and water shut-off. She directed him to other things in the lab storage room.

A student seemed to be at a stage in his project where he was still trying to decide on a topic. Sophia Loren instructed the student that she was not at that stage, nor should he be. She told the student he should be writing his research or doing the hypothesis. One student was constructing a purpose statement in Microsoft Word, using the Word Art feature to build her title and purpose statement on line. Sophia Loren walked over to the *Mothership* computer and displayed the Internet website www.google.com on the television. The color on the television screen was a muted yellowish color, not showing up very clearly, but could be seen from the back of the room nonetheless.

Students shut down the e-Buddy laptops at the end of class and placed some of them in a locker type storage box. Sophia Loren walked from desk to desk asking if there were any other computers that had been shut down that needed to go on the *Mothership*. She placed some of them on the cart, connecting them for re-charging. Others went in the trunk. Some students stood up and looked at the poster projects that were displayed around the room, while others milled about quietly talking to each other and asking Sophia Loren questions. Some students remained seated and chatted among themselves. Sophia Loren announced that she still had a couple of laptops out. She asked students to look on the floor to see if any paper was around them and to pass it to a student to place in the trash. She ended the class by asking students to put their chairs on top of their desks.

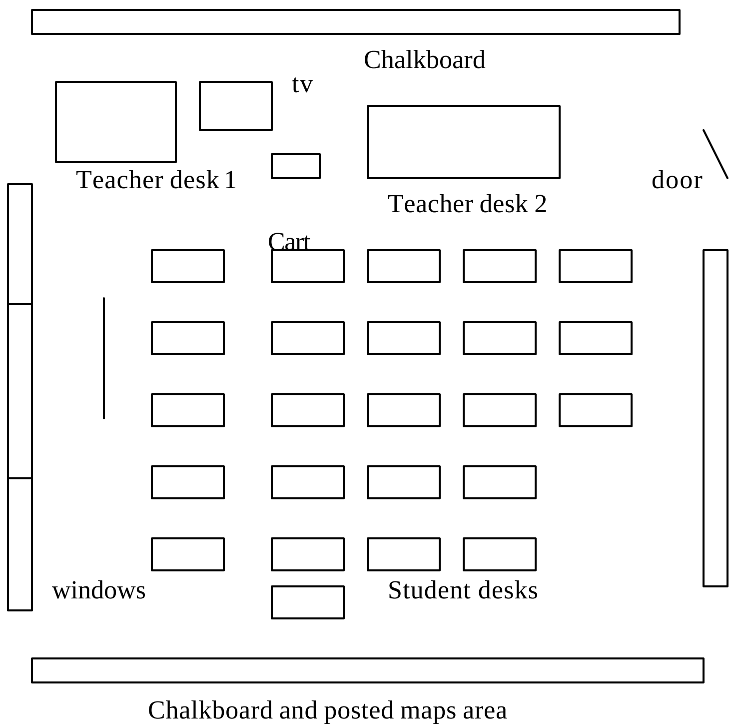
Bailey Ma

Bailey Ma was a formal teacher technologist at the private high school academy. She described herself as just female. She had been a teacher for 28 years and a formal teacher technologist for 10 years. In her career span, she has witnessed the ongoing evolution of computers in the classroom. As a formal teacher technologist, Bailey Ma was responsible for providing in-house technology training to faculty and staff. She stated that her primary goal with training teachers is to "ask them what it is they want her to help them do" with technology in their classrooms. She wanted to offer teachers "how-tos" on thinking about ways to use technology and then hoped that they can see a connection to the use of technology in their particular discipline. She reported her biggest feat as trying to get teachers to think of good learning strategies where technology could enhance what they do in the classroom. Her philosophy about the use of technology in the classroom was that it should be a vehicle for the curriculum. Each semester Bailey Ma posted technology courses that were offered at the private high school academy to a public location in e-mail that faculty could access, as shown in Table 5. Not very many teachers signed up to take the courses offered each semester. This researcher attended three of Bailey Ma's technology courses: Laptop Workshop – Philosophy of the school's Laptop Program, Web quest and PowerPoint Comic Strip Animation. Only four teachers (this researcher included) attended the first course, three people attended the second and five teachers attended the PowerPoint Comic Strip Animation class. Courses are offered both before and after school, 7:40 a.m. to 8:40 a.m. and 3:45 p.m. to 4:45 p.m.

In addition to training teachers, Bailey Ma taught two college level U.S. History classes and one Contemporary Issues class. This researcher sat in on Bailey Ma's Contemporary Issues class. Bailey Ma taught the class in another teacher's classroom (see Figure 5). That teacher's classroom was very crowded with two teacher desks and an overhead cart all crammed into a very small space in the front of the room. Thirteen students attended the class. Bailey Ma opened the class by going over the special schedules for next week. She informed the class that the following week was Intramurals Week and that she would be attending a conference in Phoenix, Arizona that week.

Figure 5

Bailey Ma's Classroom Configuration



Bailey Ma opened for discussion the topic on enslavement in the United States. She began by asking the class if anyone knew whether or not they had any slaves in their family. One student raised her hand. No one else knew. Bailey Ma explained that the video she would show explained what society was like in a world of enslavement. She stood in the front of the room, very animated with her hands as she spoke.

Bailey Ma asked if anyone had ever heard of Negro spirituals. One girl said she thought it was "when they had their preaching and their songs." Another student mentioned the song "Sweet [sic] Low Sweet Chariot." The song "Follow the Drinking Gourd" was explained by Bailey Ma as a song used by runaway slaves as a signal to escape the plantations; the gourd represented the North Star. The "Jordan River" song was used to refer to the Ohio River: "I looked over Jordan and what did I see, a band of angels coming after me, if you get there before I do, tell my mother I am coming, too."

Bailey Ma told a student to go to the map posted on the blackboard in the back of the room to find the Ohio River bordering the states Ohio, Kentucky and Pennsylvania. She also sent a student to the map to identify the Mason-Dixon line. Bailey Ma started the video. She allowed the video to play as it instructed students about the reasons for slavery: to help build the plantations and for cotton production. She stopped the video and asked if anyone knew any statistics on slavery. No one responded. She stated 1% of the white population owned 70% of the enslaved in the South. There were lots of white people who did not own slaves, not because they did not want to, but because they could not afford them. Bailey Ma raised the issue that even though movies portray that slaves were abused unmercifully, she stated that wasn't the case most of the time; due to the fact that slaves were needed to do the labor, hitting wouldn't be cost-effective. They would instead sell the rebellious slaves.

Bailey Ma re-started the video. The video expounded that slaves could not strike whites; they could not blow horns or beat drums. The enslaved could not be educated, could not learn to read and write. Bailey Ma stopped the video. She stated, "Education was very valuable. Education frees people." She talked about the slang used by uneducated people: "ain't, gonna, reckon, and bubba." The slaves of the South were not allowed to be educated.

Bailey Ma restarted the video. The video covered the types of slave housing. Bailey Ma stopped the video to explain that homes of the enslaved usually constituted one room. Bailey Ma mentioned that the Old City Park log cabin house in downtown Dallas was a replica of a slave home, a one-room shotgun house. The houses were called "shotgun" houses because one could stand at the front door and shoot a gun through to exit out the back door without hitting anything. Bailey Ma restarted the video:

> The Master and his family lived in the big house. All Masters had two faces: one was a friendly face and one was a mean face (from the words of a slave). When my daddy died I had to take over the plantation of thirty Niggers (words of a new Master, after the old Master died). The new Master continued: I recollect only two or three bad Niggers. Some White Trash killed slaves, used hot irons on their Niggers. There was one Nigger I was fond of. His name was Hector. House Niggers get the best food and wear fancy clothes. Most field Niggers think the house Niggers think they better than anybody else. Uppity Niggers think you better than the others, good as the Master. Voice of female slave: Master came to my house at night; I told him no, I have me a fine man. When I'm on the auction block, I act crazy and looks real ugly when I don't want to go with that man. When I see a fine rich man, I smiles real nice and down goes the auction hammer. Voice of female Mistress: the plantation house servants and field hands are always needing tending to. I nursed the Negroes. I was obliged to supervise them. I had to teach them how to stand, how to behave, how to speak politely, and how to cook. The slaves owned us. Voice of black Mama: Master married his new wife and

all the cats, dogs, and Negroes had to come see her. She put a bucket of dimes on the porch and threw dimes to the Niggers. But like they say: love gets old and sin gets bold. I think they all hated the poor Nigger.

Bailey Ma stopped the video.

A student walked into the classroom, slowly setting up her laptop. Bailey Ma solicited comments. No one commented. Bailey Ma restarted the video. “Slaves rarely dared take off their masks. The economy might have fared better had the plantations been operated or managed by offering incentive to the slaves, rather than using fear.” Bailey Ma stopped the video. Bailey Ma referred to “Song of the South” and Uncle Remus’ tales in which Brer Rabbit was very similar to Aesop’s fables. She emphasized that the powerful animals were overcome by the crafty, small animals and gave an animated version of Brer Rabbit and the briar patch.

Twelve students kept their laptops open, taking notes throughout the class discussion and video watching. Bailey Ma stopped and asked students about the Brer Rabbit tale. “What is the meaning of the Brer Rabbit tale?” A student quipped, “It means you don’t have to be powerful to win. The weak can overcome the strong if you use your brain. This was why the slaves could escape and go North, using the Underground Railroad route.” Students volunteered that the Underground Railroad was a house-to-house connection of Quakers and abolitionists who would take the slaves in and give them food and send them on their way. Bailey Ma mentioned that Harriet Tubman was known as Moses and managed to free quite a few of her family and other slaves. Harriet Tubman had epilepsy, carried a gun, and once threatened to kill a slave who tried to go back. Bailey Ma asked the class “Why would she shoot someone?” A student answered, “Because that slave might tell.”

Bailey Ma wrote an address on the overhead: www.gliah.uh.edu/ahd/slavery.html. She asked students if they had their Netwave cards in to go visit the website. A Netwave card allowed students to connect to the network through a line-of-sight connection box located in the classroom. The connection box was hooked up to the network, which allowed students to access the Internet. Most of the class got online while others looked on. One slide on the website pointed to the rental of slaves. Slaves were rented out and wore slave tags around their necks. The topic of producing mulattoes by the slave master was approached. A student asked, "What does antebellum mean?" Another student answered, "Pre-civil war." Bailey Ma continued, "Why wouldn't the field hands have nice clothes?" "Because they worked out in the fields," someone responded. Bailey Ma asked the class to visit the section on Frederick Douglas and asked, "What do you think about him?" At this point, some students went through the website slides without Bailey Ma's guidance and offered comments along the way. Someone read, "When a slave is singing, he is the saddest; things are terrible; the voice takes the place of my tears." Reference was made to the song "Sometimes I feel like a Motherless Child." One student made reference to the slide that showed a bill of sale of slaves. Another student found an interesting commentary on slide 24: slaves in America were civilized. Bailey Ma questioned the class, "Why would Whites say that bringing slaves to America was civilizing them?" A student answered, "Of course, we don't want to say we would hurt them, do we?!" As students continued to read the website slides, a reference was made to the Cherokee Indians' Trail of Tears. A question was asked, "Why would you move them from Georgia to Oklahoma?" A student responded, "To get the Indians out. White people wanted their land. Move them to Oklahoma and no one will want Oklahoma." Oklahoma means "red land." Bailey Ma offered a quote, "Of all the promises the White man made and kept, he promised to take our land and he kept it." A point was made about the importance of slaves being converted to Christianity, how the White slave owners loved using the passage in the Bible where Saint Paul admonishes slaves to obey their master.

Bailey Ma instructed students to go to the course online textbook website http://www.ilrn.com which required a username and password. Each student had a username and password. Once in the website, students were instructed to go to the "Live Under Slavery" link. Bailey Ma went through the three autobiographies and biographies of the slaves and masters. She asked students about the snippets of information offered on each. Students were allowed time to read and then discussed. Bailey Ma continuously moved about the classroom looking over students' shoulders. The atmosphere in the classroom was very relaxed. It began to get warm. Bailey Ma made a comment that she wished the teacher to whom the room belonged would turn the heat down in the room. Reference was made to the movie *Roots*, based on the book authored by Alex Hailey. Bailey Ma encouraged students to go and rent the *Roots* series. The class was ended with one minute left in class. Bailey Ma reminded students that next class they would do their group presentations.

7Seatrulz

7Seatrulz had been an informal teacher technologist for one year and was in her third year of teaching, all at the private high school academy. She rated her level of enthusiasm for using computers in the classroom as a level seven on a rating scale of one to seven. This enthusiasm was evident by the more than one hundred technology training hours she had logged, most of those by attending five technology conferences in the past three years.

7Seatrulz taught five Chemistry classes, four of Chemistry I and one of Chemistry II. Seventy-four students in grades 10 through 12 were enrolled in her classes. Only 10% of homework assignments in these classes involve use of the computer, as reported by 7Seatrulz. Students frequently used computer in 7Seatrulz's Chemistry classes to take notes, construct web labs and build reports for labs, do computations, presentations, research, projects and for molecular model construction labs.

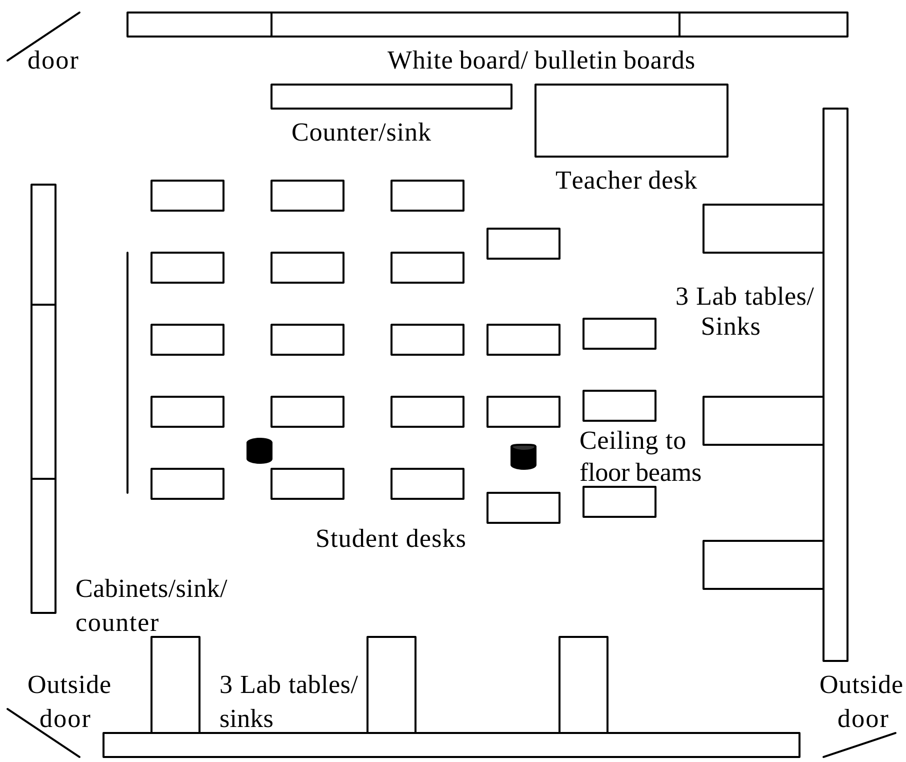
This researcher sat in on a teacher training class in which 7Seatrulz trained teachers on the use of the STELLA software tool that she reported using frequently in her classes during instruction. The training class was offered immediately after school at 3:45 p.m. in the faculty workroom. Only two teachers attended the training (this researcher included); we all sat around a low, round worktable, using laptop computers. We each were given a copy of the STELLA software to install on our laptops before the training session began. STELLA is a useful tool for developing a flow chart of a system or investigation, providing flow-charting symbols to allow creation of a project's development over a period of time. The other teacher who attended the training was a math teacher. The school had purchased a site license for the software. STELLA is an interdisciplinary tool that can be used in math, science and the liberal arts.

This researcher also visited 7Seatrulz's Chemistry II class of seven girls, six seniors and one junior. Students explored the topic of molecular bonding using the computer as a tool to conduct the lab. Students could easily hear, view and participate in classroom activities. In the center of the classroom, there were two tall floor-to-ceiling beams around which standard student desks were arranged as shown in Figure 6. 7Seatrulz had a computer up front on her teacher desk, but was currently reviewing the homework on the whiteboard. Students were allowed to ask questions as she reviewed the assignment. Appropriate lighting was provided from the 13 florescent lighting fixtures in the ceiling. The room had a comfortable temperature. A fan was blowing in the far left corner of the room.

7Seatrulz and her students could hear each other without any outside noise. Even though the classroom was located on the lower recesses of the building, it was isolated from everyone else. Students were free to talk to each other and to the teacher in a cooperative manner. A lot of cordial joking and friendly banter was exchanged until 7Seatrulz began the homework review session. Questions were posed regarding the assignment. 7Seatrulz handed out an example sheet on bonding and anti-bonding to correlate with the homework review.

Figure 6

7Seatrulz's Classroom Configuration



After 15 minutes of homework review, students were asked to take out their computers and assemble into their groups for the lab. They were free to form groups of two, three or four students. One student had to leave class early; the remaining girls assembled in two groups of three and four. The assignment given to students the day this researcher observed 7Seatrulz's Chemistry II class was to complete a lab on constructing molecular orbitals. According to the handout 7Seatrulz distributed, molecular orbitals result from the delocalization of electrons around two or more atoms. The purpose of the lab was to show a visual representation of the molecular orbitals, which would be constructed using the Internet. Students were instructed by 7Seatrulz to access the Internet using only one student's laptop in each group. 7Seatrulz circulated the room as students assembled in their groups at the lab tables in the back of the room and asked the girls to visit the Chemviz website and enter in supplied user name and password. Each group was given an orbital to construct. One group constructed $H_{2,}$ hydrogen, and the other 0_2, oxygen. The Chemviz website was constructed by two high school chemistry teachers to allow students to log into a database and submit molecular construction requests to a server located on the University of Illinois at Urbana campus in Champaign, Illinois. The server downloaded the requests and constructed the orbitals and re-submitted the results back to the students. The results revealed the probability of finding electrons in regions around the nucleus. Students were instructed to use their results to complete the chart in the lab.

Students accessed the Internet by using their Netwave card that connected wirelessly via the network box located near the top of the ceiling by the teacher computer. The results took a few minutes to return; the answer had to be constructed in three stages. While the students were waiting for the constructed molecular orbital to return, they discussed the upcoming "Powder Puff" football game between the juniors and seniors. It took at least five minutes to get the first response back. 7Seatrulz explained that with just two groups it goes faster than with more groups on line. She learned about this project at the Supercomputing 2000 and 2001 conferences and at the National Computational Science Leadership program that summer.

After the results came back in the form of the molecular structures, students discussed the structures and finished the lab chart, answering and asking each other questions. One group was supposed to do the H_2 orbital and the other O_2, but because both logged on using 7Seatrulz's user name and password, they ended up doing the same O_2 orbital. Both groups came together and collaborated to finish out the H_2 orbital. As questions were asked, 7Seatrulz was there to offer further explanation. There were questions about the X, Y and Z planes. 7Seatrulz used three pencils to explain the directions of X, Y and Z, so students could answer the rest of the questions. Looking at the results, students told whether or not the results were two sigma star, two sigma, one sigma star, one sigma, or pi bonding, etc. With three minutes left until the end of class, one student took the lead and called out the formulas for the lab. 7Seatrulz instructed the students that they would continue with this lab next class. 7Seatrulz collected homework and asked students to save the labs they ran on the computer.

<u>Ara B. Jaamz</u>

Ara B. Jaamz, an African-American male, taught 84 students in four freshmen level English I courses and one junior level English III course at the private high school academy. Ara B. Jaamz had been an informal teacher technologist for five years. He reported that 40% of homework assignments given per week in his classes involved the use of computers. Ara B. Jaamz reported using a computer to prepare or teach lessons in all of his classes. He rated himself as a level seven computer enthusiast, level seven represented "very enthusiastic." He conducted a study hall class of nine students who he reported used their computers 98% of the time for study. His junior class used the computer to take online quizzes. He reported that allowing the juniors to take online quizzes placed the responsibility and flexibility of when to take the quizzes in the hands of the students. The students could take the quizzes when they felt they were prepared to do so.

When this researcher observed one of Ara B.Jaamz's freshman English classes, 17 students were in attendance. All 17 students plugged their laptop computers in, using several extension plugs strung together down the middle of the classroom aisle. Ara B. Jaamz instructed students to copy a sonnet folder from two disks that he passed around on both sides of the room. He instructed students to open the files after copying them. Ara B. Jaamz walked to the blackboard and asked students to look at their poetry project on their computers, as he reviewed what was expected of them on the board.

The Poetry Project 2002 computer file outlined the assignment and included a rubric. A student interjected that she did not have a power cable to hook up her computer. Ara B.Jaamz responded quickly that she needed to get one. Another student loaned her the power cable. Ara B.Jaamz continued by informing students they needed to use eight-sentence paragraphs. Ara B. Jaamz asked for questions. No one had questions so he instructed students to close the Poetry Project 2002 file and open the Sonnet file.

Ara B. Jaamz opened the lesson by reviewing the parts of a sonnet. He informed students that they must be able to identify who is the speaker and what is the occasion as they analyzed a sonnet. He continued reviewing the file which described the two types of sonnets, Italian and English. Ara B. Jaamz walked around as he talked with one hand in his pocket. He stopped and asked students to take out their books entitled <u>Perrine's Sound and Sense, An Introduction to Poetry</u> (Arp, 1997). A student asked questions about the "Why" column on the board. Ara B. Jaamz explained what it meant.

Ara B. Jaamz went back to explaining a sonnet. Another student asked what was the rhyming pattern of the sonnet. Ara B. Jaamz said this indicated that each sonnet could be broken down into pieces or lines. Ara B. Jaamz's classroom had two chalkboards (Figure 7). On one board he had written:

Quiz & HW	Read (1) aloud
Computers OUT!	Speaker(s) Talk about
Literary Terms	Re-read(#) (2) aloud
Define	Find (3) devices (write down)
Poetry Project	292 – Realism
Syllabus	293 – Naturalism
	108 – Romanticism

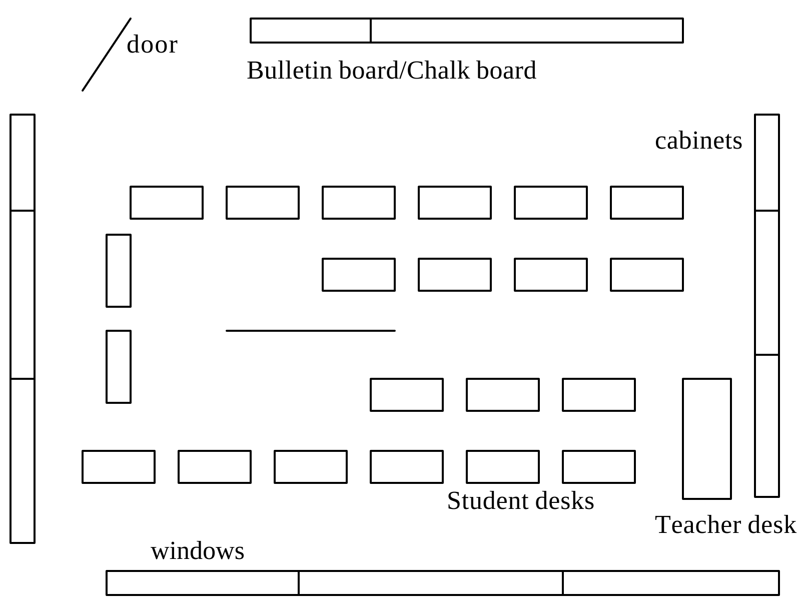
The other board contained:

Creative writing

Monday – Will have oral reading from project in progress and I will check your progress on your project overall.

Figure 7

Ara B. Jaamz's Classroom Configuration



Ara B. Jaamz asked students to read the poem “When my love swears that she is made of truth” in Perrine’s book (Arp, 1997):

When my loves swears that she is made of truth
I do believe her, though I know she lies,
That she might think me some untutored youth,
Unlearned in the world’s false subtleties.
Thus vainly thinking that she thinks me young,
Although she knows my days are past the best,
Simply I credit her false-speaking tongue;
On both sides thus is simple truth supprest.
But wherefore says she not she is unjust?
And wherefore say not I that I am old?
Oh, love’s best habit is in seeming trust,
And age in love loves not to have years told:
Therefore I lie with her and she with me,
And in our faults by lies we flattered be.

William Shakespeare (1564-1616) (p. 39)

Students were asked to re-read the passage. Ara B. Jaamz asked students to find at least three devices, as listed in the Literary Terms Excel file document. He allowed students five minutes to think of the devices. He asked students to re-open the Sonnet word document file. Some students had both the Sonnet and the Literary Terms documents open concurrently. Some students used the Microsoft Windows Arrange All feature to show both files on the computer screen at the same time. Ara B. Jaamz socratically addressed students: “Who is the speaker in the poem?" A student responded, "A middle age man." " What is the occasion?" queried Ara B. Jaamz. He continued to wade through the first part of the poem asking for meaning: "What does swear mean? What is the speaker saying?" One girl responded, "The speaker is suggesting that the girl is not being truthful, that 'made of truth' is a metaphor." "I do believe her, though I know she lies," Ara B. Jaamz read and periodically stopped to explain most words.

At this point Ara B. Jaamz walked over to the podium and stood behind it. He used his hands and facial expressions to help with the explanations. He used an example in the classroom to explain what "false subtleties" meant. He demonstrated with a student by saying how she quickly closed her laptop cover when he passed by because she did not want him to see that she was "IM-ing," using AOL's instant messenger. AOL's (America Online) instant messenger software was very popular among students at the private high school academy. Students could chat online with other students at school or anywhere else.

"In this first quatrain," Ara B. Jaamz said, "the metaphor of comparing the woman to truth is used." He read the next quatrain. A student raised her hand and was recognized by Ara. B. Jaamz. She said, "The false-speaking tongue is a personification." "What other devices are in this second quatrain?" Ara B. Jaamz asked her. The student responded that she thought alliteration was used with the s-sound, imitating the sound of some sort of natural event, such as the snake. Ara B. Jaamz asked "What is the volta, the moment of shift?" He paused to give students a chance to answer, then he answered by reading "But wherefore says she not she is unjust? And wherefore say not I that I am old?" He asked, "What does wherefore mean?" A student answered, "It means 'why.'"

Ara B. Jaamz asked students to turn to page 331 in Perrine's green books to read "Shall I compare thee to a summer's day." Students used Perrine's green book or another book with the same material, but different page numbers. In the other book, the poem was on page 398. He told students to be patient with the syllabus in trying to find the sonnets in either of the books. A student volunteered to read the sonnet. A student read a few lines. Ara B. Jaamz asked another student to read the poem:

> Shall I compare thee to a summer's day?
> Thou art more lovely and more temperate:
> Rough winds do shake the lovely buds of May,
> And summer's lease hath all too short a date.
> Sometimes too hot the eye of heaven shines,
> And often is his gold complexion dimmed;
> And every fair from fair sometimes declines
> By chance or nature's changing course untrimmed;
> But thy eternal summer shall not fade
> Nor lose possession of that fair thou ow'st
> Nor shall death brag thou wand'rest in his shade
> When in eternal lines to time thou grow'st
> So long as men can breathe or eyes can see,
> So long lives this, and this gives life to thee.
>
> *William Shakespeare (1564-1616)* (Arp, 1997, p. 331)

Students began asking him a barrage of questions about the test, rather than the poem. Ara B. Jaamz re-focused the students' attention to the poem. Ara B. Jaamz walked over to the black board and asked, "Who is the speaker and what is the occasion of this poem?" "The poem," he said, " is based in hyperbole."

A student walked into the classroom to return something she borrowed from Ara B. Jaamz. It was five minutes before the end of class and students still had their laptops open, books open, notebooks on their desk, laptops and bags are all on the floor around their desks. Ara B. Jaamz's walls were decorated with several happy faces scattered here and there. Across the back wall were green icons and names of his freshman homeroom class. Students were allowed to ask questions now, any questions they wanted to ask. One student got up and went outside the room for water and came back. A question was raised about a volta. Ara B. Jaamz explained that voltas occur in sonnets, but every good poem will have a moment of shift. He shifted to another poem "Break of Day" on in Perrine's green book:

Tis true, tis day; what though it be?
Oh, wilt thou therefore rise from me?
Why should we rise because tis light?
Did we lie down because 'twas night?
Love which in spite of darkness brought us hither
Should, in despite of light, keep us together.

Light hath no tongue, but is all eye;
If it could speak as well as spy,
This were the worst that it could say;
That, being well, I fain would stay,
And that I loved my heart and honor so
That I would not from him that had them go.

Must business thee from hence remove?
Oh, that's the worst disease of love;
The poor, the foul, the false, love can
Admit, but not the busied man.
He which hath business and makes love, doth do
Such wrong as when a married man doth woo.

John Donne (1572-1632) (Arp, 1997, p. 30)

A student was asked to read. The student read the poem. Another student asked if she could turn off her computer. Ara B. Jaamz answered, "Yes, but would you re-read the poem first?" Another student interjected about not being able to save the read-only Sonnet file. Ara B. Jaamz told her to do a "Save As." As it neared time for the bell to sound, Ara B. Jaamz humored students as they packed their laptops and belongings. Ara B. Jaamz reminded students that the upcoming test would be fairly straightforward. One minute before the bell sounded, students noisily got up to turn in their homework assignments.

Sally T. Smith

Sally T. Smith reported using computers in the classroom for five years. She rated her level of enthusiasm for using computers in the classroom as level seven out of seven possible levels. Sally T. Smith, a Caucasian female, taught five art classes at the private high school academy. She taught Design and Drawing, Painting, Independent Study Digital Art, and Advanced Placement Studio Art to a total of 64 students during the 2002-2003 school year. Sally T. Smith reported she frequently uses the computer to prepare or teach class. She had one student enrolled in her Independent Study Digital Art class, who used the computer 100% to complete the digital artwork assignments. She reported that the other classes used computers in her classroom 10% of the time. Students used the computers to take notes, complete assigned projects and to present information to the class.

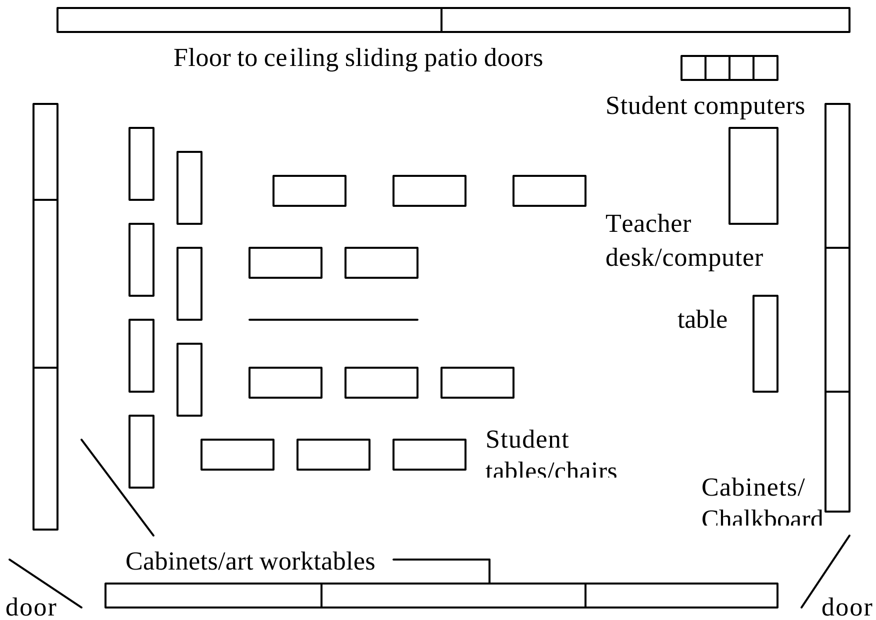
This researcher observed Sally T. Smith teaching her AP Studio Art class in which seven seniors and four juniors were in attendance. Sally T. Smith used the overhead projector and a laptop computer in a classroom that had eighteen tables and chairs in a u-shape formation facing forward (Figure 8).

Sally T. Smith had technical difficulties at the onset of the class; she had to retrieve another data projector because the original one would not work correctly. She finally got the projection system working and began the class by passing out a copy of the PowerPoint presentation notes for the slides she was projecting. Sally T. Smith showed students photos of Sandy Skoglund's work. The work on Skoglund's "Fox photo" was discussed.

Sally T. Smith asked students to reflect and share what associations the fox brought to mind. Some students replied that they had heard the phrase: "sly as a fox" or a woman as being referred to as "foxy." Sally T. Smith asked, "What cultural meanings do you associate with the fox?" One girl responded, "The fox is small and in this country is known to be effeminate, as a wolf would be known to be masculine." "Foxes also are independent animals, so therefore catch prey that is smaller than them," Sally T. Smith shared, "whereas wolves are masculine, traveling in packs to attack larger animals." She went on to explain the photo appeared to have red foxes in the foreground with the appearance of invading the territory of human beings in a restaurant setting. A student got up and closed the drapes in front of the patio doors to see the overhead screen better. Sally T. Smith went on to explore other photos of Skoglund's work, displayed on the overhead. Sally T. Smith also showed students examples of work done by Renee Magritte. Students reacted and shared more when she displayed these slides. Each slide showed a photo of reality with unreality woven into it.

Figure 8

<u>Sally T. Smith's Classroom Configuration</u>



Most students had their laptops out, but were more attentive to Sally T. Smith and the slides on the overhead. Only two were using their computers. Some students moved closer to the overhead screen. From their seats they could not see the photos clearly on the overhead screen, which did not show as sharp a picture as was on her laptop screen. Four students got up and moved to stand behind Sally T. Smith who had her laptop perched on her teacher desk, connected to the overhead projector. Two students sat on top of the table and two students stood behind her. She didn't seem to mind. Students freely engaged in conversation with Sally T. Smith. The students asked questions and offered comments. One student commented that Magritte's work made her feel like she was moving, in constant motion; his works were very unsettling and unusual to her. One student made a comment about the titles of Magritte's photos being very unusual, not really seeming to have anything to do with what is visible to the eye.

Sally T. Smith ended the PowerPoint presentation by giving students their hands-on assignment for the remainder of the class period. Students were instructed to get in one of three groups, to get one of the Art department's digital cameras (Canon Powershot G1s) and to find a real environment to photograph anywhere on the school campus. Sally T. Smith told them to also be thinking about unreality and conflict within their environment and construct images to include in this space that will create a new reality. A student from each group picked up a camera.

This researcher shadowed one group. They went to the front of the school building and took a photo of the massive front entrance, with a huge Christmas wreath framing the door. The group then went to one of the girl's bathrooms and took a picture of three of them washing their hands as they looked in the mirror simultaneously and one picture of the inside of a flushed toilet bowl swirling with clear water. The group trekked over to the cafeteria area where they went out on the patio and snapped a picture looking down from the balcony into the tops of the trees. In the cafeteria one of the girls in the group got on the floor and took a picture of one of the ceiling light fixtures. One took a picture of the empty chairs and tables in the cafeteria.

After one group of students returned to the classroom, they went over to one of the four desktop computers located behind Sally T. Smith's desk and hooked the flashcard on the camera which had the digital photos stored on it to the USB port. They looked at each of the photos taken and stored it on a diskette for later. Sally T. Smith told the students that in the next class they would access the Internet and find other pictures to add to the photo environment. Students would then take one of the school photos and using PhotoShop 6.0, graft it into the Internet picture to make a new environment. As the other groups returned to the classroom, class ended with one group of students looking at the photos they took, viewing them in the viewfinder on the digital camera and the other groups downloading their digital photographs on a computer.

Genny J. Matt

Genny J. Matt reported that she has been a teacher for 20 years. She has been using computers in the classroom since 1996, the same year that the private high school academy introduced the school to the Learning with Laptops program. Her classroom was a pioneer classroom in the institution of laptop computer technology at the school. Genny J. Matt taught four Algebra I freshman-level classes. Two of them were freshman honors courses. Seventy-nine students were enrolled in her classes. Genny J. Matt reported that in all of her classes, the percentage of homework assignments per week involving homework is 20% and in the classroom students use 20% of class time on their laptop computers. Genny J. Matt reported using the computer to prepare lessons and to teach lessons.

When this researcher sat in on one of Genny J. Matt's freshman honors Algebra I classes, all 19 of the students had their laptops booted with the Investigations #1 document already loaded and opened. Eleven of the 19 girls were plugged into the wall, using electricity for their laptops; cords ran up and down the aisles leading to the plugs in the walls. Eight of the girls were using their computers' battery power. Earlier in the class, Genny J. Matt distributed a disk for students to copy the handout files to their computer hard drives. The handout files included an Investigations #1 assignment, Tip of the Week #9 and the Course Outline for second quarter. Genny J. Matt's room contained a teacher computer and printer in the front on the teacher's desk and one printer in the back of the room (Figure 9).

Also, in one corner of the room a scanner and Compaq desktop computer were located. On the back chalkboard the teacher had written:

> This Week's Quote: From Charles Babbage mathematician (1791-1871) early pioneer for computers " On two occasions I have been asked by members of parliament, Pray Mr. Babbage, if you put into the machine the wrong numbers, will the right answers come out? I'm not able to understand the kind of confusion that would cause someone to ask such a question."

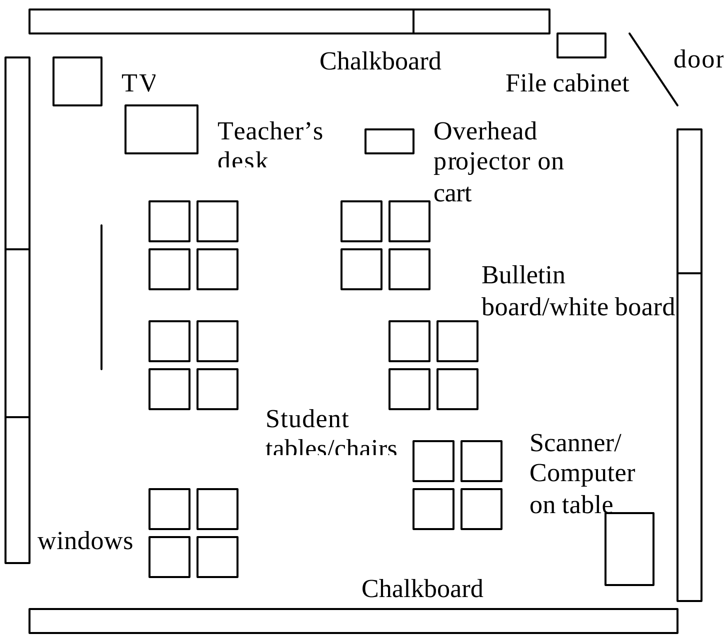
Additional instructions were on this board, along with "PLEASE DO NOT ERASE:" instructions on chapterbook readings; vocabulary lists; and problem assignments. On the white board on the sidewall were that day's instructions:

> Please bootup your computer; save/copy the Algebra I Investigation:
>
> 1. file to your math folder, desktop or C: drive. Open the file and wait for the class to start.
>
> 2. Tip of the Week #9: Questions Anyone
>
> Today's skills will focus on asking the right question to solve a problem situation.
>
> 3. Introduction to the problem ' class discussion' – work with partners to answer question in Activity 1 --- make the table; define vocabulary; create a graph (making the graph: you may choose the method – paper and pencil in notebook; calculator, with sketch on paper; computer if you know how).
>
> Check your work with your table when you finish part 1 and let me see your work.

Genny J. Matt gave students instructions at the beginning of class from the tv projection device that was connected to her laptop computer. Students were asked to load the same problem that was projected on the television, and in groups of two, solve the problem and graph it on their graphing calculator.

Figure 9

Genny J. Matt's Classroom Configuration



One student had graphed the answer on her graphing calculator and Genny J. Matt asked her to show the answer on the overhead projector. A special data projector was turned on, to which students were allowed to connect their graphing calculators. The student plugged in her graphing calculator to project the information on her graphing calculator to the overhead screen:

Window Xmin = 0 Xmax = 100 Xsc1 = 10.

Genny J. Matt asked the student to go to the table setup and enter values and show what the X and Y values were for each.

During the observation period this researcher sat at a set of four tables in the back of the room. The area was apparently off limites to students because the teacher had placed a sign that ready:

"Please do not sit at this table. Thank you. Mrs. Genny J. Matt ☺!"

Genny J. Matt asked the class what they would do if a student worked the equation a certain way. Students collaborated with each other freely, asked questions, even while the student was at the overhead working the problem. Genny J. Matt asked a question, "How many tickets need to be sold to get $940?" The student up front displayed the answer "48 tickets" on the overhead. Students were seated in their seats. Some students were using their graphing calculators. Some students were on their laptopas typing in or making a table. Genny J. Matt continued, "What is the input variable for the table?" A student answered correctly, "X is the input variable or number of tickets." Genny J. Matt continued questioning, "What is the synonym for an input variable?" A student answered, "Domain." "What can we use to describe our domain?" Genny J. Matt asked. Various students responded that whole numbers is the domain. One student further added, "You can't have negative or positive tickets, but you can have whole numbers." Genny J. Matt asked the student at the overhead to explain how she arrived at the problem on the calculator. The student demonstrated to the whole class how to set up the table on the graphing calculator. Genny J. Matt continued questioning the students: "What is the output?" The students replied, "The revenue." The teacher continued, "What is the output variable?" The students responded, "The range." She explained to students that the X-axis represented the number of tickets sold and the Y-axis represented the amount of money gained. "What type of graph is this?" she asked. Some students responded with various answers such as scatterplot, discrete. The answer was discrete. The student who demonstrated at the overhead asked if she could she sit down. Genny J. Matt responded, "Yes."

Genny J. Matt picked up a paper copy of the document that was displayed on her television, moved over to the white board and continued with more questions: "How many tickets can you sell to get 50 dollars? How do you describe the number of tickets? Could it be zero? Could we have no tickets sold? Could zero be in the domain? What equation did you write to describe the number of tickets?" She wrote $y = 20(x)$ on the white board. She asked "What do we call y?" A student responded "The output variable.' She wrote $r = 20(n)$ on the white board and asked, "What do we call r? How do you put that in your equation? How do you decide what the window on your graphing calculator is going to be?" A student guessed that 100 tickets would be sold. One student pointed out that her table was showing 260 tickets. Genny J. Matt told her she should adjust her window to make it larger. The class quieted down considerably. Some students were on the computer, some were looking at Genny J. Matt as she continued. She put another equation on the board:

$x = kx$ (constant of proportionality).

She continued with a printed document of what the students had on their computers in one hand as she expressed with her lefthand; she told students she was reading from the document, they could follow along on their laptops if they liked. Genny J. Matt wrote on the board

r = \$20 per n tickets

She instructed students to answer the questions in the document regarding the relationship of "r to n." The students worked in groups of two to four. One student used her graphing calculator. Two students were sitting and thinking it through, it seemed. Eight students were completing the table on the computer. Most students sat with their legs crossed. One girl was sitting on one of her legs. One girl had both feet in her chair, tucked under her in a lotus-like position. The girls were encouraged by Genny J. Matt to interact with each other if they needed help building their tables. Genny J. Matt circulated the room and worked with girls individually. Some girls were relaxed and talking, but also seemed to be working. Students were asked near the end of class to

write a summary of what they learned in a Word document and if they were done, to answer the questions on page five. Genny J. Matt instructed the students to answer the investigation follow up questions. Students were in a humorous mood yet seemed to be
on task as they wrapped up the class assignment.

Near the end of class, Genny J. Matt asked students to either log the graph in their notebooks or on the computer, whichever they chose. At 3:26 p.m. students were still very much engaged in the lesson. Two students were logging their answers in their notebooks; one student was using the graphing calculator. Class ended at 3:35 p.m.. One student spent the entire class going back and forth from the math document to a website that gives out free fonts. Some students at this point changed their conversation to talking about their cats. One girl stated that this class was too much fun!

The girls seemed very relaxed with their laptop computers. One student was leaning against the credenza with her laptop balanced on her lap, her legs were crossed.Genny J. Matt asked students to give her their attention. She asked that they take their hands off the keyboards. Genny J. Matt stood at the white board and asked, "If I say one variable varies directly with another, what is the equation to model that?" A student answered correctly, " y = kx." Genny J. Matt continued, "What if x = 3 and y = 4.5, two data points, could I find the constant of porportionality? What is the equation to make these two values happen?" She wrote on the white board (4.5)/3 = k; if x = 10 and asked, "What is y going to be?" Students were now half listening. Some were packing their belongings. It was 3:34 p.m. Only one minute until the bell rings! One student began a conversation with the teacher. One student was on the calculator. Genny J. Matt asked students to save on their laptops what they had so far. She stated that the homework assignment was listed in the syllabus file. She ended the class by stating they would continue with the investigation next class.

Maria Rodriguez

Maria Rodriguez reported that she had been using computers in the classroom since September 2000 at the private high school academy. She rated herself as a level six out of seven levels for enthusiasm for using computers in the classroom. She taught five classes with a total of 86 students. Four of those classes were World History and one class was a Latin American Studies course. In the World History classes she reported that her students used computers 90% of the class time and 50% in the Latin American Studies course. Seventy-five percent of the homework done in Latin American Studies had to be completed using the computer and 90% in the World History classes, as reported by Maria Rodriguez. Maria Rodriguez also reported using the computer to prepare for her classes and to teach the lessons.

When this researcher visited one of Maria Rodriguez's World History classes, the topic was 'Slavery in the Americas.' Twenty sophomore girls were present in that class. Maria Rodriguez's class materials included a video clip from the *Amistad* movie shown using the videocassette recorder and television, the computer, and the white board with the following instructions written on it:

Check here when you have finished reading #5 about the middle passage:

(Answered)

Journal #13: What are your initial reactions to the piece of the movie you just watched?

12/6 WH

Journals #9-12 due today by 3:35; WHASSIGN 5: African Slavery in the

Americas

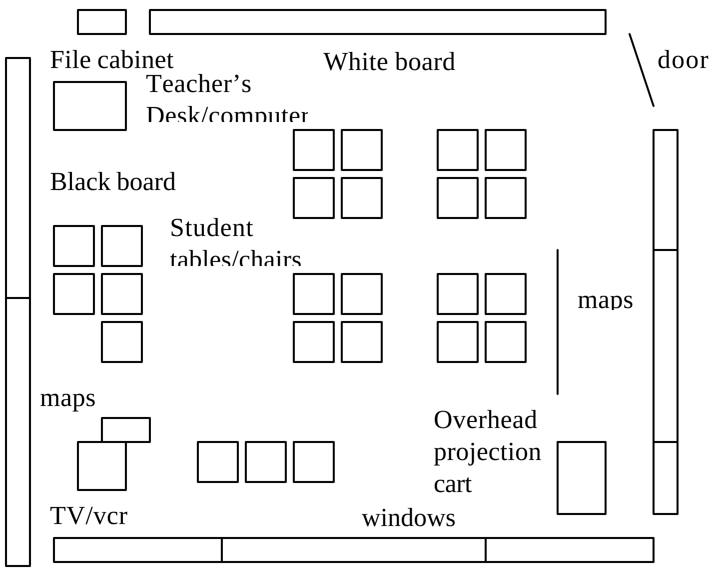
Amistad – Journal #13

Maria Rodriguez began the class by passing around diskettes, asking students to copy the file WhAssign5. Students were instructed to open the file after copying. Maria Rodriguez asked students whether they had access to the Internet. Most of the students raised their hands affirming that they could go online. Maria Rodriguez circulated the room checking to make sure each pair of students had access to the Internet on at least one of their laptops. Twenty-four tables and chairs were crammed into the small corner classroom in groups of four, facing each other (Figure 10). Maria Rodriguez barely had enough room to maneuver between the tables as she assisted students. After she verified that each group had at least one working computer with access to the Internet, and had successfully loaded the files from the diskette, Maria Rodriquez began verbally quizzing students about slavery. "What were the main issues about slavery in this country?" she asked. One student answered that it was about economics and the need for "non-profits" to work on the sugar plantations. (Maria Rodriguez corrected the student: "They were slaves, not non-profits"). Maria Rodriguez explained that she wanted students to open the file WHAssign5 on "Slavery in the Americas" and click on the Narrative link in the file and read it. She allowed them time to read, then asked them to click on the "Europeans Come to Western Africa" link and read that. After going to the Internet and reading those passages, students were instructed to read the section on the "African Slave Trade and the Middle Passage."

Maria Rodriguez instructed students that after the group had read all of the material, someone from the group was to go to the board and put a check mark that their group was done.

Figure 10

Maria Rodriguez's Classroom Configuration



Students quietly read and discussed the passages in each group. One student read from the Internet to the other, while the other student typed in the answers to the questions. There were 10 pairs of students. In four of the groups, one of the partners wrote the answers to the questions from the reading with pencil and paper, while the other partner navigated the Internet site and read for answers to the questions. In the other six groups, one of the partners typed the answers in Microsoft Word, while the other navigated the Internet.

Most students at this point had read the text and were looking at the photo "European tastes the sweat of an African." Some groups were discussing the photo. In one group, both students were on the Internet looking at their own screens with very little interaction. The groups in which only one student operated the computer while the other looked on tended to be more interactive and more verbally engaged with each other. Maria Rodriguez at this point circulated the room, checked students' progress and offered explanations. She answered specific groups' questions about the text and photos. One student got up to put a check on the board signifying that her group had completed the assignment.

Maria Rodriguez came over to where this researcher was seated and whispered that her earlier class did the same assignment, but did not get beyond discussing the video clip, and that class would have to continue the lesson on next class. She told this researcher that students would watch the video after everyone was done with the reading assignment. For the video, students were required to record using Microsoft Word their reflections of the lesson in their electronic journals. Maria Rodriguez stated that she collected the journals via e-mail twice each quarter. She also reported that she gives feedback to students by commenting on their reflections and e-mailing them back. Another student got up and put a check on the board.

Students were talking more, having spent time reading and digesting the material. In one group, a student read aloud to her partner. In another group, a student read the question to her partner and typed the answer as the other student responded. Another student got up and put a check mark on the board. Maria Rodriguez stated that she tried to address a variety of student learning modalities in the classroom as much as possible. In this class, she reported earlier that she would be addressing the kinesthetic learner by having students get up and put a check mark on the board. Another student put a check mark on the board.

Maria Rodriguez went to her desk and sat down as she looked around the room. She had circulated around the room twice already. Students were quietly talking amongst themselves as they completed the questions. There were five groups left to put a check mark on the board, signaling total class completion of the assignment. Another student got up to put a check mark on the board. Five of the girls were leaning on one hand with it cupped under their chins, as if to prop up their heads. One girl extended her body forward, half-lying on the desk. Ten of the girls were seated properly in their chairs with their backs against the backs of the chairs. Two girls were slumped forward. Another girl put a check mark on the board. The girls who were done were still engaged in the assignment, answering the rest of the questions. Another girl put a check mark on the board.

The sun streamed in through the large windows and yielded a lustrous, mellow aura in the classroom. It was 1:34 p.m. in the afternoon. Students were very relaxed and attentive to their Internet site explorations on slavery. Another student put a check mark on the board. One group interrogated Maria Rodriguez about one of the photos on the website. She interpreted the dichotomous nature of the photo, how a slave looked relaxed in the photo, although violence seemed to be portrayed also.   Maria Rodriguez said she thought the intent was to show the violence coupled with the…(she trailed off, using her hands to complete the sentence… the student nodded and seemed to understand the completed idea). One student blurted out that she forgot to read the directions first so she was just getting the connections between the various components of the assignment. Maria Rodriguez went over to her and jovially said, “That’s just like you, complain first, then read the directions.” The student laughed.

Another student got up to put a check mark on the board. Maria Rodriguez began working with another group. Another student projected, “So, what’s our reaction? Is it *impulsive*?” Maria Rodriguez corrected the student, “You mean *repulsive*”. As her partner typed, the student continued, “By throwing living slaves overboard, they were throwing away lives (as she wringed her pencil through her fingers), even though they were not healthy. Instead of… like… helping them get better…they just threw them overboard! If a white were to get sick, they would help them, but because it was a slave they just threw them overboard.”

Maria Rodriguez came over and asked if it was okay to talk to this researcher, at which this researcher nodded, " Yes." She whispered, "Did this researcher notice that one group was holding up everyone else?" She said it was because their group's laptop stopped working. They lost Internet connection and she had to loan them her laptop so they could complete the assignment. She stated that this happened quite often holding up the rest of the class. So far, 9 of the 10 groups had put a check on the board, indicating that they were done, but this one group had not been able to do that yet.

Maria Rodriguez asked students to stop what they were doing and told them to close their laptops so as not to be distracted. She explained they were going to watch an eight-minute clip from *Amistad*. She explained that the clip was very intense. It was about a lawyer who is telling the story of the slave and what happened when he was kidnapped. The classroom was so crowded that students had to move their heads to see the video located in the back of the room. Three students had to move closer together. Maria Rodriguez started the video and seated herself on top of the extra student desks near the television and videocassette recorder unit by the window.

Maria Rodriguez stopped the video and explained that the place in the video was located on the West coast of Africa where slaves were being captured for the Spanish. A student asked, "So the Africans captured their own people?" Maria Rodriguez explained that the Africans they were capturing were from another tribe. She started the video again and let it play for a few minutes. She stopped it again as the slaves were loaded on the ship. Maria Rodriguez told the students to note that the priest was blessing the slaves and forgiving *them* for their sins. A couple of students snickered at her comment. Maria Rodriguez told them to remember that the Europeans were trying to justify what they were doing by saying the slaves were not Christians.

She started the video again for three minutes. She stopped the video to explain that stripping the slaves physically stripped them of their dignity. She explained that taking the slaves through such atrocities was purposeful to cause the slaves to lose their dignity and not be able to fight back. She started the tape again. She stopped it and instructed students to notice that slaves were brought on deck to watch others get whipped in order to break their spirits. Maria Rodriguez pointed out a woman who jumped overboard representing a form of rebellion and resistance to inhuman conditions. Students were very intense when watching the movie. Two students had their hands over their faces as slaves were being whipped. One student flinched with every whip. Maria Rodriguez stopped the tape to explain that food became a competition on the ship and a source of fighting in their struggle to survive.

Maria Rodriguez stopped the tape and asked students to write the "Journal #13" question down that was written on the board. She instructed them to reflect on what they had viewed in the video and to record their initial reaction to the clip. Students were busy typing in the question and making an entry. It was 2:03p.m. The bell to end class sounded at 2:05 p.m. A student asked if the journal question was for homework. Maria Rodriguez responded that it was homework if they did not finish. She said she would allow them a couple of minutes at the beginning of the next class to respond because she wanted to know their initial reactions. She opened the curtains covering the windows behind the videocassette recorder-television unit. Students shut down their laptops and put them away in their laptop cases.

Sam

This researcher met Sam in the hallway one day at the private high school academy and her enthusiasm for using technology in the classroom shone through at that time. She explained that her Biology classes used a CD-ROM of curricular materials to supplement the textbook.

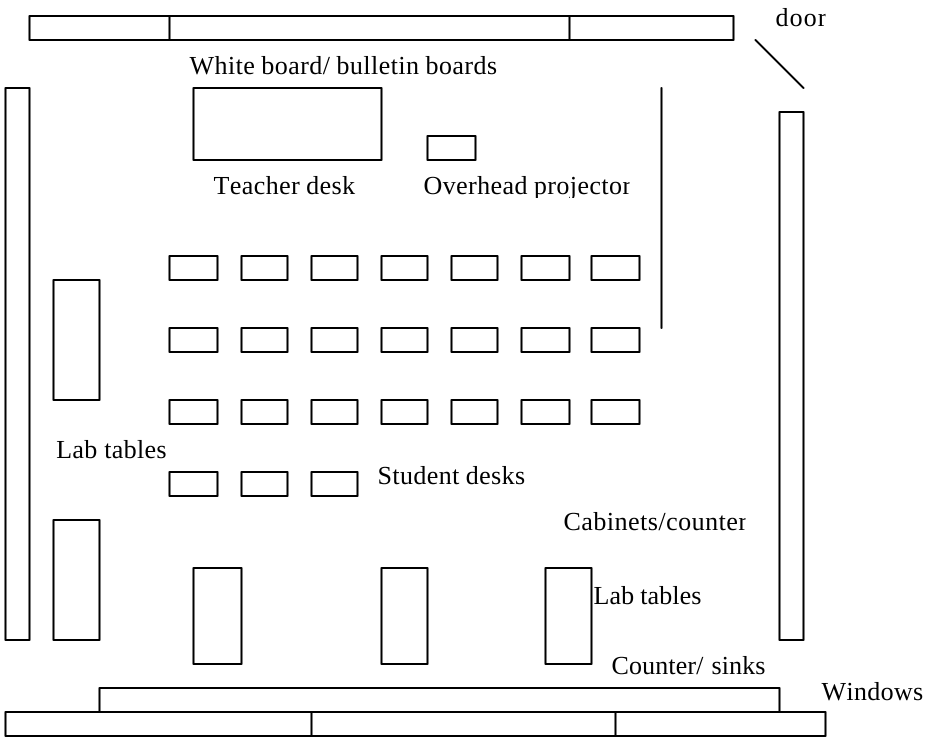
Students went online to research science topics quite often. Sam has a Ph.D. and reported that she has 10 years of part-time teaching experience at the college level, and has been teaching at the private high school academy for two years. She reported that she has only been using technology in the classroom since March 2001. Sam taught five freshmen Biology classes including two honors courses to 91 students. She reported that her students used computers in the classroom 50 to 75% of the time. She reported using the computer both to teach and prepare lessons for all of her classes.

This researcher observed Sam in an honors Biology classroom of 17 freshmen girls who were studying the replication of homologous pairs of chromosomes. Sam used an overhead projector and laptop computer from her teacher desk in the front of the classroom where she stood most of the class time. The physical layout of the classroom included 24 student desks arranged facing the teacher desk and lab tables outlining the outer perimeter of the room (Figure 11).

Sam opened the class by asking students questions regarding the reading assignment, working up to the question “What is a homologous pair?” Students asked and answered questions at random. Some students raised their hands. Others just interjected and asked as Sam was talking. Sam took a seat at her desk as she turned on the data projector after 10 minutes of questioning and went to the CD-ROM file on Bio-Inquiry. Students had already been given a copy of the CD-ROM. All of the students had their laptops opened. Some students were either taking notes in Microsoft Word or following along on their laptop screens with what Sam had projected on the overhead screen. Some students were in various places in the CD-ROM different from Sam.

Figure 11

Sam's Classroom Configuration



Sam pointed to a slide that described chromosome replication and asked students to identify the pairs and what they were. Students did not answer correctly at first so Sam got up and pointed to the overhead screen with her finger. She then pointed to a drawing on the board (Figure 12). A student answered that they were sister chromatids. She acknowledged the student's correct answer and then moved over to the board to draw a drawing of replicated homologous pairs (Figure 13). She moved on to the next slide about chromosome replication, meiosis. She pointed to the drawing on the board (Figure 12), and also turned around (she was seated very close to both the board and the overhead screen) to use her laptop mouse to show the same on the overhead.

Figure 12 Meiosis: Chromosome Replication

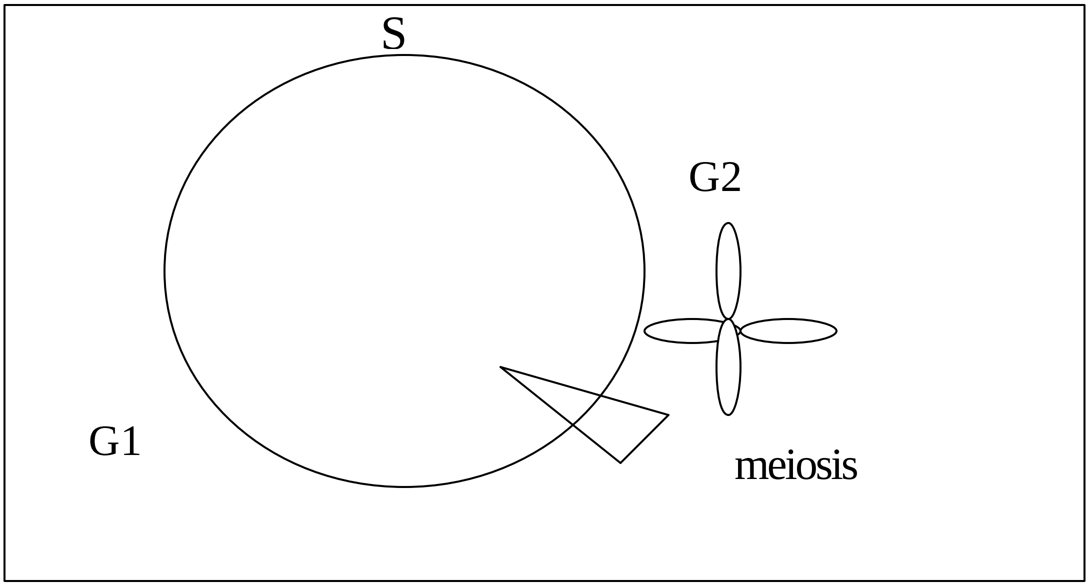
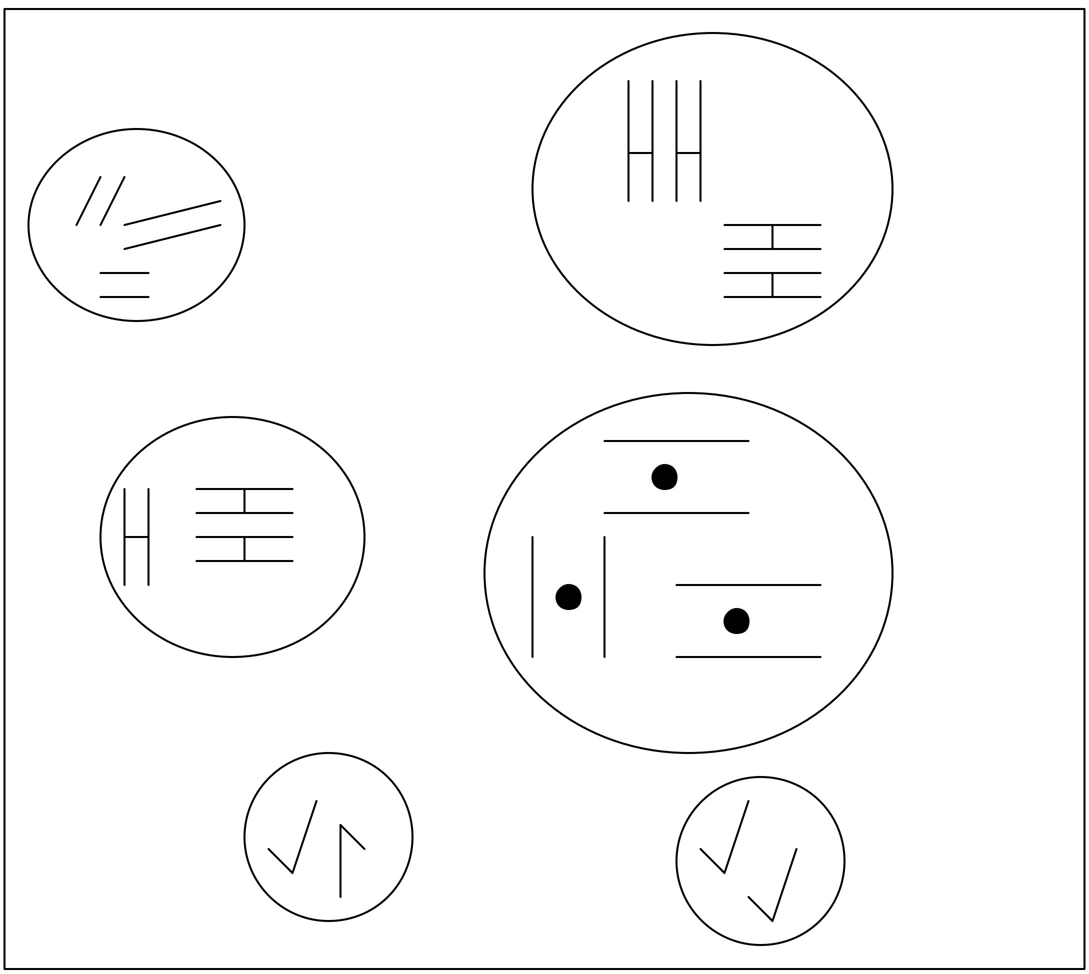


Figure 13 Replicated Homologous Pairs



A student asked, “What is the definition of sister chromatids?” Sam responded, "Sisters are exact copies. Homologous pairs will be the same length, can be cut out and matched up from any given cell.” She continued, “Females have 23 pairs of chromologuous chromosomes and males have 22 chromologuous pairs with one non-homologous pair, X and Y. Females are XX. Males are XY.” A student asked, “Why is that?” Sam responded, “Because of the ‘Y’.”

She moved to the next slide on chromosome replication, meiosis. A student raised her hand. Sam acknowledged her. The student asked, “So, they replicate so there are two in each cell…could you explain one more time the drawing on the board?” Sam pointed to the drawing and explained what G1, G2 and meiosis processes are. The student was feverishly typing in Sam’s explanation. Sam asked the student if that explanation was sufficient. The student attempted to re-hash her understanding of the processes, what G1, G2 and meiosis does. She explained part of her answer incorrectly. Sam interrupted her at that point as she corrected her, pointed to the board and explained the process again. Another student asked about homologous pairs. Sam gave her the answer. Another student asked about the drawing and the process on the board again. Sam pointed to the board and gave her an explanation, as another student interjected to help the student understand. Some students were trying to gain a sound understanding of chromosome replication by asking questions and offering explanations in their own words. Most students were quietly typing in the notes while the same six students continued to ask questions. The students who were asking a succession of questions had the Bio-Inquiry file loaded on their computer laptops. The other students were using Word to type up their notes.

Sam continued with the lecture, switching to an explanation of the diploid and haploid cells. She explained that each trait comes in two forms; one is contributed from each parent, but they separate during meiosis. She continued, “Mendel’s law of segregation expanded to say each pair of homologous chromosomes will separate: one goes to one gamete, and one to the other." Some students struggled to learn the process. Sam allowed them to ask questions until they learned what they needed.

Sam switched from lecturing the class to explaining the lab assignment. Students were given a lab handout and instructed to form two paired groups among themselves: group A and group B. Group A was assigned to work with the red and blue pop beads representing girl chromosomes. Group B was instructed to work with the green and yellow pop beads representing boy chromosomes. Sam had cups of beads in each color to represent the chromosome pairs on the lab tables in the back of the classroom. Students were instructed to get in their groups, make their pairs and produce an offspring. Students were also directed to the textbook section on cellular scaffolding.

Students moved to their lab stations in the back of the room. Students grouped themselves. Students seated themselves at each lab table in two paired groups: one group represented the boy chromosomes and one group represents the girl chromosomes. Sam was at her desk, listening to students in their groups. She assisted some students who were struggling with the process of cell division. One student in one of the groups explained to the rest, as they constructed the lab.

As this researcher moved from lab table to lab table, the group dynamics were different from group to group. One person in the group reading the instructions, while the others in the group executed the instructions drove some of the groups. One group relied on the instructor for more explanation. Sam was seated at her desk for a time. She allowed students to come to her and ask specific questions. She used the CD-ROM loaded on her laptop to point them to specific slides. She used the white board to review and explain also. One group used the handout to move the chromosome division from one figure to another; at one point they located the same step in the textbook and referred to that. Sam assisted another group at the board. She drew a circle with chromosomes in it and explained the process to the two students at the board. Another student went up and interrupted with a question regarding how to draw a map. Sam enlisted the assistance of another student to help the student with drawing the figure. She also instructed the student to come down later to “the box” to pick up a handout on it. “The box” is a spot in the science department where students can drop off or pick up assignments and handouts. The science department was located on the ground floor of the main building. Sam’s classroom was set up with beakers and flasks on pegboards on one wall. The periodic table decorated another wall. A student printer was perched on the counter along the wall with windows. Two microscopes occupied one counter.

The noise level in Sam’s room during lab time was a constant flow of animated conversation about the lab. Some students began to get a bit fidgety and talk about other things. Sam circulated among some groups then went to the board and called the class’ attention by speaking loudly. Conversation lowered considerably as she reviewed and explained the drawing on the board (Figure 13). One student was standing next to her, looking at the periodic table on the bulletin board. Another group engaged Sam in explaining the replication and copy making of chromosomes. The rest of the class resumed their group work. There were nine minutes left until class would end. Sam walked over to a group’s table and used the pop beads to further explain the chromosome replication process. She pointed to the drawing on the board and using the pop beads let them know how the process worked. She explained that the genes were all strung out in the drawing on the board, but normally would be twisted.

A Typical Day for Teacher Technologists as Described in the School Environment

School Technology and Readiness Perspectives

As part of painting the picture of what it is like as a formal and informal teacher technologist on a typical day in each of the schools, each of the 10 teacher technologists completed the online School Technology and Readiness (STAR) questionnaire as offered by the CEO Forum as a tool to further identify their knowledge of their school's preparedness for the use of computers in the classroom. Each participant completed the online STAR questionnaire located at http://www.ceoforum.org/starchart.cfm, under the K-12 STAR chart link. The results of the 20 multiple-choice questions (See Appendix M) were reported back immediately to each participant. Each participant printed a copy of the results, each of which is reflected in this analysis. The results of the online questionnaire categorized each participant's answers into five areas. A school could be reported as prepared for technology use in the classroom in the areas of hardware, connectivity, content, professional development, and integration and use. In each of those areas the teacher technologist reported his or her perceived profile of the school's technology preparedness on one of four levels: low tech, middle tech, high tech and target tech as shown in Tables 6, 7, 8 and 9 (STAR 4, 2003). The responses to this questionnaire further identified how technology was currently being practiced at these two schools. At the CEO Forum website, the results of each of the teacher technologists' responses to the questionnaire were averaged and a school profile of low tech, middle tech, high tech and target tech was assessed as shown in Table 10 (STAR 4, 2003). Each teacher technologist provided a perspective on the school's practice and use of technology in the following areas: hardware; connectivity; professional development; content; and integration and use.

Table 6

Hardware and Connectivity – Use /Availability of Computers and the Internet (STAR 4, 2003)

	Students per instructional computer connected to the Internet	Technical Support	% of Instructional rooms and administrative offices connected to the Internet	Quality of school's connection to the Internet	Use and availability of other forms of hardware technology
Early (Low) Tech	More than 10	Takes several days	More than 25%	Dial up access on some computers	VCRs, cable TV, projection devices, calculators
Developing (Mid) Tech	10 or less	Takes place next day	50% or more	Direct connectivity on campus and in some classrooms	VCRs, cable TV, telephones, voice-mail, projection devices, digital cameras, calculators
Advanced (High) Tech	5 or less	Takes place same day	75% or more	Direct connectivity in most classrooms; adequate bandwidth	Wide variety of VCRs, cable TV, telephones, voicemail, random access video, projection devices, digital cameras, scanners, portals, personal digital assistants, two way video conferencing, calculators
Target Tech	1 student per instructional computer connected to the Internet	Tech support available 24/7	100% or more of all instructional rooms and administrative offices are connected to the Internet	Direct connectivity in all classrooms with adequate bandwidth to prevent delays	There is a broad use of a wide variety of other technologies such as two-way video conferencing, VCRs, cable, TV, telephones, voicemail, random access video, PDAs, projection devices, digital cameras, scanners, portals, calculators, thin clients, servers, etc.

Table 7

Profiles on Technology Professional Development (STAR 4, 2003)

	Delivery and format of professional development	% of technology budget allocated to professional development	Understanding and use of digital content by educators
Early (Low) Tech	Trainer-led instruction	Less than 10%	100% at entry or adoption phase A few use for lesson planning
Developing (Mid) Tech	Trainer-led instruction Embedded help within applications	11-15%	100% at adaptation phases Some begin to use with students
Advanced (High) Tech	Online mentoring	16-29%	100% at appropriation phases
Target Tech	Anytime, anywhere	30%	100% at appropriation or invention phases

Table 8

Digital Content – Profiles on Software Use For Students and the Educator (STAR 4, 2003)

	Software Format	Educator Role of educator and degree to which digital content is integrated into instruction	Students Students employ digital content to enhance learning	 % of students using digital content and frequency of use	Content budget allocation to purchase digital content
Early (Low) Tech	Receives information/tools from prepackaged software	Teacher-centered Supplement instruction with digital content	Reinforce basic academic skills	50% or more Weekly	Use some supplemental instructional materials funds only
Developing (Mid) Tech	Receive information from CD-ROM and searchable, online content	Teacher-directed Beginning to integrate into instruction	Use for research, communications and presentations	75% or more 3-4 times a week 20% have online course units available to expand opportunities	Use significant instructional materials budget, but little to no textbook budget
Advanced (High) Tech	Manipulatable digital content and tools available commercially and on the Web	Teacher-facilitated in local or distant classrooms Fully integrate into instruction and use for research, planning, multimedia presentations and simulations, and to correspond and communicate	Use for research, to solve problems, to analyze data, to collaborate and to correspond with experts and to become content producers	100% Use digital content daily, but activities are isolated by grade, disciplines, classes 30% or more have online course units available to expand opportunities	Scrutinize entire budget as appropriate and shift funds from textbook budget to acquire digital content
Target Tech	Full range of digital content and tools structured to support production and collaboration	Student-centered in local or distant classrooms; teacher as guide Digital content changes the teaching process, allowing for greater levels of inquiry, analysis, creativity and content production	Digital content changes the learning process, allowing for greater levels of collaboration, inquiry, analysis, and creativity	Seamlessly integrated throughout all classes and subjects on a daily basis 100% have online course units available to supplement and expand school course offerings	100% instructional materials budget is available to purchase “most appropriate” content

Table 9

Integration and Use – Profiles on the Use of Technology in the Classroom (STAR 4, 2003)

	Student achievement & 21st century skills	Alignment and continuous improvement	Assessment	Equity of access
Early (Low) Tech	Demonstrate improved academic skills	25% align standards, curriculum and assessment using technology	25% or more beginning to integrate digital strategies into assessment Limited use of fixed answer format	Some students have access to technology to reinforce basic skills
Developing (Mid) Tech	Demonstrate some improved mastery of 21st century skills	50% align standards, curriculum and assessment and report results 25% monitor and measure results to inform new instructional decisions	25% or more use digital strategies for assessment	Can access Internet at times other than school hours All teachers are appropriately trained to integrate technology
Advanced (High) Tech	Demonstrate mastery of 21st century skills	100% align standards, curriculum and assessment using technology and report results 50% monitor and measure results to inform new instructional decisions	50% or more use digital strategies for assessment Experimenting with technology for measurement and accountability	Can access digital content at times other than school hours 75% or more of students use technology to develop 21st century skills
Target Tech	Demonstrate improved student achievement and mastery of the full range of 21st century skills	100% align standards, curriculum and assessment using technology 100% monitor and measure results to support teaching and learning and link to continuous improvement	Systematic continuous improvement using digital content and tools Use of technology for measurement and accountability	Equitable access technology to all students anytime, anywhere 100% of students use technology to develop 21st century skills All students have the opportunity to achieve and to receive remediation

Integration and Use – Profiles on the Use of Technology in the Classroom (STAR 4, 2003) (cont.)

	Using research	Administrators	Parental and Community Involvement
Early (Low) Tech	Schools inconsistently apply ad hoc research	Communicate objectives w/ other administrators and teachers	One-way access to school web pages which communicates policies, standards and initiatives
Developing (Mid) Tech	50% review external research and apply appropriately 50% conduct internal research on program effectiveness 50% of schools use IT for planning 25% of teachers use IT in classrooms for ad hoc action	Use technology to collect data and communicate with constituents Initiate some data driven decision making	Limited access to two-way communications link via email and privacy-protected web tools (e.g. to obtain individual attendance and assessment data)
Advanced (High) Tech	100% use external research and apply appropriately 100% conduct internal research on program effectiveness 100% use IT in classrooms and administrative planning to collect and manage data to improve current operations	Use technology to collect data and analyze results Use technology for data driven decision making	Communicate two-way via e-mail, and privacy protected web tools, e.g. to access some school information and resources from home
Target Tech	100% of schools and districts systematically use external and conduct internal research 100% of teachers and administrators to collect and manage data to guide decisions and inform continuous improvement	Use technology to set policies, procedures, analyze performance, report and communicate with constituencies Use technology to manage continuous improvement	Parents actively involved in defining educational objectives, setting individual student learning plans and able to view results via privacy protected web tools Community involved in defining educational objectives and informed of results and district level interventions via privacy protected web tools

Table 10

School Technology And Readiness Profiles (STAR 4, 2003)

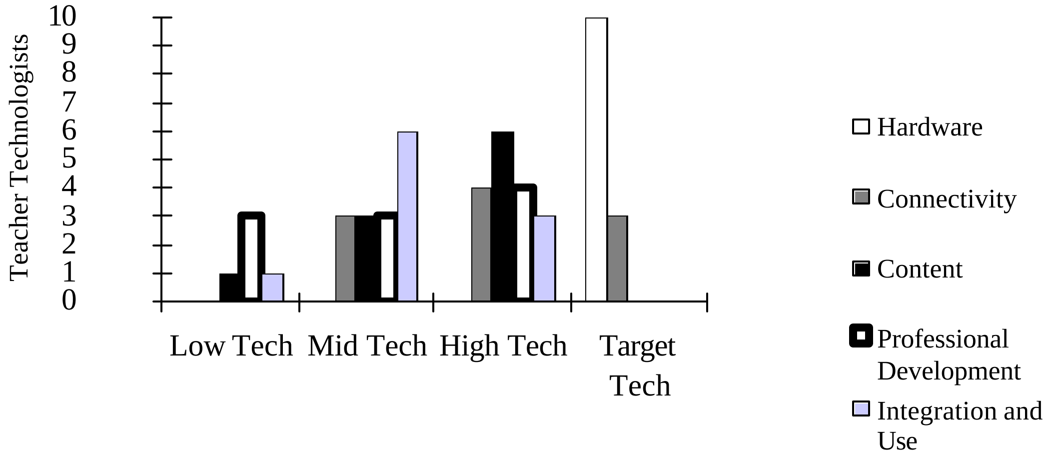
School Profile	Educational Benefits
Early (Low) Tech	Master basic academic skills through linear drill and tutorial software
Developing (Mid) Tech	Improve 21st century higher-order critical thinking with access to multimedia content Greater information resources available for research and education from Internet and CD-ROM
Advanced (High) Tech	Improve 21st century skills especially higher-order thinking, research, research, collaborative and skills Most students/teachers able to communicate with parents, experts, other students and teachers outside school
Target Tech	Improve student achievement Develop and support the full range of 21st century skills that students will need to thrive in today's educational environment and tomorrow's workplace Promote student-centered authentic project-based learning All students/teachers able to communicate with parents, experts, community members and teachers outside the school Learning at home and at school occurs seamlessly

Hardware

In the area of hardware, all of the participants reported their schools at the target tech level (Figure 14). All of the participants from the private high school academy rated their school as target tech in hardware availability; that is, each of the students has an instructional laptop computer and technology support is available. Also, each of the teachers in the private high school academy had access to a desktop computer in each of the classrooms. Four of the seven teachers reported the use and availability of other forms of hardware technology at the private high school academy such as VCRs, cable TV, telephones, voicemail, projection devices, digital cameras, and calculators. Three of the seven teachers reported other hardware technology such as personal digital assistants (PDAs), and scanners available at the private high school academy.

Figure 14

Ten Teacher Technologists' School Technology and Readiness Perspectives



At the public middle school academy, Mkad reported one instructional computer per student, whereas Gdad and Sophia Loren reported five or fewer instructional computers per student. There were 28 student desktop computers in the computer literacy lab. The school had 15 e-Buddy laptop web computers available for teachers to check out for classroom use. At the public middle school academy, when participants were asked how long does it take to receive technical support, Mkad responded “It takes place the next day,” Gdad responded “It takes place the same day,” and Sophia Loren responded “Tech support available 24/7.” Each of the teachers in the public middle school academy had access to a desktop computer in each of the classrooms. Each of the participants at the public middle school academy reported the use and availability of other forms of hardware technology such as telephones, voicemail, video, personal digital assistants, digital cameras, scanners, calculators, and projection devices.

Connectivity

At both schools involved in this study, all 10 of the teacher technologists responded that 100% of all instructional rooms and administrative offices were connected to the Internet. At the private high school academy, Bailey Ma, Genny J. Matt, 7SeatRulz, Maria Rodriguez and Sally T. Smith rated the school as target tech in response to the quality of the school's connection to the Internet; all responded that adequate bandwidth connection to prevent delays is available in all classrooms. Ara B. Jaamz and Sam rated the private high school academy as high tech in the area of connectivity; they responded that adequate bandwidth connection to prevent delays is available in most classrooms. At the public middle school academy, the three teacher technologists responded that there is adequate bandwidth connection to prevent delays in all of the classrooms.

Professional Development

In the area of professional development at the private high school academy, three of the participants rated the school as high tech, two of the participants rated the school as mid tech and one participant rated the school as low tech. When asked what forms do delivery and format of professional development take, Bailey Ma, Genny J. Matt and 7SeatRulz responses were "anytime, anywhere." Ara B. Jaamz, Maria Rodriguez and Sam responded that professional development is in the format of "trainer-led instruction," and Sally T. Smith responded "trainer-led instruction and embedded help within computer applications." For the question of their perceptions about what percentage of the technology budget was allocated to professional development, six of the seven teacher technologists at the private high school academy responded " less than 10%." Two of the teacher technologists at the private high school academy responded "11 to 15%." In response to the question "what is the understanding and use of digital content by educators?" Five of the teacher technologists at the private high school academy responded "100% at adaptation phases; some begin to use with students." Sally T. Smith responded "100% at appropriation phases." Genny J. Matt responded "100% at appropriation or invention phases" (See Table 11).

At the public middle school academy, in response to the question "what forms do delivery and format of professional development take?" Mkad, the formal teacher technologist responded "anytime, anywhere." Both Sophia Loren and Gdad responded, "trainer-led instruction." Varied responses to the question concerning what percentage of the technology budget was allocated to professional development produced "11 to 15%" from Mkad, "16 to 29%" from Gdad, and "less than 10%" from Sophia Loren.

Table 11

The Stages of Professional Development - Apple Classrooms of Tomorrow (CEO Forum, 2003)

Entry	Educators struggle to learn the basics of using technology.
Adoption	Educators move from the initial struggles to successful use of technology on a basic level (e.g. integration of drill and practice software into instruction).
Adaptation	Educators move from basic use to discovery of its potential for increased productivity (e.g. use of word processors for student writing, and research on the Internet)
Appropriation	Having achieved complete mastery over the technology, educators use it effortlessly as a tool to accomplish a variety of instructional and management goals.
Invention	Educators are prepared to develop entirely new learning environments that utilize technology as a flexible tool. Learning becomes more collaborative, interactive and customized.

In response to the question "What is the understanding and use of digital content by educators?" Sophia Loren responded "100% at entry or adoption phase; a few use for lesson planning." Mkad and Gdad responded "100% at appropriation phase" (See Table 11).

Digital Content

At the public middle school academy, Mkad and Gdad reported that software used at the school offered a full range of digital content and tools structured to support production and collaboration; Sophia Loren reported that the software format was information received from CD-ROM and searchable, online content, as was reported as well by Sam and Maria Rodriguez at the private high school academy. Ara B. Jaamz reported that the software format he used were prepackaged software tools and information. Bailey Ma and 7SeatRulz reported using software in the form of manipulatable digital content and tools available commercially and on the web. Sally T. Smith and Genny J. Matt reported using a full range of digital content and tools structured to support production and collaboration.

In response to the following questions on the STAR questionnaire (See Appendix B), teacher technologists responded:

(*Bailey Ma, 7SeatRulz, Ara B. Jaamz, Sally T. Smith, Genny J. Matt, Maria Rodriguez, and Sam are teacher technologists at the private high school academy; Mkad, Gdad and Sophia Loren are teacher technologists at the public middle school academy.)*

What is the role of the educator and degree to which digital content is integrated into instruction?

Genny J. Matt, 7SeatRulz – "Instruction is teacher directed and at the beginning stages of integrating digital content into instruction."

Maria Rodriguez, Sam, Ara B. Jaamz, Bailey Ma, Gdad – "The role of the educator is facilitation and that there is full integration of digital content into instruction for uses such as research, planning, multimedia presentations, simulations and communication."

Sally T. Smith, Mkad – "The role of the educator is student-centered instruction with the teacher as guide."

Sophia Loren – "The role of the educator is teacher-centered instruction, supplementing instruction with digital content."

How do students employ digital content to enhance learning in the classroom?

Mkad, Bailey Ma, 7Seatrulz, Sally T. Smith – "Digital content has changed the learning process, allowing for greater collaboration, inquiry and creativity."

Ara B. Jaamz, Genny J. Matt – "Students use digital content for research, to solve problems, analyze data, to collaborate, to correspond with experts and to become content producers."

Sophia Loren, Gdad, Maria Rodriguez, Sam – "Students use digital content for research, communications and presentations."

What percentage of students are using digital content and what is their frequency of use?

Ara B. Jaamz – "One hundred percent of students use digital content daily, but activities are isolated by grade, disciplines and classes and at least 30% have online course units available to expand opportunities."

Mkad, Gdad, Genny J. Matt, 7SeatRulz, Bailey Ma, Sally T. Smith – "Seventy-five percent or more of students are using digital content, three to four times a week, 20% of students have online course units available to expand opportunities."

Sophia Loren, Maria Rodriguez, Sam – "At least 50% of students are using digital content on a weekly basis."

What is the content budget allocation to purchase digital content?

Ara B. Jaamz, Sam, Maria Rodriguez, Sophia Loren – "Supplemental instructional materials funds only are used."

Sally T. Smith, Genny J. Matt, Mkad – "Significant instructional materials budget funds are used, but little or no textbook budget funds."

7SeatRulz, Bailey Ma – "One hundred percent of instructional materials budget is available to purchase most appropriate content."

Mkad – "The entire budget is scrutinized and funds shifted from textbook to digital content."

Integration and Use

Sophia Loren reported that technology helped students improve basic skills for the 21st century (CEO Forum, 2003). Sam, Gdad, Genny. J.Matt and Sally T. Smith reported that technology helps students demonstrate some improved mastery of 21st century skills. Ara B. Jaamz, Bailey Ma, Maria Rodriguez, Mkad and 7SeatRulz reported that technology helped students demonstrate mastery of 21st century skills.

According to the CEO Forum (2000) and as adopted from the ISTE (International Society of Technology Educators), developing 21st century skills entail:

- the ability to be proficient in the use of technology;
- the ability to communicate information and ideas using a variety of media and formats;
- the ability to access, exchange, compile, organize, analyze, and synthesize information;
- the ability to draw conclusions and make generalizations based on information gathered;

- the ability to know content and be able to locate additional information as needed;
- the ability to evaluation information and sources;
- the ability to construct, produce, and publish models, contents and other creative works;
- the ability to become self-directed learners;
- the ability to collaborate and cooperate in team efforts;
- the ability to solve problems and make informed decisions; and
- the ability to interact with others in ethical and appropriate ways.

At the private high school academy, when asked “What percent of your school or district aligns standards, curriculum, assessment and/or uses technology for continuous improvement,” Bailey Ma and Genny J. Matt responded “100% of the school align standards, curriculum and assessment using technology”; Maria Rodriguez and Sally T. Smith responded “50%”; and Ara B. Jaamz , Sam and 7SeatRulz responded “25%.” At the public middle school academy, Mkad responded “100% align standards, curriculum and assessment using technology”; Gdad responded “50%”; and Sophia Loren responded “25%.”

In response to the following questions on the STAR questionnaire (See Appendix B), teacher technologists responded:

<u>What percent of your school or district integrates digital strategies into assessment and/or measures 21st century skills?</u>,

Sally T. Smith, Ara B. Jaamz, Sam, Sophia Loren – “Twenty-five percent or more are beginning to integrate digital strategies into assessment, limited to the use of fixed answer formats.”

Gdad, Mkad – “Fifty percent or more integrate digital strategies into assessment, measuring 25% of 21st century skills.”

Bailey Ma – "Seventy-five percent or more integrate digital strategies into assessment, measuring 50% of 21st century skills and using multiple formats including project- based assessments, portfolios and simulations."

Maria Rodriguez, 7SeatRulz, Genny J. Matt – "Fifty percent or more integrate digital strategies into assessment, measuring 25% 21st century skills."

What percent of students has continuous access to technology?

Bailey Ma, Sally T. Smith, Genny J. Matt and Maria Rodriguez – "Students have equitable access to technology anytime, anywhere and 100% of students use technology to develop 21st century skills; all students have the opportunity to achieve and receive remediation."

Sam, Ara B. Jaamz – "Students can access digital content at times other than school hours; 75 or more of the students use technology to develop 21st century skills."

7SeatRulz – "Students can access the Internet at times other than school hours and all teachers are appropriately trained to integrate technology."

Gdad, Sophia Loren – "Some students have access to technology to reinforce basic skills."

Mkad - Students have equitable access to technology anytime, anywhere and 100% of students use technology to develop 21st century skills; all students have the opportunity to achieve and receive remediation."

Three other questions were asked in the online survey: (1) How is research used? (2) How do administrators use technology? and (3) How do parents and the community use technology? However, for purposes of this study, only the responses to questions pertaining to the use of computers in the classroom were identified in keeping within the frame of the research questions asked in this present investigation.

Research question 3: How do you incorporate technology into your curriculum for you as teacher?

Individual Textural Analysis - Incorporating Technology Into the Curriculum As Teacher

<u>Bailey Ma</u>

> Usually it's if I am going to incorporate a particular activity for the students. Usually it's an Internet activity. Sometimes it would be a demonstration, and I would use a projection device. When they give their speeches I'm usually using the computer to do the rubric that I'm going to be grading their work on. I think there's really far more collaborative work between the students and myself as far as a learning journey. What that allows me to do particularly is if I come up with some hair-brained idea, I can at least try a field test. They have allowed me to not be the fount of all knowledge. It's a very fluid kind of thing. It's not hard and fast. The use of different research tools is there. But how it is actually going to come out is going to probably look very different than what I had originally envisioned the thing to do.
>
> CNN has saved my life as far as finding good contemporary issues and materials and ideas and combining both the Internet site that they have that is a sole student site on contemporary issues with stuff that I pull down from the satellite feed at 3:00 in the morning. It's a great way to be able to pull a whole bunch of things together and see a bigger picture than just looking at a textbook lesson plan. I had to create a course using materials that don't cost any money, so I use all of the network feeds. I can use the *New York Times* online. I can use the *Christian Scientist Monitor* online. I can use *The Dallas Morning News.*

Probably one of the best projects that they did right off the bat was to look at different points of view from different news services and to see how, for example, how three or four different sites or services are going to treat Yassar Arafat, for example. How are they going to look at him? I'm sure the national paper for Israel is going to look at it a whole lot differently than some other source. But the kids need to see that because when they look at one source they think they have truth. And they don't have truth. They are learning a whole lot about what propaganda does and how it works.

I'm also, in History, a great incorporator of video. I guess because I've always liked pictures and video. If they like sound, and that's what they work on that I'm hearing, that's fine. I give them kinesthetic kinds of things to play with. Otherwise they sort of drift off.

A lot of people hate history. There was a whole generation of people who were forced to memorize very bad things. And that generation of people also made a lot of sugar cube Alamos too, which we don't make.

<u>7SeatRulz</u>

I only teach Chemistry, so it would be for Chemistry. To prepare lessons, I use the computer to write up assignments and then I've gotten into the habit of giving out assignments on CD's or on floppy disks to cut down on paper. It's easier for the students to just answer the questions, typing it up there and then print it out and give it to me instead of handwriting it.

Sometimes I will use various computer programs if we are doing something that is very visual, and I can't draw. It's easier to explain and show it through the program than it is for me to draw it on the board. However, a lot of the things are visual figures that I may draw on the board so sometimes it's a lot easier for the students to physically watch me draw so that they can see the process of how I'm doing it.

A lot of times when I give lectures, I tend to elaborate and put a lot of little notes in it. I do my notes in outline form and, for me personally, I learn and I remember things by hand writing them down. I don't really use PowerPoint to do presentations and I don't really use a lot of other things to do presentations. I tried PowerPoint once where I gave my students a photocopy of my notes, and while they liked it because we could go through it faster, they didn't like it because they didn't feel that they had that learning process of physically writing it down and they were losing something in the learning step.

And also by me writing out the notes, it gives the students time to write it down in their notes. By just doing it in PowerPoint, I can't judge how long it's taking them to write things down. And I've even asked students, and they like the fact that I write out my notes manually every single period on the board.

I actually changed the entire curriculum, the way that I teach things because of something I included with the computer. Computational science. Using the computers to help the students see the relationship between Math and Science and the modeling of Science, and understanding how a system works as a whole and not just getting caught up in the Math or not just getting caught up in some little detail and looking at the entire picture. Throughout the entire year I use various programs and the Internet for labs, for projects, and I've restructured the way I'm teaching my class to include this. I used to in the past just teach one subject, go to the next, go to the next, and it was kind of structured.

So I'm kind of teaching it backwards. It was kind of weird at the beginning of the year to make my mind always go 'Okay, I'm teaching it backwards. I'm not teaching it the way where I explain the little stuff first and then I just build upon that.' I'm always breaking it down into the next level. And so now that I've broken it down to the smallest level, we're starting to build it back up and build it up to a different part of Chemistry. I'm starting to explain how this other side of Chemistry works. But they tend to get a better idea and they are able to tie all of the different concepts together a lot better. And all of it is because of the system analysis and going through the systems which a lot of it I have to use the computers for them to understand how the systems work as a whole.

The students will give me stuff with Pack and Go and I have just figured out how to use WinZip on my own. I don't use it to zip anything. I primarily just use them to unzip files and not to zip them up.

Computers have had an impact on planning because the things that I have to teach are on the computer. I have to find the time if I'm passing stuff out on CD's or floppy's. I have to find the time to pass those out. So a lot of time, yes, I have to restructure the individual class periods to make sure that I get all of the computer stuff in there.

For the classroom organization, I'm lucky with the Chemistry lab. Every single lab table has at least four outlets on it so every single student can just go around the classroom and I can hand things out easily that way and they basically have their own workstations around the room and they don't have to move too much. I'm hoping when they build the new Math /Science building that we continue to have those outlets for computer use.

If a student decides on an oral PowerPoint presentation for a project, I restructure the way I run that class to allow them the time to do that. They will also turn stuff in on disks if it's a computer-based assignment and sometimes I require them to turn it in on disk so I can open it up and make sure it works the way it's supposed to. It also restructures the way that I have to grade the assignments as well as give the assignments.

For the times when I use the programs to show the visual stuff, I have to go get the TV and hook it up. So I have to reorganize. I have to find a place for it in the classroom where it doesn't block the board and where all the kids can see it. Sometimes that is kind of hard because I have a big post in the middle of my room. The post is annoying because no matter where you stand, there is some angle in the classroom that you can't see somebody. For the most part, when they do labs, I just have to walk around and make sure that I can see everything that is going on with the labs, especially labs with acid or fire.

I can give students their quarter grades faster. I got a program on my computer, and I make a printout copy for them. But it does all of the calculations for me, which for me is nice. I don't remember what it's called. It's not the one that is on the school computers and it's not Excel. I think it's called Excelsior. It allows me to set up the computer the way that I want to for calculations and it prints out student grade reports so they can see all their grades. I do it a couple of times a quarter to give them periodic updates. Sometimes if they hand something in on disk, I'll just put all of the comments on the disk itself and just give them back their thing with the grade there on the disk. I think right now those are the two primary ways that I do that. With the disk it has made it easier because you can just type it up there and not write it out. It's easier to calculate their grades.

I use the computer to prepare their tests and projects and the quizzes and the labs. I try to make sure that I have at least one computer-based component per unit to make sure that the students continually use the computers and continually see the computers throughout the entire year, a major project or something where they have to use the computer each quarter.

<u>Genny J. Matt</u>

I feel that computers gives me a whole other tool to present the materials with, not just in my developing my lesson, but in using resources from the Internet as well. It has just expanded what we can do.

A lot of my presentation, my teaching, is still done with direct lecture examples on the board. You still do that part of the algebra, the manipulation of the skill. But, also it allows me to hand problems over to students and allows them then to generate representations and answers while I'm standing on the side. It allows them to construct understanding and share it with the class as opposed to my telling them the concept. I have a blend of what I did without computers, and a blend of what we do now. The computers and the graphing calculators allow me to change the class style to have a whole group instruction and group work, collaborative learning, and so there is a balance between the two where we go back and forth between the two in my classroom. I'm always moving back and forth between the group discussion and whole class discussion

Most all of my notes and lesson plans and my calendar—all of that is done with the Office software and my tests are generated with a program through the computer, whereas before all that I did by hand. I do it all in Word and keep it on disk, and so that part of it I use. I find that I have a bigger variety of lessons and examples and problem-solving activities. With the use of the Internet, there are some wonderful Math resources that I regularly tap into and use. I get units from materials on the Internet that are supplemental to our textbook.

Websites I visit all the time are Math Forum, NCTM also has many web links off of it, which is the National Council of Teachers in Mathematics web site. I recently discovered another Algebra teacher, who has a wonderful web site with many materials and things, and I have been sharing with her. So I share with individual people, and not just big host web sites too. There is a Geometry one that has some algebra links on it too that I share with another teacher. Since we don't have our web pages posted yet, it's nice to be able to tap into some others and kind of see what they are doing as a model. I also use the Eisenhower Clearinghouse web page and PBS has one.

One of the things I have been doing recently is more e-mail with students. Students are absent or, they want to come in for help, or they had a question, or whatever. I have given them all my e-mail address, and they are now beginning to get their Internet cards so they are beginning to be connected more. They will e-mail me and tell me, 'I need help. Can I come by?' I've even had parents e-mail me. 'My daughter is ill. What do we need to do?'

Every time they have a grade, I have a little program that I use that lists all of their grades and recalculates their average, and so I make a little printout that I give them with their test every time I give them a test. It's A-Grade, or Auto-Grade I guess is the full name for it. It's this little miniprogress report I print every time we have grades. I use a point system, and they can keep up with how they are doing. I would say that about once a week they get a little printout of their grades. As freshmen coming in, they are real tentative about how they are doing and I think that input and ability to use that program to get their grades is a real helpful tool. I also sometimes print out a little chart for assessment, like if they are doing a presentation I will print out a little chart rubric of what each part of the presentation is going to be worth, like if they are thorough or they are accurate or they are visually creative with their presentations and things like that.

For me as a teacher, the only other use of technology that I haven't mentioned is the professional support that I get through the different organizations that I am a member of. They all have websites. There are so many things I want to do that I don't have time for, but things like Web Quest, projects, and online courses even, like how to do web pages and those kinds of things like that. I do a lot of that that I would have never done because I didn't have access to them and now I do.

I'm always evaluating what I do to see if it really does what it needs to do and it's not just a new toy. And I could get all excited about the new toy sometimes. But I have to keep grounded and make sure the kids are actually getting what they need from it. And that's another thing is to be able to evaluate what you've used and make sure it's good quality and it accomplishes the goal that you're after.

There are some specific things we talk about in the discussion of research, like if its Jack's Home Page, would you consider that necessarily to be a good source. If it's Rice University, there's a difference between the kind of information you're going to see on those resources and I always make them cite their source. And also I always as a teacher compare what the information is to what it would have been had I just used the textbook. The textbook is my grounding device, and if it's not presented better than it would have been in the textbook then it's not necessarily a good thing to use. If it's not made clear, if it goes off on a tangent into something else that's not necessarily the core goal of what we're after, then do the kids really need to be doing that? Is that really where you want to take it?

I would like to say that there are times when we don't do anything with technology. There may be days where the best tools to use are the good old paper and pencil and white board and textbook, and there may be days where we do that. When we're covering a very difficult mathematical concept then we need to do to "drill and kill" is what I call it. I only use technology when there is a purpose for it. I only do a PowerPoint presentation when there is a need to present something different than what is in the book.

I think there is a balance that you have got to have for your classroom to work well and I think that balancing technology with the traditional approach of teaching, you know, with stand and deliver lecture, group work, paper pencil work; I think there has to be a balance of all those things. And yes, I think that comes with using it day in and day out, seeing what works, seeing what doesn't work, seeing when to use, when it is appropriate. The tool that I miss the most that I wish we had is the access to the Internet using our own web pages, where I can post a web page and have students go to my web page and pull down a document, pull down an example, pull off a link and go. I'm looking forward to that element being a part of our instruction. And I think that when I have that ability to incorporate that type of access, I think my instruction will really change. Right now I use disks to get syllabi and assignments to students. I don't have a web page. I don't put a web page on disk. The girls that have their computers now have a CD burner, and they can burn a CD and we can do stuff with CD's and I haven't had a chance to develop any of that. So now it makes sense to maybe put a web page and burn it to a CD and let the girls use it, that type of pull it off the internet and doing in house that way. But up to this point it hadn't made sense to do that to me. I'm wanting to post class notes, examples, documents that we now do on paper. I give them a syllabus on paper. I can give them on a disk, but right now I just give them a hard copy. I want them to be able to make a connection online, and everything is right there. I think that would be the next way to go and they could in turn reply to me with their work.

<u>Ara B. Jaamz</u>

It varies. With juniors, I have online quizzes. I'm able to implement research from the beginning of the school year where we can say, 'Let's go to this particular website. Here are the goals that we have when we get to that website.' I use the Internet for a research tool, for a quizzing tool, which has really been a great thing to do, and then for a communication tool. I e-mail them probably twice or three times a week. Right now more juniors than freshmen, but a lot more junior-wise. I'm e-mailing them at the house and saying, 'Don't read all the way to Chapter 35, just try to get to Chapter 26 tonight' because I'm reading with them so I know what kind of pain it feels like. I like being able to be in contact with them.

And I have all of my students' e-mail set up in a group so I just click one button and then send them all the same e-mail. So that's how I distribute the URL for the quiz. And then I had to actually put in my whole class and all the stuff you do to set up so that they can go and quiz, and then it e-mails me the answer. So the time I spend typing the quiz up takes away from all the grading time.

For the junior quizzes I use www.school.discovery.com/quizcenter.html. I can set up the quiz questions such that I don't mind if they use their notes or books, and I can also give them a certain amount of time. It reports back to me what time they logged in, when they completed the quiz, and then it e-mails me the score. The quiz setup is amenable to true or false, multiple choice, or like fill in the answer. The online quiz sends me the grade. If it's short answer, then what I'll do is I'll go in and double check that the answer is right because sometimes it's imprecise. If I have short answer questions, I have to make sure that the grade it gives was right before I write it in my book. And then I'll reply to them.

When you set the quiz up, you can select whether you want multiple choice, true or false, or short answer. You can say, 'I want this to be exactly the answer.' Or it can be close. On the short answers it's imprecise sometimes and I'm still working with that. So what I will do is I'll e-mail them back and say, 'You didn't get a 3 out of 10. You got 9 out of 10.' And nine is what's going in my book. So that's the way I handle that. So you just have to go back and check it, but still in all you don't have to carry around an arm full of papers. You just log in, correct it online, write a number in your book, and move on. It makes life a little simpler.

Their quiz scores pop into my e-mail when they are done taking the quiz. That's one way to do it, or you can go by the site and check the quiz log and look at a big log of who logged in, who logged out, and what did they score? On e-mail, you can double-check it real quick. 'That one's right not wrong. You have control over what you write down in your book, but you don't have control over how the computer interprets what you said the right answer is. That's where you intervene. But now for multiple-choice, it's the bomb! It really is, because it also automatically randomizes the questions. So if you have everybody in here taking the same quiz, it automatically randomizes the order of the answers. They have to know the answer. They can't say 'A, C, D, F, A, B, D, C.' That keeps them honest. If you're doing it at home, Shelly can't call Mary and say, 'The answer is A, C, D, B, F, A, B, C' because when Mary gets on there and fills it in it will all be wrong.

Now freshmen-wise, I do have a course CD that's still in development so I use the computer in that case as an organizational tool. I'm helping to introduce to them the idea of your computer as tool rather than computer as novelty. When we break the barrier of the computer as toy, I mean the first thing they do, I mean believe it or not the first thing they do when they get their Internet cards is they want to IM everybody in sight. 'What's your IM address?' That's all they want to do. That's why I wait until third quarter. I don't give them that. That's what they do. That's what they want to do, and that's fine.

But once that wears off, the newness of that wears off, then it's time for me to step in and say, 'Okay, now let's go to this website. Let's go do this web quest. Let's go look at what research resources are available to you for this particular novel or play or whatever.' It takes a semester to break them in.

And I think also it's the nature of the class too because what I want to do is more online so I have to wait until they are all up to the technology speed. Very few times all year will I require them to use PowerPoint. Instead, I'm going to go straight for the Internet, straight for the Excel chart for style analysis, and Microsoft Word, of course at

all times. So Microsoft Word as a tool is quick, but in terms of the Internet it takes at least a semester. I do lot more of searching the Internet for appropriate material.
I spend some of my 'free time' fixing links on my web CD, so the ways I prepare are different because I'm using the computer as a preparation tool.

I'll write a lesson on the computer and then I'll go to class and double click that document and open it and sort of teach off my computer screen sometimes. And that's a good way for me to not lose stuff, 'cause it's all on the desktop. Having my own machine is a great big help. If I didn't have a machine that I can say, 'Okay, I'm going to go in that corner and do my computer stuff' then it wouldn't be as effective.

I use the computer to plan classes for freshmen for the entire year rather than just a quarter at a time. You have to think in terms of what documents are they going to need fourth quarter, then I need to make sure they get on this CD so that way I'm trying to get the work done at once and then have to redo it every quarter.

And then as far as juniors are concerned, it does take time to come up with questions that aren't too easy and aren't too much of a stumper kind of question so that they can use their book and I have no illusions that they are not using their book. If they're not, they're probably apathetic. Juniors need a little bit harder-type question than freshmen do.

In the classroom, I have my desk turned the opposite way. Instead of them facing me so that I'm looking at the back of their laptops, I have them facing away from me so that when I'm giving instructions, I can see all of their computer screens and say, 'Okay, you don't have the right document up. I want you to maximize that. I don't want to see the naked man on your background. Oh I'm sorry. Three quarters naked, or five-sixth naked. I don't want you to be distracted by the background.' Or I ask you to get this document out and I see that you have such-and-such a thing open. So, yes literally I've changed the way my classroom looks so that I can see their screen and not their little dumbfounded view in their face over whoever's on the background.

No IM'ing is occurring in my classroom. No games, no music listening to. I make a special point to tell them if you have a program that starts automatically, it is an automatic infraction, no questions asked.

Sometimes I'll give them one or two documents on disk. For juniors, I like to change what's appropriate for the time instead of always following the script. That kind of annoys some of them, but with computers I'll say, 'Hey, here's the updated file.' So I can update it on the fly, which is really a good thing to be able to do. I wish we had web pages where we could do that same thing so I could just update one and don't have to worry about copying everybody. 'Okay go to my page and see whatever the update is.' That's how it was in college. We need to have that same thing, especially in a school like this.

If I invent an assignment, or think of an assignment that's appropriate using hyperlinks and geared to being done on computer, I'll send a copy to my colleagues in that particular level. And they'll either decide, 'Yes, I want to do this too,' or not, but it allows them to benefit. Just recently the opposite thing happened, where one of my colleagues on my level said, 'Here's something that I wanted them to do online, and I'm sending you a copy to see what you think of it.' So now if I want to do it, I can and the groundwork is laid with the sites because that's what I found from summer school, it kind of upped my Internet IQ. You have to go to the place you want them to go before they get there. And previous to this year, I would just send them first but now I understand that you have to go by there and see what they are going to see and do the thing that you want them to do so you can see if it works or what. So that's great, and again with juniors, I'm able to do that.

Now with freshmen, I can collaborate with my colleagues, 'cause I have a course CD where things are more or less thought out. I can pull out a copy of a document for the next unit and give it to my colleagues through e-mail. Or ask them, 'Hey, would you e-mail me whatever quiz you did on this particular thing.' So I think it works great in terms of computing in that way to keep us both on the same page to what the other teacher is doing, but again it's not Internet-based. It's more or less document-based. It opens your mind. It opens you up to things you can really accomplish.

On my junior level, I was dissatisfied with John Smith as the first American literature that we want to read and study, so I made it an assignment that asks them to find the first American literature. Who was on this continent before Europeans? And so I made them confront these questions. Because you know you have the Vikings. The

French landed in the north. That's where Canada is now. Spanish landed in the south. That's where Mexico is now. After the Louisiana Purchase, Thomas Jefferson more than doubled the size of this country in one purchase. He was working it in more than one way. He told Bennie to go bring him another biscuit out the kitchen before he had to sell his wife or something. Thomas Jefferson was a trip, but don't get me off on him right now. He left a legacy, a heritage, and a whole lot of different-colored people.

With my juniors, because they're older, I'm able to really ask them what they think. And I just recently asked them about the future of this class. I told them things that I expected from them and I wanted them to talk back to me about what they felt. I sent them a group e-mail, and then I mentioned it in class. And then I gave them fifteen minutes in class to either answer my e-mail or finish one of the online quizzes. So I gave them time in class to follow up on that because I really wanted their commentary.

I don't mind doing it and I probably will do it again in terms of getting their feedback about what they think about the assignment or the book or whatever. I'm still looking for a good chat page too, where we can set it up where you could post an idea and then have everybody come behind you and post theirs too; a chat room, but not like in the IM flavor of real time. I mean I don't want that same environment.

Sally T. Smith

I'm able to give PowerPoint lectures. Before I would type up notes to myself because in art class, there is often the lecture and discussion. They're free to ask questions as they go along, and often it's easy to get distracted. Well with a PowerPoint, I not only have the visual images up on the screen, but I have a kind of an outline that's going along with it. If I get off track I can easily be pulled back by what's the next point or the next bullet on the PowerPoint presentation. I think I'm reaching different kinds of learners through the PowerPoint presentation because you're not only reaching the students who need visual information, but you're reaching the ones who learn by listening. Of course we have the hands-on projects then to support that. I think I'm reaching now the different kinds of learners better than I was able to do before.

I think there's less distraction. I think it's really easy for students to be listening to a lecture and start daydreaming. If you have something visual to look at, now certainly we had slides before, but I still think there is something about having the bullets up there and the visual information and the teacher's lecture, that even if they begin to drift off they are pulled in by the visual image plus the bullets up there. But you have things that are going to hold their attention somehow so I feel like it's a lot better.

It's really made my job easier. Before I would spend hours pulling slides and now I can actually prepare these lectures in the summer time, in my off time, you know scan in the images off the Internet and use them for reference. It's helped me a lot in terms of time.

I also use Auto-Grade for progress reports or updates on their grades, that kind of thing. When it's time for quarter grades I print out student mini-grade reports and as well for progress reports. Occasionally a student will need a grade for say a recommendation for say NHS (National Honor Society) or something, and I can print out a little progress report right them and show them what their grade is.

In terms of assessment, I don't really use it other than I prepared a grading rubric that I follow for the students, and then I actually print out their grade and how I determined that grade, but other than that I give them a little report with each assignment.

They know ahead of time what the assignment requires in the syllabus I give them. I think my curriculum as teacher is automatically imbedded. The fact that we function so much as teachers our internal communication is totally based on technology and revolves around technology. I can use several textbooks now for information rather than the students having one textbook to follow. I incorporate information from several textbooks into my PowerPoint slides, not only my personal knowledge, but information from different sources including the Internet are all included, and I don't rely on one textbook. I do have sets of textbooks here that are available for visual reference too, but they are not required by any means. They are just available as an additional resource.

At the beginning of the school year I give students a syllabus, which basically has a course outline on it. It has the grading rubric on it. But I don't even give them links there. In fact I give them an outline of each lecture, and that will often have links on it.

Maria Rodriguez

All of my syllabi and my assignments are all word-processed and saved onto disks, which I pass around the class so they can load them onto their computers. I also use the Internet for background research for the topics that we will be learning, to find sites that will be applicable in class, and to be up to date with issues on the history that I'm teaching. In class, I use the computer less, but the students use it more.

My access to the primary sources on the Internet has really changed the way I teach because it's so easy to use at the drop of a hat. If something comes up in class and I have certain websites, like Fordham University has a very good primary source web site, and I can say, 'You know what, it's on there, let's go read it.' And that has really impacted the way that I teach. It's so much easier to access instead of our textbook, which is not very good. I use http://www.google.com every day. There is a site called LANIC, http://www.lanic.utexas.edu , which is out of the University of Texas, and it's a Latin American Studies database. I use that a lot. The Fordham address is very long. But it's Fordham University, and they have western European primary sources online. I check Google, every day. The Lanic and the Fordham one I check at least once a week, if not more. And I use news sites a lot too. Like *New York Times* and CNN.

I am now always thinking of their laptops when I'm planning. Especially again, the Internet—I think that's my biggest tool in that I can almost always use that. So in planning I'm almost always incorporating some sort of web-based component. So that's the way it's changed planning the most because then I have to go on the Internet, thoroughly look at that site before I present it to the students and make sure it has value and all that.

It has probably actually taking me longer to plan now than it was before I had the tool. It might be my own fault, because you get carried away. One thing leads to another. It just sucks you in.

It's better in the sense that the girls have everything at their fingertips from my class. They have the syllabus. There is no such thing anymore as, 'What is the homework?' It's on the syllabus. And so are the assignments. I do very detailed directions on their assignments so they know that they have it on their laptops.

With colleagues I think technology has isolated us. We tend now when we find something to just e-mail it to each other, which can be good and time saving. We don't have a lot of time. A teacher will still come up to me and want to confer, and sometimes that's so good for me because it helps put things in perspective for me. Whereas, when I'm e-mailing with everybody else, you don't get that. So it's good in that you get quick information from each other, but there's the bad thing where you're not getting that real communication with them.

But with my students, because I am face-to-face with them, it's been really good for collaboration because I don't know everything at all, especially about history. I teach world history. And so it has become very common in class where something will come up and we'll look it up and somebody else will look this up, and together we learn something. And that's actually some of the most exciting moments in my class when I don't know it either, but together we're all going to find it.

I think that I am a more effective teacher because of the computers. And I say that hesitantly because there are so many issues that go with it. It's so many things. But overall, I know that those computers are making my job easier. The instruction is more effective.

We're addressing not all of the learning styles, but we are addressing more of them with the computer. Obviously I am addressing the verbal and probably the intrapersonal when they do journal writing. And then when it's with their computer and it's just them, they have time to reflect. For the interpersonal, I have been able to use the computers in groups but it's harder. I have to cut down on the computers. I'll use maybe two computers per group and then they have to share. And so that way they are still working on that interpersonal. These girls tend to have a real strong interpersonal learning side, maybe too much. So that has been good. I have some girls who are very mathematical and spatial and I know that the computer is addressing that in some way, but I don't know that I am doing it the most effective way. I try to address all of the learning styles as much as I can. I do because I don't want to just hit ten of my students. I want to hit as many of them as I can. I try to do a lot of kinesthetic stuff too. Let's get up and move. Let's walk around the school and talk about something. Am I doing it every day? No. You can't. But I'm trying to. I have 22 girls in the classroom, and they all are going to have some sort of difference.

We always end up grouping out of necessity in my classroom because someone won't have a working computer, but most of the assignments in my class are grouped.

The computers make that easier as long as you get rid of some of them. You can't have four girls working on four computers unless there is a multi-tasked thing. But then that's not group work. That's individual work that they are doing together. So I usually like to break it down where there's two, and then maybe one will have the Internet and one will have the directions, something like that. Groups are no larger than four. Occasionally I'll have five if there are people missing or something like that. That's how they sit in my class. They sit at tables.

In regard to feedback to students, if they have a class essay, they type it and then I pass a disk, and they save it on the disk. That way I don't have to have a ton of disks. They save it as their last name.

And then when I grade the essay, I can insert comments and that makes it so much easier for some reason, instead of the whole writing on the side. And the e-mail has been good for feedback because like with the journals, I made them turn them in, and that's a completion grade, but they get quick feedback that I got it and this is their grade.

Then their grades, if they e-mail me and ask, I'll do it. But I'm not going to do it for everybody blanket like that. I don't have that kind of time. I have given them, when I have parent-teacher conferences, I print up a grade. I do use the Auto-Grade minireport feature.

Honestly I don't know that I can even necessarily separate technology from my curriculum because I'm always in front of a computer if I'm planning, if I'm writing an assignment, if I'm writing a syllabus, or if I'm researching. Even for simple things like trying to find the book, I'm online looking at the Dallas Public Library to find the book. And I think I have definitely become a product of my generation. And I'm a bookworm, but I now tend to first look on the Internet and then go to a book.

I do use books for resources but it depends on the area and how much time I have. If it's something that has just come up and I'm about to discuss it in class, then I'll look on the Internet. But if it's something that I have more time to do, either I'll look on my own or I'll go to the library.

Sam

I use the computer for curriculum purposes to outline for lesson preparation, for lectures, for making tests, basically designing the curriculum, and to present a CD-ROM. In my biology classes, I use the BIOinquiry CD-ROM. It is another way to present the same material that is both two-dimensional and in the book.

Using computers has enhanced these concepts but not really changed my values or the kind of time that I spend on certain concepts. Computers have enhanced my curriculum by saving a bit of time, saving my eyesight from reading homework for sure.

I use different methods now. I usually hand out assignments on floppies, my syllabus on floppies, involving much less paperwork.

By handing things out on floppies and not having to write things on the board we are all on the same page. I don't have time to write things on the board and move from class to class.

As the homework assignments include going over, there are *interactives* on the CD-ROM. Each student gets a copy of that. They have to pay for it. It doesn't replace the textbook. It's a little textbook instead of the 50 pound one that we have. For example, they can watch on the CD-ROM the first person who ever saw living cells and what he saw. It's a re-creation. And they can watch this over and over again and see what it was like the very first time, every time. This replaces them having to sit there and read words and visualize something…because even if you get a photo in a textbook, it's one-dimensional.

Yes, and there is also verbiage. The student can take this home and play it over and over and read the material. There are quite a few videos on the CD-ROM plus animation and *interactives*. They have to solve problems in order to move to the next one. And then I follow up with questions on this. I can't expect them just to do it.

Actually there is a book that comes with this CD, and then the regular class has the book that I used last year without the CD and this is just an enhancement. So, I have two classes that have the book that goes along with this and it's fully integrated. The other one, I pick and choose from the CD what assignments to give them.

Computers definitely help visual learners. The CD-ROM is just another tool to show visual learners the same sorts of things that they will get by reading the book and basically looking at electron micrographs in two-dimensional pictures.

For these organelle, for instance, they can go in and look at mitochondria and look at pictures and an idealized cell. And they can actually drive and stop, and if they want to know what that is they can look. They still have to memorize what they do, structure and function, but it gives them another tool to look at the way that these structures appear when the cell has been killed and fixed and sliced and looked at by an electron microscope. It's very different. But you're getting as best of a representation as we have with an electron micrograph. To be able to go back and see this just puts the whole three-dimensional cell better into the mind of a freshmen biology student. Of course, are they impressed? No. Are their parents impressed? Yes. Parents go out and buy this book. Their daughter doesn't use it much but they do.

The biggest improvement that I can see is to communicate with students when they are ill or they don't understand something and they need a quick update. We e-mail daily back and forth or following a lecture we have probably a couple of weeks' sessions going on with one student …15 seconds of, 'I thought I understood this in class, but could you explain?' Parents as well, but particularly when students have been ill.

I can give students better feedback about concepts using e-mail. I can give them progress reports using Excel and posting them periodically. I use Grade Book and Excel to publish grade reports.

The Internet is also part of this curriculum and there are icons that come up as part of it on the CD-ROM. We've had problems in accessing some of that from school, but those that are set up at home have web access. I do give homework on these. If everything is working for them at the school, they can do this at school as well. The things I have them complete as a project is to look at the real organelle using Internet sites. And they think that's cruel and unusual punishment. The book that goes with this series also, as it follows along with the text, has little icons that say, 'If you would like to investigate this further…' and it gives the web address links.

<u>Mkad</u>

I have taught Math and Science before. By looking at the Math and Science curriculum today, they send students in to start with computers doing research. It has been gigantic steps for these kids to learn things. Without these computers, they would just be bored.

In terms of impact on my planning, computers have made my planning extremely easy. The topics I address in Computer Literacy are now on the Internet. I just go in and click on them. My textbook has all the units electronically, also. I just click on the text, click on the page. I have CD's with copies of everything that I can just print out. I can plan anything at the drop of a hat.

I construct my lessons. We are using the new curriculum with the TEKS, called Oasis, so the lesson planning involves basically click, click, click.

In terms of keeping papers in order, I'm not very good at that. To organize what I'm doing, it's all on a file server. When I plan a unit, I save everything there and then the next year I can change it, resave it, and put it back on the server. That makes it much easier to update the curriculum from year to year. I just change the date sometimes.

In terms of student assignments, it makes it extremely easy because they have more fun doing their assignments. Paper and pencil is nothing. Word processing and getting images off the Internet makes classes come alive. They should be able to remember longer what they did research on.

Right now in my enrichment classes, we do group work. For example, I had two kids who decided to do a PowerPoint slide show on every eighth grader that shows what they were like in the seventh grade and what they look like now, using pictures. There are eighty-nine eighth graders. They are excited about it. It's for a district Computer Literacy contest that we will take part in. So that's a project they are doing for it. When they are working on a project, usually if it's for a grade, then they are on their own. If it's something that they can get together as one, I'll allow it—maybe two or three, only if they are working. If they are playing, then it goes back to where everybody does their own. There is a lot of speaking back and forth; "you get this and you get that." They each have their own computer, but they are just talking and sharing.

The way I teach, they see everything on the screen from my computer through the data projector. They can follow every step. I can teach them how to edit, and go back and let them catch up to me. It's better than sitting with a book trying to learn something.

I think computers have made assessment so easy because the kids see immediately; they can click on something and know that they can immediately get answers from me. If something doesn't go right, there is always another kid next to them that it happened to or myself. The projects that they turn out for grades are tremendous. Sometimes you look and think that they are almost like a little professional. Everybody did a brochure on a famous scientist, and some of them turned out to be almost like a company. They can't wait to see who gets a 99 and who gets 100.

When I grade students, I don't weigh one kid against the other. I look at what they did. They know in advance what the criteria for the project is. I give them the instructions with what they must have. And if they have everything down, and they did their spell check and it looks good, it does what I told them to do, then they usually get a 99 or 100. If it doesn't, they automatically get a 0 and they have to start all over.

You know if the pictures aren't centered correctly or they are half on the page and half off the page and they didn't take the time to do it; but usually they want their work to be just so and if it's not they come in at lunch and I'll have twenty kids in here trying to finish a project. Yes, and those who go over get a much better grade, but after a while when you have 100+ extra there is not much you can do. No one fails in the district, and my testing is usually 40-50 points above the rest of the district.

In terms of e-mail, I don't e-mail students or parents because most of them don't have e-mail. The district is setting that up, where every parent and child will have an e-mail. They have an $80,000 grant and every child can from their home access the files on my file server, do the homework, and send it back or e-mail it to me. So far, they have a program that isn't working that well. All the cast-off computers are updated and passed on to those parents who can't afford one. An Internet account is provided for them. It's a whole lot that they have to do with that $80,000.They have two years to set it up and spend the money.

Gdad

In all my Algebra classes, I have the computer connected to an in-focus machine so I use it for overhead projection. I am projecting from my computer in the MicroSoft Draw program. I use the computer to demonstrate how to set up equations. I use it to draw lines, angles, and graph problems.

I get some stuff off the Internet. I have several favorite math websites: www.discovery.com; and www.aamath.com. I get math puzzles and word associations off the Internet.

Computer use here just doesn't have that much impact in math. Not yet. Not until we get computers in each classroom. I do think that computers have changed the way I teach somewhat. I can get information off the Internet that has to do with the math agenda as opposed to straight out of the textbook. I use the Internet about five per cent of the time for curriculum needs.

Computers have had an impact on my planning in that I use the word processor to do all my planning. I use MicroSoft Word. I use a grid or table in Microsoft Word to set up my seating charts.

I use the district's grade book program to do my grades. The grade book does all the averaging. It averages automatically. It does all the weighted categories. Beginning last year, we could keep our grades online as an option. I do not keep a separate paper grade book, but I print out a copy of the grades from the computer. I have access to it every day. It's great, fantastic.

For feedback to students on their grades, I can print out their grades and that's helpful. I can print anything on their grades. I give them a copy of their grades once every three weeks.

Sophia Loren

When I use computers to teach in my classes, we either use the e-Buddies, which are the real small laptops or we go to the computer lab and use the desktops in the computer lab. The e-Buddies are just miniature laptop computers. You can't save to them so whatever the student does in the classroom, they have to go ahead and send it to the printer and print it out. There's no access to a floppy disk to save to. The e-Buddies have the Internet, Word, Excel, and PowerPoint loaded on them.

I haven't used them at all this year. I'm going to use them on Monday and Tuesday and the students will have an option to either do Internet search or to begin writing their research papers. They should be at the point in their science fair project where they are at the writing stage. Like all science fairs, I have students who are still bringing books to me, holding them up, and saying, 'Choose a topic for me.' And we've moved way past that. But some students are not moving with the rest of us. They are really at all different levels.

From the teacher's standpoint, it's much easier for me to generate tests, notes, and lesson plans rather than to type them on a typewriter and then take them and copy them.

Now that I have access to the Internet, I do all my lesson plans on the computer. A good example is that we've been studying the Edwards Aquifer. Well, during my off-class period I pulled up the Edwards Aquifer, and I printed off some endangered species from the Edwards Aquifer. I've got the photograph. I've got the common name. I've got the scientific name. I've got all these different things about them.

So the Internet is really a big boom, because everything is real current and it's in color. If it's black and white, they're not interested. It has to stand out and be in color. I think that is really grand.

I feel like these kids are being prepared here at this school for the modern world, and the fact that they are adept at using the computer by the time they leave the 7th grade, I think is going to put them in good stead.

I think the Internet is a good tool, but I don't think it's the only tool. I think learning how to use a book and learning how to use a dictionary is a big concern of ours right now. They are going to have dictionary skills on the TAKs test, and our kids don't understand how to use the dictionary. They will not have access to the computer while they are taking the TAKs test.

It's a state-based test. The test that they'll be taking won't have spell check because it will be coming out of the end of their pencil. A lot of them feel very strongly that they don't need to learn math because they have calculators now. They feel they really don't need to learn to spell any longer because all the computers have spell check.

They have not been teaching handwriting in elementary school. I don't know if it's because they just don't have time or because they feel that we're moving into the computer age and we really don't need handwriting any longer, but the writing samples on the old TAAS test have been so horrendous that the scorers have not been able to read the samples so now penmanship is going to be a part of the new test.

They are being tested at the 7th grade level for writing samples, and penmanship will be part of it. So even though we may live in the computer age and the computer will think for us and do our math for us and do our spelling for us, when we assess the students, we don't give them access to the computer to assess them. We ask them to generate something out of their pen or pencil and it's going to be a shock. Yet I don't think they should be allowed to do the testing on the computer.

I think the computer is a wonderful source of information. In the past I've not been able to do this, to just pull up information and print it off.

Computers have cut down on the number of hours that I have to spend planning. My product looks better, rather than a handwritten lesson plan. It's easier to include a lot of things, where in the past I would go, 'I'm not going to sit here and write for three hours.' If you do it on the computer, you can put a whole lot of stuff into your lesson plans. You can be very complete in how you have things prepared because it's not time intensive like it was in the olden days, three years ago.

When the e-Buddies are used, my desks all have to face forward because they all have to face the *Mothership*. So we have the *Mothership* up there, and then they're all facing that in case I want to put something on the big screen. The *Mothership* is this big tv monitor and a teacher e-Buddy computer on a large cart so whatever I type in there shows up on the big screen. All of the e-Buddies are wirelessly connected to the server.

I want them all facing me because I want them all facing the same direction and I want to see who's on Pokemon and who's on science fair, that type of thing.

The computer gives me access to lesson plans from other teachers. It gives me access to information on the topics that we're studying. Last year, we were studying catastrophic natural events. The first one we studied was about asteroids. The world had a near miss on January 5th or 6th, and if it had hit the earth, it would have wiped out a piece of land about the size of France or Texas.

It made it real current because they don't read the newspaper and most of them don't watch the news either. I mean they are aware of 9/11, but most of their families don't take the newspaper and most of them don't watch the news.

It was real interesting. I enjoyed reading about it. I'm glad it didn't hit us. In the year 2000, we've had two near misses; one just on the outside of the moon's orbit, and one that actually passed closer to the moon. We're going through the path of some small asteroids that are out there. It's been out there a long time. A major one hits the earth every million years, something like that. It may be longer than a million. It may be 10 million or 100 million.

I don't normally e-mail my students. I have taken tests myself from my college professors on the Internet. No, I did e-mail one student last year. I had given my e-mail to the parents asking the parents that if they wanted to e-mail me they could, and instead of getting something from a parent I got something from a student. And so he e-mailed me one of those 'what's up' kind of e-mails and so I sent him back an e-mail and explained that I had really sent it for the parents.

I did have one parent who e-mailed me about two or three years ago and she was upset a lot, and the e-mail made it real safe for her to e-mail me and be unhappy with me. I had asked them to make a brochure. It was when we were doing biomes, and I specifically said, 'This is not to be about a state or a county. It's about a biome.' Sure enough this kid turns in something about Florida. And I told the class that I specifically told them not to do that. Well I got an e-mail that night. I had embarrassed her child in front of the whole class and she was devastated and she said, 'This is a beautiful project. I don't understand why you didn't accept it.' Well she hasn't followed the guidelines that I had given out, and I don't recall having made a big deal out of it. It's just that I told her, 'You know, I specifically told you it was about a biome.' I mean that's what the lesson was about.

I don't know how many of my students have e-mail.

I ask them periodically if they have access to the Internet and they say yes. But a lot of them apparently don't buy ink for their printers because I asked them to bring part of their science fair project today and I wanted it to be typed on the computer ready to put on the board and they brought me a disk and said, 'There's no ink in my printer.' I think the parents have bought the computer and perhaps even bought access to the Internet but have not bought ink. You know, ink is expensive.

I use the computer to make the tests but not to give the tests.

I encourage them when they do their science fair projects, they are required to have three Internet sources listed in their bibliography. They are required to interview an expert in their field, and what I've told them is, 'If you're doing a product test or something like that, you can just look on the back of any product and there's a website on there. Go to the website. Request that someone contact you so that you can interview them.' I had a student do that last year. She interviewed a farmer in Kansas or Nebraska or some place about fertilizers and she e-mailed him some questions and he e-mailed her back. It was from an area where her grandmother lived, and during Thanksgiving or Christmas she interviewed him face-to-face and it was wonderful. It was really neat.

But then, on the other hand, you hear all these horror stories about kids making contact with adults on the Internet and having a very negative impact so I don't want my face on the *Dallas Morning News* because I asked my kids to interview somebody via e-mail and the kid ended up in a compromised situation.

Composite Textural Analysis – Incorporating Technology into the Curriculum as Teacher

The teacher technologists in this study offered many ways that they incorporate technology into the curriculum as a teacher.

All of the teacher technologists cited using the Internet to research information or get curriculum for their classes.

Teacher technologists used the Internet in the classroom for "incorporating a particular activity for the student." The Internet is useful for constructing labs in the Science classroom. The Science teacher technologist can organize the lab instructions using the Internet and also have students go online to construct the lab.

Teacher technologists used the computer as a presentation tool and to develop their lessons. As teacher technologists developed presentation materials for the classroom, they used the Internet as an additional, convenient resource. The Art teacher technologist cited, "Before I would spend hours pulling slides and now I can actually prepare these lectures in the summer time, in my off time…scan in the images off the Internet and use them for reference." Materials are vividly presented on the Internet: "the Internet is really a big boom, because everything is real current and it's in color." For the English teacher technologist, information obtained on the Internet is just "one click away." Teacher technologists accessed Computer Literacy and Science lesson plans; "there are icons that come up as part of it on the CD-ROM." "I just go in and click on them."

The Internet is useful as an online "quizzing tool." Students can take online quizzes, receive immediate feedback and make it easier for the teacher.

All of the teacher technologists cited using the computer to plan lessons by typing them or copying information from the Internet.

The computer offered a "way to be able to pull a whole bunch of things together and see a bigger picture than just looking at a textbook lesson plan." Teacher technologists can create and plan courses using information from the Internet that doesn't "cost any money, so…use all of the network feeds." Teacher technologists used the computer to write lessons, incorporating calendar dates and problem-solving activities. "I find that I have a bigger variety of lessons and examples and problem-solving activities." Information is compactly stored on computer hard drives and diskettes, so using the computer to plan lessons is a "good way…to not lose stuff."

Planning and writing lessons are seamless activities when done using the computer as a typing tool and gathering resources. Teacher technologists can "incorporate information from several textbooks into PowerPoint slides", " not only personal knowledge, but information from different sources including the Internet are all included." Teacher technologists cited "using the computer for curriculum purposes to outline for lesson preparation, for lectures, for making tests, basically designing the curriculum." The Math teacher technologist gets " math puzzles and word associations off the Internet." The Environmental Science teacher collected information on the Internet pertaining to the Edwards Aquifer and "printed off some endangered species from the Edwards Aquifer."

Seven of the teacher technologists at the private middle school academy offered that they use the computer to build syllabi to hand out to students on disks or CDs, planning classes "for an entire year rather than just a quarter at a time." CDs or floppy disks are handed out to students to copy assignments and syllabi to their computers, eliminating the need for so much paper.

All of the teacher technologists in this study used the computer to prepare and enter student grades.

Teacher technologists used grade book software such as Auto-grade to enter and calculate student grades. Teacher technologists discussed being able to give students a printout of their grades much faster and more frequently. "When they give their speeches I'm usually using the computer to do the rubric that I'm going to be grading their work on. Every time they have a grade, I have a little program that I use that lists all of their grades and recalculates their average, and so I make a little printout that I give them with their test every time I give them a test." A grade report can be printed immediately for the student who needs an occasional current grade "for say a recommendation for say NHS (National Honor Society) or something."

Online quizzes provide immediately feedback. For grading essays on the computer, teachers use the note feature in Microsoft Word to provide responses to students: "When I grade the essay, I can insert comments and that makes it so much easier for some reason, instead of the whole writing on the side."

All of the teacher technologists had working e-mail addresses. When physically capable, the teacher technologists cited e-mailing students or colleagues.

E-mail offered a line of communication between the teacher technologists and their colleagues, although one teacher technologist revealed the isolation she has experienced since using e-mail at school; although e-mail can be a timesaver, "technology has isolated us." The teacher technologists at the private middle school academy also used e-mail to communicate with students who were ill and to provide missed lesson assignments. Students who "don't understand something and need a quick update" can also e-mail the teacher technologist "back and forth." "One of the things I have been doing recently is more e-mail with students. I have given them all my e-mail address." Teacher technologists who e-mailed with students back and forth, admonished students could flesh out understanding concepts and challenges with the lesson assignments. With the use of e-mail, students no longer have to wait until the next day or class meeting to get information about missed assignments.

Individual Structural Analyses – Incorporating Technology into the Curriculum as Teacher

Bailey Ma

The underlying structures expressed by Bailey Ma regarding incorporating technology into the curriculum for the teacher included collaboration, coordination of contemporary information and variation in lesson presentation.

Bailey Ma expressed that the Internet was useful for collaborative activities. Both she and the students researched Internet websites for information on current events. She and the students discussed those ideas and shared their viewpoints based on the researched information. She taught students how to look at various websites and how to evaluate them.

Bailey Ma used the computer to coordinate information for course material. She expressed the switch to finding materials and ideas from various Internet sites, rather than spending money on textbooks. Using computers for information gathering allowed students an opportunity to experience a global view of contemporary issues rather than using a traditional textbook, chapter by chapter.

Computers allowed Bailey Ma to present the lesson in a variety of formats. Students visited the online textbook website and other websites and read assigned passages for class discussion. Bailey Ma played segments of videos to teach students and facilitate class discussion. Students presented projects in class using PowerPoint slides.

7SeatRulz

7SeatRulz's underlying structures for using computers in the curriculum as a teacher meant that computers were great for computational science and labs, the computer served as a file cabinet, computers were useful for passing information on to students and the computer allowed for ease in immediate assessment feedback.

7SeatRulz cited that computers have been useful for computational science projects. 7SeatRulz used online websites to construct molecular lab lessons for students to explore. Students were able to use computers at the lab workstations.

The computer served as a file cabinet for 7SeatRulz's course materials and class assignments. The lessons she taught in her Chemistry classes were stored on the computer. Lesson information was passed on to students on CDs or floppy disks.

Class assignments, labs and projects that had been turned in by students on disks were graded and returned to students on disks. 7SeatRulz expressed that the computer allowed her to set up a grading program and provide more immediate feedback on grades to students.

Genny J. Matt

Genny J. Matt's underlying structures in using technology in the curriculum as a teacher involved using the computer to present lessons, to vary grouping arrangements, to communicate with colleagues and students, to provide immediate feedback on grades to students, and to use the computer as a file cabinet.

Genny J. Matt presented her lessons in the classroom using direct lecture, but supplemented that with Internet resources projected on the television screen or by using the graphing calculator projected on the overhead screen. She went back and forth between using technology and writing example problems on the white board.

Genny J. Matt used a variety of teaching methods along with various grouping patterns in the classroom, as well. Students were grouped using their laptops and graphing calculators as writing and calculating devices. Students also were assigned independent lessons using their laptops.

Genny J. Matt used the computer to communicate with other colleagues in the building as well as other online professionals. She cited that e-mail was useful for communicating further with students, especially students who had questions outside of the classroom time, or who had been absent and needed to catch-up with missed assignments.

Being able to provide immediate feedback on grades was cited as a use of technology for Genny J. Matt. Freshmen students were able to receive a mini progress report of their grades in her class at least once a week.

The computer operated as a storage unit for Genny J. Matt. Her calendar, files for class assignments, grades, syllabi, and notes were all kept on disk. Genny J. Matt cited wanting to be able to have a web page that posted most of the curricular information students needed for her math classes.

Ara B. Jaamz

Ara B. Jaamz's underlying structures for incorporating technology as a teacher into the curriculum included online quizzing, communication, and copying assignment information to students.

Ara B. Jaamz cited using an online quiz website to prepare quizzes for his junior level students. The quiz center offered him the opportunity to set up the quiz and have students take the quiz. This alleviated printing quizzes on paper and having to lug papers around to grade. The quiz center e-mailed the students' scores to Ara B. Jaamz's e-mail address.

Ara B. Jaamz cited using the computer for communication with both students and colleagues. He e-mailed students to announce a change in lesson plans. He e-mailed his colleagues about lesson plans.

Ara B. Jaamz passed out class assignment information on disks. Students copied the information to their laptop computers. This alleviated making paper copies of lesson assignments. Too, if he had any last minute updates to the lesson files, he was able to have students re-copy the updated file.

Sally T. Smith

Sally T. Smith's underlying structures for incorporating technology into the curriculum as a teacher involved presenting PowerPoint lectures, pulling information from several sources, and providing immediate feedback on grades to students.

Sally T. Smith used the computer to present PowerPoint slide lectures to students in her Art classes. Being able to use PowerPoint has reduced her lesson planning time. She is able to plan lessons anytime she has access to the Internet. Students were less distracted with the PowerPoint lectures because Sally T. Smith used lots of visual imagery.

Sally T. Smith expressed using the Internet to pull material from various resources for her classroom lessons. She reported that she no longer relies on only one textbook or textbooks only for gathering materials for lessons.

Sally T. Smith used the computer to record grades. She provided printed grades to students upon request.

Maria Rodriguez

Maria Rodriguez's underlying structures for incorporating technology into the curriculum as a teacher consisted of copying assignment information to students, pulling information from several sources, communication, addressing various learning modalities, and grouping students when necessary.

Maria Rodriguez copied assignment information to students. She gave students copies of the syllabus and any word-processed assignments on disk.

Using the Internet to pull information from a variety of websites was especially useful to Maria Rodriguez. She cited specific websites that she visited every day for information. She cited the importance of visiting websites that she asked students to visit so as to determine if they were worthy sources.

Although Maria Rodriguez seemed reticent about communicating with her colleagues by e-mail only, she explained the ease in being able to e-mail other teachers and save time. Students e-mailed her their journal entries about specific issues discussed in class. She read them and returned their entries with comments.

Maria Rodriguez discussed being able to address several learning modalities using the computer: intrapersonal, interpersonal, kinesthetic, and verbal. She addressed the intrapersonal by having students write daily journals. She addressed interpersonal by allowing students to pair up in groups to work on Internet assignments. She addressed the kinesthetic by allowing students opportunities to get up and move around the room or walk around the school for various assignments.

Sam

Sam's underlying structures for incorporating technology into the curriculum as a teacher included presenting CD-ROM lectures, copying assignment information to students, and communication.

Sam expressed that using the BioInquiry CD-ROM during lectures gave students one more exposure to learning biology. Each student had a copy of the CD-ROM and could take it home and replay the lesson as many times as necessary for understanding.

Sam reported using disks to hand out any assignments. The disks alleviated her having to make paper copies of assignments and also having to write as much on the board, especially since she doesn't have a stationary classroom.

Sam communicated with students by e-mail. Students were able to e-mail her if they had been absent from her class to receive the assignments missed. Students could also e-mail her if they needed clarification on a lesson or if they had questions concerning assignments.

Mkad

Mkad's underlying structures for incorporating technology into the curriculum as a teacher involved using the computer for on-line lesson planning, as a filing system, to present lessons, and for group assignments.

Mkad mentioned accessing the state of Texas' Computer Literacy curriculum on the Internet. The textbook had an accompanying CD, which he used to plan lessons also.

Mkad used the computer to store all of his lesson plans, making it easy to modify those lessons from year to year. Everything he taught came directly from his computer through the data projector for students to view. All of his lectures involved explaining a concept by demonstration.

Students followed through with Mkad's lessons at their computer workstations, sometimes being allowed to work with a partner. Students shared their knowledge with each other but were responsible for turning in individual products.

Gdad

Gdad's underlying structures for incorporating technology into the curriculum as a teacher consisted of presenting lessons, planning lessons and providing immediate feedback on grades to students.

Gdad discussed using technology as a teacher in his classroom for presenting Algebra lessons to students. Gdad doesn't have computers in his classroom, other than the teacher desktop computer. His only chance to use the computer as a teaching tool is by projecting equations written using Microsoft Paint and a WACOM input stylus to the front of the classroom.

Gdad used technology to plan Algebra lessons. He downloaded student activities from various Internet websites and printed them out to share with students and other teachers.

Gdad used the district's grade book program to record his students' grades each day. He cited being able to give students updated copies of their grades.

Sophia Loren

Sophia Loren's underlying structures for incorporating technology into the curriculum as a teacher included Internet research, planning lessons, and pulling information from several sources.

Sophia Loren reported using the Internet to research lessons to share with students. Sophia Loren especially used the Internet to get up-to-date information concerning endangered species. She used the Internet to show students colorful photos to capture their interest.

Sophia Loren cited that all of her lesson planning is done using the computer. She expressed being able to pull information from the Internet into her lesson plans.

Composite Structural Analysis – Incorporating Technology into the Curriculum as Teacher

Life as the traditional teacher knew it may have been altered forever due to the integration of computers in the arena of teaching and learning. All teachers have become teacher technologists if they are using computers in the classroom. One role of the teacher technologist, whether formal or informal, is to be able to organize and appropriately use vast amounts of information that is now available to teachers on the Internet.

The teacher technologist uses the computer as an organizational tool.

Whereas the traditional teacher collected, saved, and filed away vast amounts of paper curriculum materials and handouts in gray, brown or black metal, three-drawer file cabinets, the teacher technologist uses the computer as a storage medium. Computer interface programs such as Microsoft Window's Desktop and Microsoft Window's Explorer have been designed to represent the traditional teacher's desktop and file cabinet spaces. Teacher technologists process grades, student activities, lecture notes, class assignments and syllabi using software such as Microsoft Office's Word, Excel, and PowerPoint, and grading software such as Auto-Grade.

The teacher technologist saves this information on the computer's hard drive, a floppy disk or compact disc (CD) and passes it on to students to copy to their computers. The teacher technologist may print out paper copies to pass on to students. When students have e-mail addresses, the teacher technologist passes the information to students by attaching a copy of the file to the e-mail.

The teacher technologist calculates and stores grades on the computer. Students receive grades at normal reporting times and at various other intervals throughout the school year.

Students and parents can request current grade averages from the teacher technologist, rather than waiting for a grade report to come through postal mail.

The teacher technologist uses the Internet to build and present lessons in the classroom.

Internet websites have become a main resource for building curriculum. Some teacher technologists use Internet websites as the primary source of information for use in the classroom. The teacher technologist can now access professional organization, current university research, and online textbook websites.

The teacher technologist teaches from the Internet directly. Students visit the websites from their seats in the classroom, read the material, and participate in a dynamic, on the spot class discussion. In one teacher technologist's classroom, students submit data to construct models online and receive the constructed model results back minutes later. The teacher technologist builds PowerPoint slides using Internet-collected information and presents to the class. Students are exposed to current information and are more vividly engaged in the lecture.

Research Question 4: How do you incorporate technology into your curriculum for the student?

Individual Textural Analyses – Incorporating Technology into the Curriculum for the Student

<u>Bailey Ma</u>

> One of the things is that the students have tools; I have tools. I can do some directing, some suggesting, but they can make some choices.
>
> What I do is a lot of very project-based kind of learning, so what they do is create a project to indicate that they have mastered the particular idea or concept or time period in history. I teach Contemporary Issues and the same kind of thing happens where they can locate information and bring that into the group discussion, and they won't just sit

there and sponge it all in. They have to bring something to the table. Otherwise it tends to be a very dull discussion.

At this school, all of our students have a wireless connection to the Internet. However, not all of them always work. So sometimes out of necessity, grouping has to happen because not everyone has a fully functioning laptop or not all of the pieces are there. Other times, if everybody is where they are supposed to be and they have all their stuff, it allows them to diverge a little bit and then bring back ideas. I do a lot of group work as well as individual kinds of things. There are other times that I know of that we have had questions from parents saying, 'Okay, my daughter has to do all of the work.' I have worked with that myself and I've struggled with that, but I think I've worked on developing rubrics and different kinds of things that make every member of the group be responsible for some element of what they are doing.

So if you an active teacher and you are wandering around the room and you are making sure everybody is on task, then you don't run into that kind of thing where you have one kid that is just kind of cheating off of everybody else's brains. I still maintain that, as far as in business and industry, they are looking for people who can collaborate with others in order to be good productive workers. And if they haven't learned that skill, we have to give them some practice in doing those skills.

A lot of it is discussion. Usually I set up a project. They had to evaluate a campaign commercial. It required them using their computers to be able to pull in websites from the different candidates. They looked at Channel 8 where one of the reporters is doing a truth sort of thing. He'll look at the ad and then really look at what it is about. And he published that finding on the Channel 8 website. So they could go and find that information and see it. It's also great because they can compare multiple things. A lot of the campaign websites have their commercials right on the Internet, so they can pull them down and take a look at them. We sent them out looking for whom I should vote. I needed them to tell me the truth about the candidates. And I said you have to cut through the rhetoric and find me some kernels of information. It was interesting because I'm sure you're aware that we have a predominantly Republican environment, yet it is interesting to see how many held views that were different from the classic Republican candidates. They were surprised to find that. I'm hoping there were good dinner table conversations at home. They found that they were amazed at what they stood for. The other thing we learned very quickly was the importance of what polls were and how they worked. And just because someone is ahead, you look at the sample and know where it came from and if it is a good one. If it is a good poll, it will be absolutely accurate. If it is not a good poll, you just pick 400 guys off the street and say it is the state of Texas, it's not necessarily the case.

In history we do the same kinds of things. They still have to bring a lot of ideas, and the computer is the tool that let's them get there. I've read a lot of really bad papers because people got tired of hand writing papers. Now I can have them do revision and send them back and say, 'I can't find the thesis. Rewrite this opening paragraph.' And

I'm not giving them a death sentence, whereas if my teacher had given me that and said rewrite this, I would say 'I'll take the C. I'm not going through this again.' For them they just pull up the file, make the adjustment, print it off or they can send me the disk, and they have had a chance to rethink what they are doing.

My assessments tend to be project-based. I come up with broader ideas or topics and then design and develop, devise project kinds of things to see if students understand particular concepts. Very rarely are you going to see any kind of multiple-choice tests from me. You're going to see probably essays. I want to pose a question and have them reflect on it and look at it from different directions and see what they come up with.

In history, the big thing is how well it is supported by research with an appropriate bibliography, etc. I still laugh when they say to me 'We're doing a speech. Do we have to have a bibliography?' I say 'Is this all your original philosophy?' 'Well no.' 'Well then I expect a bibliography.' 'Oh, okay.'

Sometimes it's PowerPoint presentations that are live. Sometimes the PowerPoint's are designed to stand on their own, like a virtual book or a virtual museum tour so that I can see that they really are understanding a particular concept. In Contemporary Issues class, they do all different kinds of things from making little Power Points of people in the news, and then they test each other to see if they know whom these people are.

I think that the fact that I teach juniors and in Contemporary Issues I teach sophomores, juniors, and seniors, they are not just responsible for memorizing the answers and spitting it back on the test word for word. If I wanted to just hear myself talk that is what we would do. Students have to look at it beyond just the rote answer.

At the beginning of the year they will say things like 'What do you want? How long does the paper have to be?' And I say 'Answer the questions. You are going to have to have a paragraph that's going to state your thesis. You're going to have one or two or three supporting paragraphs that prove that what you're saying about the thesis is true. And then you're going to have one more paragraph that concludes it. So I would think somewhere around four or five paragraphs.' I say 'I'm not going to hold it absolutely to that, but it kind of answers the question.' Give me an answer and then prove that what you just said is an adequate answer and that it is justified. And you can do it through PowerPoint. You can do it through Word. You can chart it, if you want to, in Excel. But you have to prove it to me. You can't just say 'This is my opinion.'

I think the responsibility for a really good teacher working with technology is the same as the really good teacher that stopped kids from shooting notes across the room. If you're trying to do your work at the same time that the kids are watching a video or in working groups and they have gotten distracted (and we all know how long they can spend on tasks before they start wandering off and thinking about the day), if the teacher is not actively involved in what's going on in the classroom then they get lost.

The kids know that and then they start doing what they want to do. They e-mail their friends. They start wandering off to websites that are interesting to them but don't have a thing to do with what you're doing in class. Or they start doing their other homework. I tell them 'I am very jealous of the time that I have with you. I do not share you in this 85 to 90 minutes with anybody else. I want you nose to nose with what is going on.'

There are some days that, no matter what I try to do, I can't think of anything redeeming of social value about what I'm doing, but you keep trying. There are some days when the lesson is very good. You try to think of a new way to approach it and keep them interested. We're dealing with kids who are easily distracted. They have so many things to keep them busy. I'm not saying we should entertain them, but we have to find ways to engage their brains so that they don't just sit there like sponges.

We do all of those things and we do them based on what the lesson calls for. There are some days that being on the Internet is what we will be doing for the majority of what we're about. There are other times that note taking is a big deal. Sometimes we put down the computers and we have seminars, where they may have used the computer to prepare for the seminar like reading materials. My History class for example has an online textbook. They better have their information in place and ready to go. When we're discussing something, I don't want them sitting there not having read the material. I prepped my part. If we're a team going after learning, then they have to prep their part too.

That's hard to say because it really depends on what it is that I'm trying to do. There is more note taking, which I don't think is the greatest thing to do. But I keep trying to decrease the note taking part of what I do. I think it's kind of funny that they love to take notes while I'm talking about something but the project or the test that they are going to be doing might not have anything to do with that or it will be coming around from the back door. They are going to have to do something different. If they think they are going to be able to consult their notes from what I said and find the answer to the project, it's just not going to be there. It may give them clues on finding what they want to do, but they have to think and construct their own response to that particular idea.

I find it interesting to watch them because they always moan and groan and say 'Do I have to carry this computer around?' But they use it and go to it. It's the thing that I fondly waited to see happen. Instead of saying to the kid 'Are you using your computer in Word to do something?' And they will look at you and say 'No, I'm responding to a question on American immigration.' It's the tool that helps you get to where you need to go.

Part of it is that our kids are so blessed to have computers anywhere anytime they need them. They can go out and draw a water sample and feed data in right at the creek bed. They can do those kinds of things. It's a great equalizer. It allows kids who don't always get to go places and do things to be able to experience some of those places and see some of those things. Not all kids have the ability to travel. Most of ours do; most of our kids are upwardly mobile kids. They can take courses online and they can follow through with things that way.

With attention span in particular, I have some kids that have some learning disabilities. If you can find their button and see what is going to help them do it, then sometimes giving them something that they can manipulate really does help. I'm a visual learner, but that doesn't mean that's the only way. Even if kids can manipulate a mouse and move it around doing stuff, that's something where they are finally starting to own the material.

I have some kids where I really had to laugh when I got the thing from the counselor about the kids who have problems. In Contemporary Issues class I had seven kids that had to be in the first row. I thought that would be strange because we don't have a front row. We have groups all over the place. So it was an interesting thing. I wondered how I was going to bridge that need. I have a lot of kids that have some real learning differences. I am not the specialist in learning difference kinds of things, but the laptop and the use of the computer in the classroom lets them express themselves and do some things in ways they wouldn't do it if it was just answering a test or memorizing this or spitting this out. They would be gone. They would be checked out.

7SeatRulz

All my classes use the computers for labs. Sometimes I have computer-based labs where they are doing different types of manipulations on their computers and they are gathering data through whatever they are doing on the computer.

Sometimes we use it for Internet research. Truthfully, the Internet research has decreased the level of work that they do, mainly because since they have the Internet, they don't feel the need to go to the library and look it up in a book. A lot of times the information that I want you can only find in a book, and I will get notes from parents saying 'I couldn't find it on the Internet.' And I ask, 'Did you go to the library and ask the librarian and look it up in the book?' 'No, but I looked on the Internet.' 'Well, I gave you the bibliography for a book and the information is there.' And so they no longer use the library. They no longer use periodicals or books, the way that they should be able to. They assume that everything can be found on the Internet. They use it more, but it has decreased the level of work that they can do because they no longer use all of the resources available.

When doing research for labs or projects, they are allowed to do it on the computer rather than physically drawing it out. Almost every single project I give is open-ended, and I always leave an option where there is a computer component if they so choose. The first quarter project that I gave, they could do an oral presentation with PowerPoint. And probably about a third of my students chose to do PowerPoint presentations.

One kid this year made a web page, and last year I had other kids who made web pages. For the second quarter, they build models of their atoms, and again some kids choose to do it on PowerPoint or through other venues on the computer. Others make a physical model and then they can present information on their element in any format that they choose. For the third and fourth quarter, they have a mandatory PowerPoint presentation for an oral presentation on a research project that they did. In the fourth quarter, they have to build a computer model of the system that they are studying, and show what would happen if they had changed some of the criteria that they were looking at.

Sometimes they just put it on the board. Sometimes if it is an in-class assignment, I will let them come up and ask me questions before, for instance if they are going to put it up on the board, before they put it up on the board I check it and I'll work with them and let them know if they are doing it incorrect or correctly. This way, I know nobody likes to put anything up on the board that they find out later is wrong. And so this way, they can fix it before they get up there. And I give them just enough information to know that it's wrong and give them an idea of where to go, but not enough that they are actually getting the answer. So they still have to do some thinking on their own. Sometimes they just give out notes verbally. Sometimes they make PowerPoint presentations to present during class. So I get a wide range of things for in-class work.

For homework, they can handwrite it out. Sometimes they type it up, but they don't have to. Some kids, because they typed it up, will turn it in on disk. It's a mix. About 20 per cent of the kids will type up their homework.

I think that with chemistry there is much math to do also. A lot of times it's easier to do the math by hand. A lot of the homework is visual. It's arrows and pictures of the compounds, and there are so many subscripts and superscripts, so it's a lot easier to just write it out than to go through all the formatting on the computer.

Students collaborate in my classes. Since a lot of the stuff I do with the computers is lab-based, they have lab partners. And so usually I don't mind if they use one computer per lab group with their lab partners and they both work off that one computer for collaboration as long as when they answer the questions, that's individual. Sometimes it makes it easier for collaboration. Sometimes it makes it harder. It depends on the assignment and what the purpose of the assignment is. Sometimes I want them to collaborate to understand how to set up the computer part, but each person's computer part needs to be individual. So they help each other set it up, but then once they have put in the data and the information, the actual model of the system, then it must be individualized for what they are doing. I see collaboration as part of that learning process with the entire conceptual way of understanding.

If I don't have a lot of time, they teach it to the groups. If I have enough time, then I'll let them come up to the class. I've done it both ways, and I don't think one way works better than the other except depending on what you're trying to accomplish and how much time you have in a class. When I have them work on projects, for example, there are Science projects that they do in the spring semester, they have to work in groups of three. Groups of two are too small. Groups of four are too big. They get off topic way too often. So I make them work in groups of three, and I've actually found that groups of three are the best. So usually if they are the large multi-week assignments, I usually have them work in groups of three.

The independent work is better because they can type it up and they can make it look neater. The collaborative work tends to look better too because they can easily e-mail the assignments to each other. They can just put it on a disk and give it to a person. They can all format it the same way because it is a lot easier for them to do that. From home, again with the e-mail, they can e-mail each other. If they are using the same program, they can describe what it looks like and it's a lot easier for them to go through it and use that. So in general, with all three of those, the way students work, I think the way they work has gotten better with having the computers.

The modeling requires that the students have to do more thinking to understand modeling concepts. The reason that I went to the modeling concepts is because of the computers because I found a new way to use the computers that, for certain units, it allows me to do some things that I could not do beforehand. It does require more thinking, and it's one of the reasons why I get more parental complaints because the students do a lot more thinking time and instead put it off until the last minute because they don't think it is going to take that much time when it really does.

For the most part, I have seen them on task more, mainly because they don't understand the new programs on the computer, and so they are on task more trying to make sure that they understand everything that is going on and the analysis that they have to do.

Last year, they learned one new computer tool and they did a lab that went with it afterwards that was a continuation of the concept. The entire unit was surrounding those two labs. They had one quiz, the two labs, but they had no homework assignments except to work on the two labs. And I set aside an entire class period where they could do nothing but work on the labs.

I set up another entire class period where I taught them how to use the tool. So I make sure to build in some class time to teach the tool, time for them to ask me questions on how to use the tool, and then also set aside a time outside the class so they have time to work on using their tool and it won't cut into their homework. Since I didn't give homework, I used that as a substitute instead. And then when I do the assessment, I separate out the questions, how they set up the problem, how it looks like when it sets up, and then I use that to determine did they grasped it correctly based on the way that they set it up and then is their data correct based on how they ended up setting up the problem. If they got the first part wrong, they can still get the rest of it correct as long as it's correct based on the incorrect first part.

I actually have students e-mail me questions, which is nice and I only check it when I'm here at the school, but if they e-mail me I will get back to them. In the past I have also had students e-mail me assignments if their printer port doesn't work or their CD or floppy drive doesn't work. I've also had students e-mail me stuff before it is due to have me check it and I can just quickly open it, check it, and then e-mail it right back to them without ever having to have a piece of paper. So a lot of times it's made proofreading a lot easier.

I think that when I do use the computer, they have a higher level of understanding. When I would use it as a lecture, they didn't get it as much, especially with the abstract concepts. The computer allows them to get the abstract concepts a lot better.

Their attention span is about the same either way. I think regardless of whether you have a computer or not, those kids who don't pay attention are just never going to pay attention. Or they will pay attention when the computer part is really cool and they first get it, and then they kind of get bored with it. You still have to harp on them to pay attention. I think that their interaction with computers when we do use assignments is more productive and more on task. Less of the 'I'm going to sit here and pretend to work and talk about my friends and what's going on this weekend.' They still do that, but I think they are on task more and they are working more when they have their computer assignments.

Genny J. Matt

One of the things that computers has allowed me to do is to challenge the students to look at the mathematical concepts and make analysis from what they have seen in a real-world situation. For instance, with a certain kind of equation, we can take that algebraic skill and then go to a real-world situation using Internet resources or just the computer itself on a spreadsheet, and look at what happens if this variable changes. How does the situation change? How would this relate to a real-world situation?

The analysis part of the mathematics is very rich through the use of computers, whereas it was static before that where you just did certain examples in a book. The kids looked at those examples and they were interested in getting answers only. They weren't trying to develop the understanding of what happens if you change this variable because it's so dynamic and so easy to explore. They can actually play. I call it play with the different representations and they can see what's happening. And so I feel like they have a lot bigger understanding. So the types of work that we do are more analytical, whereas before I wasn't able to get to that part of the learning curve.

Computers definitely increase student time on task. But I do have to admit that these kids multi-task. They will be doing several things all at one time, such as they will be answering e-mail and using instant messenger while they are doing some informational searches. At first I felt that it was real threatening and I would always get onto kids that wrote notes with paper and pencil instead of taking my notes in class and all that. But now I have gotten to the point where I feel like if they are so used to doing three things at once that as long as they are getting the content, and they are keeping up, and understanding, I don't even go there anymore. I let them do it. In the workplace they are probably going to have to do three things at once, so the sooner they learn the better. Now if I find that they are not getting the information and they are struggling, then we'll sit and have a little talk about where is your focus in class.

I think that they expect a faster pace. You know they talk about the Sesame Street generation where you go from one topic to the next topic to the next topic. And I think especially in our schedule where we have a block schedule, we really need to keep a fast pace. We need to jump from one 'Okay, if this is this, then let's look at what happens if' and not repeat the same thing.

Now as far as being able to process more, no I don't think so. I think in Algebra at the freshmen level this may be the first time a lot of the girls have experienced abstract ideas. As far as the development and the maturity to develop an abstract idea and then put it into an analysis situation, I don't see any faster learning curve there. I see them moving at the same pace, but with deeper understanding definitely because we can represent it in so many different ways. They can construct the understanding from so many different viewpoints in their own mind that I feel like there is a definite deeper understanding of what the Math concepts mean, rather than just manipulating symbols.

It used to be that it took a while to compute all the numbers. Now the graphing calculator can generate a table for you pretty quickly and then you can go from there and analyze. The spreadsheet is the same. You can look at more examples without the tedium of doing the arithmetic, and so that allows you to look at the Mathematics concept without the tedium of the arithmetic connected to it. So we are able to do more examples and we are able to connect them to richer ideas by connecting it to real world situations. Instead of just using x and y, we can use population growth and population over years, and we can actually get the real data and look at it. And then we can manipulate that data very quickly, whereas before it would just be x and y and very simple numbers because you couldn't calculate it. So I think that's one of the things. The tasks are less tedious as far as the arithmetic is concerned. The focus is on understanding the process.

Where one student might be a very visual learner looking at all the graphs and things that you can create with the computer, and even examples on the Internet even will allow that visual learner to see it and understand it, whereas another student might want

to see the manipulation of it, to see it move and see it be created. And we can do some of that with Geometer's Sketch Pad. I think those kinds of things really do help a student understand it better, whereas before it was very difficult for students to visualize things.

Geometer's Sketch Pad is really meant for Geometry, but there are some applications for algebra. They can go in and create a sketch of something and discover if one is twice as big as the other then how does the area change. It's a tool for allowing them to visually discover facts about how things change. With the use of their laptops, they have ways that they can take a spreadsheet and create a graph from it and present that graph in a Word document and explain what they have created and what they made in a different way than they would have been able to do with just paper and pencil. I think that it facilitated the communication of mathematical ideas. They can go to the Internet and look at an example and use it in class discussion, a real-world context. We can as groups or as the whole class.

I do have to have a little bit more structure with them, especially at the beginning of the year. But when I taught the seniors, I did a lot of that type of thing where one group would go and do something and another group would be doing something else. One student would be working on an individual project. It was more fluid. It wasn't everybody doing all the same thing all at the same time. I never thought about it being a function of technology, but it probably was for the fact that they have access to the information. But with my freshmen, I'm not there. I don't do that much of that. They need more direction on how to study, and how to take notes, and what's important, and those kinds of things. I would like to move in that direction though.

I don't think the use of computers always keeps their attention. It's the real world. I know that there are a lot of times that they are busy, and one of the things that I have to be patient with is that if we are doing something with technology, for instance, and we're doing a new sketch on Sketch Pad, that sometimes the girls are so wrapped up in the technology and they are playing with the tool and they are doing this and that and they are not really listening to what the concept is that we are trying to get across or they are not drawing from that experience for the big picture that I am trying to get them to understand. And so, yes, sometimes they are distracted by other people or by themselves involved in other things in the technology part of it.

There are times when they are not with me, and there are times when I will do something with them and I think they are really going to get it. I did an activity the other day with Sketch Pad where they were supposed to get an input and output and see that the rate of change was constant, and they no more saw that. That activity didn't work. But then I have done other activities with them where I've gotten so much better results than I thought I would get. They just took it and went with it and they were just asking really good questions and learning really good things from that representation on the computer, so just like any other lesson there are good lessons that work and there are lessons that don't work. It is an Algebra class, and they are freshmen students, so that is the reality of it. I will say that most of the time though when we are doing stuff with the computer, their initial reaction is very much to engage in it. They are wanting to problem solve with the tools as opposed to getting out paper and pencil to solve these problems. Their attitude is better towards it when they use technology than when they don't, but I don't know if that is the honeymoon period where they are just now getting to use it, and when they get to be juniors and seniors it may be different.

Ara B. Jaamz

When you observed, you saw one of the ways that I embed technology into the curriculum for the student. I directly taught using an electronic word document. Every time they ask a question, if I know I've already answered it on a document, then I'll sort of get in their vicinity and say, ‘Okay, now I want you to scroll up. Now read that part to me.’

So being able to teach off the computer document, I don’t think I could do that every day because they would find ways to get by me. I’m not so naïve to think that I’m always going to win. But since the situation is more rare than not, I think they stay with me and pay attention to me more than if we did it every day. I give them so many electronic documents, and I think this is the double-edged sword. On the one hand, it helps students who are proactive. On the other hand, it tends to cripple students who are used to being told what to do often.

Giving them a whole disk full of electronic documents where they’ll find all the information they need, and they’ll still ask me, ‘How do I do this? What do I have to do here? You never explained this and that.’ And I always go back to, ‘Did you look at the document that I gave you that said this?’ And I’ll pull out a hard copy and say, ‘See, it says here to do this. Did you look at that?’ So they are used to being told so often that they still lean on that. So for that kind of student it can be harmful, but again too, it becomes a learning experience. You’re in this type of school where you need to be continually referring to the electronic document your teacher gives you. Always look at your syllabus every day closely.

<u>Sally T. Smith</u>

I embed technology into my curriculum for students through the PowerPoint presentations and the lectures. Students usually pull out their laptops whenever they need them.

I do have one independent study student who took my Digital Graphics class. She had computer-based assignments. She had to research all sorts of sites of other digital artists and then reference all of them and turn in the list to me. She also had to, as she did her projects which were all digital imagery, she had to print out a history of the steps that she used, the procedures, so that we had backup information not only for my purposes in grading her to see what she did, but also to help her to realize what she was doing consistently, what worked for her and what didn't, so that she has that printed information rather than just arbitrary use of tools.

I would like to be able to contact all my students by e-mail when something comes up unexpected. I intend to do that in the future, but right now I only have my advance placement students that I feel like I need to keep in contact with them. I don't e-mail them frequently, but I can when I need to.

I think that students are realizing how important it is to think beyond the obvious any more. The speed and advancement of technology today has impacted their thinking processes I believe. Students are realizing that art needs to go beyond. Technical skill is important, but your thinking skills are even more important. I think that technology has really impacted that.

There are some images that take on a digital quality, a visual digital quality. I don't know how to describe that to you. You can spot when students have used digital imagery as a point of reference or if they have altered images and are using them digitally. I can spot that. This is okay. I think it's okay because art mirrors what's going on in the world, and technology is certainly a big part of our world, so I think that is perfectly acceptable and is to be expected.

A lot of times we alter images, which is one of the projects we're doing. They're going to be incorporating their own images, their own photographs for this digital project. Students can do a digital project not necessarily in painting, but they'll use it as a tool to base their art project on. For instance, they may do some of the work by digitally scanning in photographs, drawing on photographs or things like that, altering images and then use that as a basis for their painting. We often do that. For computer-based tasks, it certainly speeded up things like that. For instance, students can scan in a photograph and alter color and contrast. These are tasks that you might do with a sketchbook and a pencil. Before computers, this would take a lot more time. Now you can test things on the computer.

Students use the Internet. They have to so that they can do their PowerPoint presentations and do research. The Painting I class has to research a female artist. The Painting II class has to research a painting style.

The computer tools used the most in my class would be between the Internet and Adobe Photoshop 5.0, with an upgrade to PhotoShop 7.0 on the way I understand. Most students work independently on the computer. I give them some instruction in Photoshop and provide assistance in it.

In terms of students' attention span, I can reach the different learning styles better using PowerPoint presentations. Also, with instant access to information, we can pull up information on an artist or a style or technique and they can see examples of it. Before I would just try to explain it verbally, where now we can look at things more spontaneously, just the spontaneity of access helps.

I'm not sure if computers have changed students' ability to understand concepts.

Maria Rodriguez

In class the students use their laptops for note taking, for organizational issues—that's where they keep the entire class in folders so they can keep the syllabus organized, so that at semester time they know what we've covered. They keep all of the assignments together, so they also use it as an organizational tool. We do a lot of presentation-style assignments, where they use the laptops for PowerPoint and things like that. They also keep journals. They do journal writing for history on their laptops, and they e-mail them to me twice a quarter. So we use that as well.

While students are required to use the computer for every assignment, they are required to have the laptop and the Internet. It's in my policy statement.

In the classroom itself physically, using computers can be chaotic. Because the room has the wires coming from the students' computers and the backpacks are everywhere. Then somebody's computer always fails. I probably spend at least 5 to 10 minutes per class wasted with problems that the girls have with their computers. So, in that sense we've lost organization in the classroom.

If they are doing something individual, and it's something that the campus computer technician needs to pay attention to right away, I'll tell the student go ahead and take her computer to the C.A.V.E. (Computer Audio Visual Education room). But if I'm in the middle of discussing something or they are in the middle of a group activity where they need to be, I'll say shut it down and don't worry about it right now. They are conditioned to say, "I'm going to the C.A.V.E."

Now assignments are more web-based. Actually now students have more reading, God bless them. Now I can give them more without having to run tons of copies, so they have more to read online and more research, but short-term research. You know, let's go find a few things here. So it's impacted in that case.

I think it's made note taking easier for them because…something that I've recently noticed (I didn't even know they could do this) but I just learned this. We do open notes quizzes in my class. And it's more to make sure that as sophomores that they learn how to effectively take notes from the book. I've started to notice that when I give them the questions, they can go and find the word in the open notes they typed in

Microsoft Word. I've never thought of that. Especially with girls that have a learning difference and it takes them too long to read through it, they do that find and it's good for them. So it's really been something that has been good in the classroom, I think. And it's such a simple word processing thing. They find words within their notes and they can find all of their information there. So I think it's fine. It's a time saver for them.

We use the Internet a lot, almost every day. So many people had a horrific history experience because the teacher stands in front of you, lectures, and you take notes or sleep. I have become much more adept at how to access the information and process it. I don't care about what year. That's not history. What does that give us? Nothing.

Most of the time when we are using the Internet, we are using either primary sources that I know are valid sources, like a historical source, or we're using web sites that I have looked at and I have further researched to make sure that they are valid. Now when they go off and do their own thing, I have tried to give them (and this is something that I need more guidance in) but I have tried to give them qualifications to make sure they can find the author. Is the author a legitimate and academic source, government source, or news source? And if it isn't, put it aside. There are so many people that have printed their opinion out there. So if they can prove to me that it's a government, academic, or news site…and then sometimes it's wrong.

Our textbook is wrong. Our textbook is wrong a lot. It really is. I don't always catch it because I don't know everything. And so I tell them that, 'Our textbook can be wrong. So can the Internet. So if you find something that you are going to base your whatever on, your paper or whatever, make sure that you have it from more than two sources.' Have you read the book *Lies my Teacher Told Me*? It's really good. He did a study of twelve American History textbooks. They get so much wrong. There's a whole thing around African American history that is wrong. I don't even know what's right myself.

I have noticed that for simple tasks like note taking and even sometimes with PowerPoint because they know it so well, it has become a mindless activity. It has become so second nature. It's just something that they do that they don't have to think about. And so, in that case, it's requiring less thought about the technology it self.

But you can also use technology in cooperative learning to encourage higher order thinking, more critical thinking exercises. But I don't know if it's the technology that's making it more higher-order thinking. I don't think it necessarily is. I think it's because I don't know enough to challenge them on the technology side of it that I am challenging them on the content on the history. They are having to do it through the Internet or using their computer to create a presentation or to do their group activity. But I don't think its more critical thinking because it's on a computer.

I would love for my students to create web sites that have to do with something historical. But I don't know how to build a web site, so I don't want to ask my students to do something that I can't do. So I guess the point is that I just need more training.

I think that if I compare teaching without computers to without, they are doing much more independent work with computers because it has become their own little world. They have so much on those computers, both good and bad. For example, when I have them do the primary source readings, most of them read it by themselves, whereas if I had been in a traditional classroom I would have copied 10 copies and everybody would have had to share. Of course I used to teach in inner city Houston, so it was a whole different financial situation in the sense that we shared a lot and worked together a lot. Here we work together but there is more of the independent learner because of the computer. A lot of times my students need me a lot less because of the computer, than they have at any other place I've taught. Or at least they think they do because they go off and do their own thing.

I think that overall it is improving attention span because the computer tends to hold their attention more because they have to do so much to it, whether it's the typing, or they are looking for a file, or they are online and they are navigating. Because it's involving another emotion or something, it's holding their attention more.

My concern is with my students who have ADD (attention deficit disorder) because they can't focus on the computer and me. I'm starting to notice that more this year. If I am talking about something and the student is trying to take notes and then let's say that I give them something that they are going to read, then I lose here because it's too much. And so in that case I've tried to find how do I…because most of our kids can multitask and can do all of it and probably listen to music at the same time. I do have a student that has dyslexia, and she is doing really well because of the computer because she doesn't have an attention issue and the computer actually is helping her because it's helping her spelling, her grammar and all that stuff, so actually she is a beautiful writer, which if she was having to hand write she would not be able to do. So it's really helped her. She's a really great student, whereas traditionally she wouldn't have been.

Sam

Computers led to changes in the kind of work that students do in terms of the work and thought required of them, however there is one large downside, and I've not reconciled this. There are two issues here and let me start with the second one.

Students are very capable of producing a product using PowerPoint, putting together an internet-researched product and learning absolutely nothing because they have learned to disconnect. Technology has been so much a part of their upbringing that, just like that place that you learn in graduate school to disconnect your hand taking notes and listening so you're doing two things at one time, I think that's what I liken it to. They have learned to put together a project, read nothing, and learn nothing about it.

I tested this last year when I had them do a project and I had a quiz on it, not even my best student passed the pop quiz. So, they are not thinking while they are creating something using the computer. This year I changed the project. I decreased the amount of labor involved. I reminded them on a daily basis that the process was what was important, not the product. I had a rubric. The project was set up and designed to teach them and not to disassociate with that. I had students to tell me at the end that they learned absolutely nothing from doing the project. They had to go back separately and learn what the project was designed to do. They had to read the book or look at the CD or learn from another source. So I am still working on the project that will make the process pay off in learning and not simply the product.

I was very surprised the first time around and I do believe it has to do with their ability to disconnect completely with this. I can't do that because I didn't grow up with this technology. I think perhaps having more time to do a project, having it count less for the grade or at least de-emphasizing the importance of the product, and just constant reinforcement that the process is very, very important. Probably what would have helped this project is if we had all been able to go online together at the same time during classes. I think that is the secret to success.

They spend less time probably by keying in their answers and then printing a hard copy or copying to a floppy to hand in to me. They probably would spend less time doing it that way. So it's less time on the computers than it would be if they did it by hand.

Some students are very good at doing Internet research and others are just going through the motions. I feel that they would have done the same in the library.

When I present in class I can stop and they can ask me questions they have not thought to ask while doing it independently or reading the book. I think it's a lot easier for them to pick up basic biological concepts that are just fuzzy. I think they are learning more than memorizing now and it may not show up in the grade. I think that students before this CD were probably making a similar grade but understanding or learning the concepts probably less than with the introduction of the CD. So I think there was more concentration in trying to memorize stuff and now it's flip-flopped. I don't think it's a conscious decision. It think that just by seeing it in the book and by hearing it from me, by seeing it move through a continuum like most of these processes occur as opposed to just reading it (phase one, phase two, phase three) but actually seeing a little animation, that they have access not just to seeing it in class, but by going home and playing that over and over-- then it's genuine.

Mkad

We introduce the students to understanding the software of Office 2000. We do it with units; little projects; sometimes they are Internet projects. Sometimes it is word processing and they have to find a picture on the Internet or do research about somebody and write an article up and put a picture in about them. We sometimes put all of this together in PowerPoint.

Since many do not have computers, homework is zero.. If there is something like setting up a list of names, we do it in class.

Everything has to be on computers; it's all hands-on.

The most important impact of computers in my classroom was updating to Office 2000. From what we used, it was a giant step because many parents have the same thing at home and are being encouraged to buy it. Before Office 2000, we had Microsoft Works 3.1, really low on the totem pole. Now it's Microsoft Office Professional 2000.

The work has changed in that they are putting more effort into it now, and they are able to see on the screen what it begins to look like. They can edit and change it. Before the kids were sort of sloppy. They would just write down something. Now they don't just do that. They know that they can go online. They can find pictures. They can find information, do research, and see what it looks like on screen, edit and correct, and print it out on a sheet of paper. The quality of work is better than ever, much better.

They spend longer time on task. Before they would just do it because they had to. Now I get the very best from them. All the things that I taught them to use, from how to do a title page to putting letters in front of the pictures, spacing; you name it and they do it all.

Students learn how to go in and draw; they actually draw the atoms, how many electrons and how to label them and print them out. They can do that. You find some of that stuck into their reports. They do so much. Sometimes it gets to be overkill. You see what they do, you see the pictures, and you see the writing and how intense they are at having a very unique looking paper. That's what they want. It has been a tremendous help.

Each teacher gives them all sorts of research. Right now they are researching making cheese. So they are doing all sorts of things to find how to do it, what does it look like, finding the pictures and then doing the reports.

For Science Fair projects, there is a Science Fair site that the teachers want them to go to and get information first. Once they get through the seventh grade class, they know how to use the Internet.

Sometimes I will hear the kids say 'I went to that website and it was good.' Or they might go into one say 'I can't read all that. It's too hard.' Some of them have big long words on them. They might even hit one written in Spanish or French or something. So they say 'I can't do that either.'

Students collaborate and share a lot. Before now, they did their own papers. Now one or two of them will chime out 'So and so, did you read this? I found it here.' That's fine with me. If you can't find it and somebody found it, I encourage them to tell the other person where they got it.

They are encouraged to work independently when they start writing the reports, then it becomes theirs. Sometimes I hear them ask how to spell a word and we go to the dictionary and use the spell check or they end up asking somebody. They actually get up and go ask other teachers how to spell it.

They are allowed to go and get whatever they need to complete an assignment, except from a porno site. I watch for porno. When I see porno they lose their privileges. They do find ways to get in to them.

Students are increasing in the way they write, what they write, the volume they are writing, and where they are getting their information. I push for them to put everything in their words. So many of them will print it out first, read it, and then sit down and start doing their reports.

Right now they are all inspired. They are all working. They all know what they are doing. Once you show them how, things begin to appear on the screen. I think it comes alive for them and is more meaningful. When they get a chance to print out what they have in a report, there is a great deal of pride. 'Mine's done. Look how good it is. I'm going to put it up.' It gives them a chance to read right in front of them on the computer. They start with things that are too deep for them, and it let's them print out just the information that they want to print out.

The computer has made learning more instant for them. If we're doing spell check and they type words that are incorrect, they know immediately that when that wiggly line goes underneath the word that it is spelled wrong. When they are looking for a picture and they know exactly what they are looking for, they may go through a hundred pictures before they find the one that they want, but in the meantime they are looking at everything else. They are reading more. That's why all of our eighth graders passed the state's TAAS exam last year.

Not only has computers increased students' reading time, but they have to interpret what they have read in their reports.

I think it has increased how they communicate with each other. They have a reason to talk besides about the playground or a boyfriend or girlfriend. They ask, 'Why did you do that?' 'I can't make it work!' 'My picture won't show up.'

Some days it looks like I'm not doing anything. It has a lot to do with knowing the software and how to use it, but it's knowing the grade level that you are working with to cajole them into doing the work and making it a fun experience. If it's not fun, they don't have a result to show you and it's boring. These kids never fall asleep in class.

I think they just loved you coming in. It inspired them to do more because they wanted you to see their good work. They wanted you to get a copy. They lit up when you asked and thanked them. Everything was, 'Someone sees us.' What we're doing as wonderful and I'm going to give it to them.

I always have an approach. I show students what an end product looks like, how to do it. I have a little project that they start doing for practice and then I open them up to interpret a big project and what I'm asking them to do. I include anything I can. On this one, they will have to put their own pictures in. That enthuses them because that means they may use digital camera pictures that has already been taken of them Right now they are doing a big project on famous African American people. They are currently making a database of it and shortly I will do pictures with them and a report. And then I have them do one on famous Mexican Americans, famous women, and famous men.

Gdad

My students have used the computers in the computer lab this year to do a biography of a famous mathematician. For that assignment, they used Microsoft Word. I took them to the computer lab for two class periods to do that assignment. They don't usually use the computers to do Algebra class work, however.

The Internet has had the most impact on students in my class. Most say they have access to the Internet at home, although I don't have an exact percentage. Very rarely, but I have given students a writing assignment to do using the Internet.

I do not think computers have led to changes in the kind of work expected of students in Algebra because they do not have access to computers in my classroom on a daily basis.

Because of the nature of the curriculum in Algebra, it's just not computer-friendly. In other words, when you start talking to them about their science and their reading, there are all sorts of people that are tied into the computer. It's different in math.

If we had a bank of computers in the classroom, it would be different.

Each student does have access to a graphing calculator, which they do use. If they had access to a computer in special math programs, I think it would be helpful in increasing their understanding of math concepts.

I do download puzzles, word associations and other assignments from the Internet for students to use in class.

Sophia Loren

For their science fair project, they are required to do everything on the computer. And the science fair project is a big part of their grade, especially for the third six weeks of the first semester. They use the Internet. They use Word. They use Excel. They can't do it by hand. No hand drawn graphs. No hand drawn charts.

They can turn in nothing written on the bus on their way to school. It all has to be on the computer. And I tell them that if they have a computer at home to do it at home and let the kids that don't have computers use the ones up here. The computer teacher is very gracious in not taking a lunch break every day and he lets the kids come in and work in his computer lab.

Both the seventh and eighth grade have mandatory science fair, so we have 160 people that need to use the computer, so I've been encouraging them to get in here early and get it done. But it's typical of this age group not to think far ahead. This is very much a procrastination age. They'll all want to use the computer the week before it's due, and it will all be my fault because they don't have access to it.

Since most of them don't have computers at home, they can work on the project before school and during lunch. They can work on it here after school because nearly everybody is bussed so everybody goes home after school.

Last year I did a PowerPoint presentation with them on cycles of matter, and what I found with that was that we spent a week in the lab, and then when we took our test I asked them to describe a cycle of matter thinking they would use the one that they had the PowerPoint presentation. And I would say 90 to 95% of them chose to do a cycle they learned in the third or fourth grade! So maybe one or two, three or four chose to talk about the one that they had done on the PowerPoint presentation.

I don't think they really learned anything doing the PowerPoint presentation. It was cool looking and it was neat, but I don't think they understood what they were doing.

They were taking the words from the textbook and putting it into the PowerPoint presentation, but I don't think there was a connection between their brain, the textbook, and the computer. It was just a connection between the textbook and the computer. I don't think they understood it. They were just typing in words. Type in carbon. Type in cycle. Type in carbon dioxide. But they never made that connection of the carbon dioxide being used by the plants and trapped in the plants, and then the plants being buried, and coal forming and then we burn the coal and the carbon is released out into the atmosphere. They didn't make the connection.

I was very impressed by that PowerPoint business. I thought that was spectacular. When I got all these wonderful things, I thought, 'Oh, these kids really understood it' and they didn't understand it at all. Instead of doing it by hand on a poster, they were just doing it on the computer and generating something for the printer. It was beautiful. I had not had that problem with them not understanding those concepts before in the past. But we have done posters in the past or they have worked in groups doing things like a group poster or that sort of thing. This time they worked individually or they might have worked together. They sit side by side, so they could have done the same one. But they didn't understand it at the end of the assignment. They were just typing it in, and they were just moving the words for the textbook into the computer and it's real sad because I thought it was a big deal. But it's not a big deal if they don't learn it.

The first year I had my laptop I was in the TIP, the Technology Immersion Project with the district, and I was required to do a PowerPoint presentation that the kids did. And we did one on wildflowers of Texas, and I showed them how to use the presentation and how to enter the stuff and all this other kind of stuff. We had done a lot with wildflowers already. It was sort of like we had already been working on it two weeks, and so this wasn't a learning project for them. It was like a presentation thing.

So as far as a learning tool, I don't think it has a lot of value. But if you want to impress people, people are really impressed by PowerPoint. As a matter of fact, we were monitored yesterday by someone from Washington D. C. and one of her comments was that the teachers weren't giving their lessons in PowerPoint presentations. And so I don't know why she felt like, other than the fact that people just think that's like the cat's meow, and if you don't do it in PowerPoint it's not real anymore.

But their product is really nice looking, because they don't do things by hand. They do it on the computer so their finished product looks nice. It's pleasing to the eye.

And they know how to import and that sort of thing, so they make it attractive. I don't think it has increased their comprehension any.

I'll give you a good example of that. They made some brochures. The students who write well and have a good strong vocabulary, when they do their brochures by hand, you can tell that the kid understands what they're reading and writing, and it's strong and it's attractive and easy to read, no misspelled words and the grammar is correct. And when the student who doesn't have good grammar and is not a strong reader and has trouble with comprehension does one, it's very attractive but it has misspelled words and terrible grammar and there's not much content in it, and you can tell that they really didn't understand the point of the lesson. It's attractive but it's still a child's work, in other words, they didn't turn into Einstein and are not producing at a higher level than they would have if they had drawn it. It just looks better.

I think the computer is already doing their thinking and their math skills and their spelling skills. I guess it just boils down to what you want the students to know. We were doing something on the aquifers of Texas this week, and one of my students held up a map of the state of Texas. I was asking them to draw a map from that map and color it and label it with the different aquifers, the nine major ones, and she said, 'Why don't you just give us a copy of this map?'

And I said, 'Well, let me tell you, when you boil it down to it, what you're saying is really valid because everything you need to know I can hand you a copy of it. I can either get it off the computer or I can hand you a library card for every single thing that you want to know or need to know.'

So technically, there really is no reason for you to be in school. Once you learn how to read and once you know how to do multiplication, addition, subtraction, there's no reason to be here. Because if you want to know what the aquifers of Texas are, go put it into the computer and print it out. It will even tell you what the endangered species are. But I said, 'I would like for you to know this rather than me hand you a piece of paper and the piece of paper carry the information. I would like for you to know what the nine major aquifers of Texas are. I'd like for you to know how large they are. I'd like you to know where they are in the state. And I'd like for you to know what kind of shape they're in because the aquifers of Texas are shaped really according to the coastlines of what the state was millions of years ago because we used to be under a sea.'

And that makes it easier when they get into high school to understand when they take Geology, 'Oh, this looks just like the map of the aquifers of Texas.' Well there's a reason for that because those aquifers were laid down when the shoreline was there. But my point to her was, 'I want you to know this, and if I could just hand you the sheet and let you put it in your notebook, then the sheet has all the information, and if you need to go back and refer to it you can do that, but I would really like for you to know it in your head and have an understanding of it.'

Composite Textural Analysis – Incorporating Technology into the Curriculum for the Student

The teacher technologists in this study offered many ways that they incorporate technology into the curriculum for the student.

Six of the ten teacher technologists cited using PowerPoint for lecture or allowing students to use Microsoft PowerPoint to build projects in the classroom.

The use of PowerPoint as a presentation tool has become very popular in the classroom environment due to the ease of learning and ease of use of the software. PowerPoint provides a *powerful* presence, second only to the imagination of one's mind in an otherwise traditional classroom. "PowerPoint presentations are live. The PowerPoints are designed to stand on their own, like a virtual book or a virtual museum tour so that I can see that they really are understanding a particular concept."

Due to the ease of use and availability in Microsoft Office packaged software, students as well can use PowerPoint to present their research projects and assignments. Students sit up, pay attention more readily. "Students are very capable of producing a product using PowerPoint." "Their product is really nice looking, because they don't do things by hand. It's pleasing to the eye."

Six of the ten teacher technologists cited that students used computers in their classrooms for Internet research.

Student use of the Internet in the classroom is much more commonplace in classrooms where computers are used more frequently. Student use of the Internet depends very much on the availability of networked computers in the classroom. In this study, student use of the Internet in the classroom depended largely on whether computers were stationary in the classroom or students had networked laptop computers in the classroom. As one formal teacher technologist cited, “Some days being on the Internet is what we will be doing for the majority of what we’re about.”

Students conduct Internet research for classroom assignments. Some students bypass going to the library and conduct their entire search for information on the Internet. One science teacher technologist cited, “The Internet research has decreased the level of work that they do, mainly because since they have the Internet, they don’t feel the need to go to the library and look it up in a book.”

“Students can go to the Internet and look at an example and use it in class discussion, a real-world context.” Student use of the Internet in the classroom in this context makes classroom learning more dynamic and alive. Students become engaged in learning that is useful, that involves current issues and challenges in the real-world.

“Some students are very good at doing Internet research and others are just going through the motions.” Students who are adept at Internet research have been properly trained on how to use the Internet for classroom projects. Students who take a computer literacy classes in earlier grades may be exposed to the use of popular search engines such as www.Google.com. Students learn how to evaluate websites. “Once they get through the seventh grade, they know how to use the Internet.”

Five of the ten teacher technologists supported using technology along with the students to assist students in staying focused with learning the concepts of the course.

Teacher engagement with students using computers in the classroom works the same as in a traditional classroom. "I think the responsibility for a really good teacher working with technology is the same as the really good teacher that stopped kids from shooting notes across the room." Teachers get involved with student learning by demonstrating their support of and use of technology, by using technology along with the students. One teacher technologist reported one way she is involved, "I've had students e-mail me stuff before it is due to have me check it and I can just quickly open it, check it and then e-mail it right back to them without ever having to have a piece of paper."

A math teacher technologist shared that she has students access real-world problem based web sites in class and "challenges the students to look at the mathematical concept and make an analysis from what they have seen in a real-world situation."

For computer product-based research projects, students are encouraged to spend time reading, writing and thinking through the research assignment first and foremost, "de-emphasizing the importance of the product and … constant reinforcement that the process is a very, very important…secret to success." "I show students what an end product looks like, how to do it."

Six of the ten teacher technologists cited that technology helps students understand abstract material and become better thinkers.

The use of technology in the classroom can aid students in engaging in the higher order thinking skills such as evaluating analyzing, synthesizing information and making contributions to new ideas. The formal teacher technologist shared that students "had to evaluate a campaign commercial. It required them using their computers to be able to pull in websites from the different candidates." Students used the Internet to search for reputable websites with sound information, "they go and find that information and see it…they can compare multiple things."

Information from the Internet can be used to build a pro or con on an issue for classroom discussion such as "looking for whom I should vote."

Students become better thinkers when using the computer for revising and rewriting research papers. Instead of tiresome hand written papers, the U. S. History teacher technologist cited that she will "send them back and say 'I can't find the thesis. Rewrite this opening paragraph.'" In Chemistry, students constructed web pages or PowerPoint slides to build models of atoms. The chemistry teacher technologist used the computer to help students see the relationship between math and science and the modeling of science, and to understand how a system works as a whole "and not just get caught up in the math or some little detail, but looking at the entire picture." "The modeling requires that students have to do more thinking to understand modeling concepts. The reason that I went to the modeling concept is because of the computers." The Chemistry students were introduced to STELLA flowcharting software to understand the connections between math and science.

"The analysis part of the mathematics is very rich through the use of computers, whereas it was static before that where you just did certain examples in a book." In Algebra, the teacher technologist may introduce students to algebra concepts by having students access the Internet for web site examples that allowed students to "change…variables…dynamically…." "I think that students are realizing how important it is to think beyond the obvious any more. I think that technology has really impacted that." In Biology students accessed a textbook CD for additional thinking time at home, school, anywhere. "I think that students before this CD were probably making a similar grade but understanding or learning the concepts probably less than with the introduction of the CD. Not only has computers increased students reading time, but they have to interpret what they have read in their reports."

Four of the ten teacher technologists cited that students' attention span in the classroom is better due to the use of computers in the classroom; two cited that students' attention span is not better.

Several learning styles were mentioned as agreeable with the use of technology in the classroom in concurrence capturing students' attention span: visual, auditory, kinesthetic, interpersonal, and intrapersonal. Students who are physically active in the classroom may find the computer keyboard an interesting satisfaction of that need to "do something."

The World History teacher technologist attended to students' attention span by allowing them to take "walks around the school and talk about something. The intrapersonal style was addressed by allowing students to do daily journal writing and the interpersonal style was addressed by "use of the computers in groups…only two computers per group of four and they have to share." "With attention span in particular, I have some kids that have some learning disabilities; if you can find their button and see what is going to help them do it, then sometimes giving them something that can manipulate really does help." "In terms of student's attention span, I can reach the different learning styles better using PowerPoint presentations and we can pull up information instantly on an artist or a style." PowerPoint presentations seem to attend to both the visual and auditory learners, as a teacher talks through a lecture using visual cues.

Technology " is improving attention span because the computer tends to hold their attention more because they have to do so much with it, whether it's the typing, or they are looking for a file, or they are online and they are navigating. They spend longer time on task. Before they would just do it because they had to. Now I get the very best from them."

"Their attention span is about the same either way. I think regardless of whether you have a computer or not, those kids who don't pay attention are just never going to pay attention."

"I don't think the use of computers always keep their attention. Sometimes they are distracted by other people or by themselves involved in other things in the technology part of it."

Eight of the ten teacher technologists cited that the use of technology has increased collaboration among students.

All of the teacher technologists at the private high school academy and the informal teacher technologist at the public middle school academy highly encouraged collaboration among students. "I do a lot of group work as well as individual kinds of things. As far as in business and industry, they are looking for people who can collaborate with others in order to be good productive workers. And if they haven't learned that skill, we have to give them some practice in doing those skills." The chemistry teacher technologist at the private high school cited "I don't mind if they use one computer per lab group with their lab partners and they both work off that one computer for collaboration as long as when they answer the questions, that's individual. So they help each other set it up, but then once they have put in the data and information, the actual model of the system, then it must be individualized for what they are doing."'

There was a consensus among the teacher technologists practicing collaboration in the classroom, that this skill is highly useful in the business world. Students who learn how to work with others can benefit from the diversity of ideas and ways of thinking offered within a classroom setting. In the World History class, students worked in groups of three to four, sharing one or two computers. A student typed, another student researched information on the Internet, while another student read instructions to the others. Students shared a lot. "Before now, they did their own papers. Now one or two of them will chime out, 'So and so, did you read this? I found it here.'"

Three of the ten teacher technologists cited that students multitask when using computers in the classroom.

Students do a multiplicity of tasks simultaneously and with ease, it seems. “They e-mail their friends. They start wandering off to websites that are interesting to them but don’t have a thing to do with what you’re doing in class. Or they start doing their other homework.” “They do so much. Sometimes it gets to be overkill.”

Individual Structural Analyses – Incorporating Technology into the Curriculum for the Student

Bailey Ma

Structures present for Bailey Ma in incorporating technology into the curriculum for the student included project based learning, group work, and project-based assessment.

Bailey Ma indicated that computers in the classroom were most useful for project-based learning. Students were allowed to research Internet websites to get dynamic information for current issues covered in Bailey Ma’s Contemporary Issues and history classes. Students worked in groups in the classroom to do reading and research using the online textbook website. For group assignments, each student in the group was assigned and held responsible for some element of the project. Students presented researched projects as PowerPoint slides or web pages. Bailey Ma used scoring rubrics to assess projects. She also assessed student knowledge with essay tests.

7SeatRulz

7SeatRulz incorporated Internet research, mandatory PowerPoint presentations, collaboration and group work using the computer, building models using the computer, and e-mail for student technology use in the classroom. Students used the Internet to research scientists and science issues, but were not limited to the Internet. Students were given a bibliography of references that included both Internet and book sources. Students discussed science problems in class, usually in groups, teaching each other.

Students were required to present an oral PowerPoint project, at least once in the school year.

Students used the computer to submit data to a university website, allowing them to build orbital atomic models. The results of the data were analyzed and discussed in the classroom.

7SeatRulz used e-mail to communicate with students. E-mail was useful for further explanation of difficult material. Students were allowed to e-mail assignments rather than turning in a paper copy.

Genny J. Matt

Structures for incorporating technology in the classroom for students cited by Genny J. Matt involved students use of the computers to do analysis, students working at a faster pace, and students multi-tasking.

Rather than students being relegated to traditional textbook examples of solving problems in Algebra, students were able to use dynamic Internet resources in the classroom to analyze math problems. Students were able to play what if and change variables to develop further understanding.

Students worked at a faster pace using computers in Genny J. Matt's classroom. Genny J. Matt attributed this to students growing up in a media-rich environment, the *Sesame Street*, push-button generation. Students were not necessarily grasping mathematical concepts at a faster pace, but Genny J. Matt felt the push to be able to switch back and forth to several teaching modes to keep the students engaged. She taught using the laptop hooked up to the VCR and television, had students engage in group work, grilled students with questions, worked the mechanics of some problems on the whiteboard, and had a student graph a problem for the whole class using the graphing calculator hooked up to the overhead projector, all in one setting.

While Genny J. Matt was switching from one mode to the next, students multi-tasked. Students had their laptops turned on. Some were taking notes, sending instant messages, downloading new fonts, while working problems, working with a partner and listening to Genny J. Matt. Several computer program screens were open on most students' laptops at the same time, or either the programs were loaded and running but minimized to the taskbar.

Ara B. Jaamz

Ara B. Jaamz's underlying structures for incorporating technology for students in his classroom were to teach students English literature as they used technology and as he taught directly from the computer. Ara B. Jaamz seemed engaged with making sure students read and used the files given them. When students were given handouts on disk by Ara B. Jaamz, they loaded the files and were instructed to follow along as he taught the class. The files included instructions, questions, terminology for students to define as it was covered during the class lecture, a project assignment and rubric for the project. When students used laptops in Ara B. Jaamz's class, they used literature books to access the reading material, along with taking notes on their laptops.

In this manner, freshmen students were learning how to use the computers using Ara B. Jaamz's three keys to surviving freshmen English: responsibility, time management and organization. Students were held accountable for information passed out on disk, for using time wisely in class, taking notes and explicating literary pieces and appropriately filing documents on their computers.

Sally T. Smith

Sally T. Smith's structures for student use of technology in the classroom involved engaging students in thinking during her PowerPoint lectures and having students use the computers for digital imaging. Sally T. Smith put together a lecture, drawing from the photography and works of various artists throughout her PowerPoint slides. As she lectured, she questioned students, seeking their interpretations of various images.

Students used the digital cameras and computers to produce digital images in Sally T. Smith's classroom. Using technology, students were able to combine real photography with unreal images. Students took digital photographs and manipulated them in Photo Editor. The images were then printed and used as the basis for their paintings. Students also researched and gave presentations on artists and painting styles or trends. At least one of their resources had to be from the Internet and at least three images were to be scanned from books or copied from the Internet as examples.

Maria Rodriguez

Maria Rodriguez's structures for student use of computers in the classroom for curricular purposes consisted of using the computer as an organization tool, as a presentation tool, and for online research.

Students used the computers to store files and take notes in Maria Rodriguez's class. Students wrote their journal entries on their computers. At the end of each class discussion they were allowed time to reflect and type up their reflections. Each journal was typed in Microsoft Word and kept in a folder on the student's computer. When Maria Rodriguez requested them, students e-mailed her their journals, which she returned with notated comments using Microsoft Word's insert-comment feature.

Students used the computers to do online research and read books online in class. Time was allowed for students to visit specific websites working with a partner. They read and discussed amongst themselves, and later converged into a whole class discussion.

Sam

Sam's structures for incorporating technology into the curriculum for students involved building projects using the laptop computers, accessing the BioInquiry CD-ROM both in and out of the classroom, and conducting Internet research quests.

Students used Microsoft Word's draw feature to represent graphically chemical structures in Biology. Students used PowerPoint to present projects on cell organelles. As students became adept at putting together a project using technology, Sam decreased the amount of time spent using technology to develop the project. She spent more time discussing the process: the structure and function of cell organelles.

The BioInquiry CD-ROM is an alternative technology tool recently incorporated in Sam's biology class. The CD-ROM was used by students both in class as they followed along with Sam as she projected it during her class lectures, and out of class as a follow-up review at home. Students were able to replay cell animations on the CD-ROM as many times as they wanted to increase their understanding of cell organelles.

Students used the Internet to conduct research quests throughout the year. Sam reported that some students were adept at Internet searching, whereas others seemed to be going through the motions, the same as students would in a visit to the library.

Mkad

The key structures for incorporating technology into the curriculum for students in Mkad's classroom included the use of Microsoft Office programs, Internet research and collaboration. Mkad's Computer Literacy classes used Microsoft Office products to develop mini-projects and projects for other classes. Students used Word, Excel, PowerPoint and Access to build assignments.

Coupled with Internet research, students use Microsoft Office products in Mkad's classroom for projects assigned in other classes. A student took digital pictures of all eighth graders and composed a PowerPoint slide show comparing them with their seventh grade photos. Students created brochures for a science project. Students used the Internet to research topics assigned for the science fair.

Although they were asked to write their assignments independently, students collaborated often in Mkad's classroom. Students talked with each other in informal groups, usually the person they were sitting next to in the lab. Students shared ideas and taught each other how to use various features of the software. Students discussed and shared Internet website addresses and materials found on the Internet.

Gdad

Students were introduced to the use of technology in Gdad's classroom by conducting an Internet search on famous mathematicians and creating brochures. Gdad also incorporated technology into the curriculum for the student by drawing equation models using Microsoft Paint and a WACOM stylus pen hooked up to the computer and a data projector. Students were able to see a graphed representation of equations. Gdad wished students had access to computers in his classroom. He cited that until each individual student had access to a computer in his classroom, the student use of computers in mathematics would be very limited.

Sophia Loren

Sophia Loren incorporated the use of technology for students in her classroom by having students do research on the Internet and using PowerPoint to present lessons. Sophia Loren engaged students in Internet research for the science fair project. Students used the Internet to search for information on their approved topics. Students were able to produce a finished product.

Sophia Loren used PowerPoint for lectures, but also resorted to traditional lectures, complaining that students did not get it. Students did not seem to understand the concepts presented in a PowerPoint as they had understood in the past without PowerPoint. It is as if the computer had taken over doing the thinking for the student. Computers did not seem to make students better thinkers or writers. Those who wrote well did so whether using the computer or not.

Composite Structural Analysis – Incorporating Technology into the Curriculum for the Student

Project-based learning seemed to be the driving force for incorporating technology into the curriculum for students in the classroom. Students were able to explore an issue or topic in any of the curriculum areas and use the Internet as the primary medium for researching the information. The ready availability of the Internet and its vast websites almost made unnecessary to go to the library for book sources. If book sources were used, students accessed those online. Students readily grouped with other students in the classroom, usually with the student sitting right next to them. In several classrooms, the group worked mandated at least one working computer in each group, especially when students needed to access the Internet for the lesson assignment. Students readily and fluidly talked to each other. One student operated the keyboard and navigated the Internet while the other talked or wrote throughout the session.

Students seemed quite comfortable with accessing information electronically. However, several teachers noted that students could mindlessly produce wonderfully created, perfect-looking project presentations, without learning anything about the actual course content. Teachers seemed perplexed at how to deal with this aspect of technology use in the classroom. One teacher offered that perhaps more time should be spent in going online along with students in the classroom, rather than assigning them a project and leaving them to their own understanding.

Most teachers expressed awe at the students' ability to operate the computers so swiftly, so deftly. Some articulated that students knew as much as they did, with so much information readily accessible. Some articulated that students knew a lot about computers, yes, but not a lot about the course content. Teachers seemed to take some solace in thinking that they still had something to teach students; students still needed them to explain the course content, yet students could also teach them, the teachers, about computers.

Research Question 5: How do you train other teachers to use technology?

Individual Textural Analyses – Training Other Teachers on the Use of Technology

Bailey Ma

> For new teachers using technology in school for the first time, I say, 'Try it. Get out there. Stick your neck out.' If you have a good lesson, then think about how technology would make it a better lesson. Don't fall back to what you learned as a college student. Get out from behind your desk, get in there, and walk among them. Get with those kids. See what they are doing. Challenge them to produce for you. They will. They'll sit on their butts and do nothing as long as that's what you expect of them. They will live right up to or down to what you expect. And if I demand a lot, they give it to me. If I don't demand much out of them, they don't give me anything. And they know how to read you. And you're not doing them any favors by not demanding it of them.

With college prep, our kids here are so stressed, but they have good minds and they need to use them. Please do not think that you know enough to sense that. So, get from behind that lecture and note taking, and if it falls flat, then so what. What did you lose? Our teachers have said, 'I don't want to teach that because I don't know my way around PowerPoint very well.' So what? You don't have to. The kids know PowerPoint. You're the expert in the curriculum. So let them express that in the language they do best. And they do multi-media expression. They write in pictures and words and poetry and song. They bring all of these different elements together in ways I can't even see. And if it doesn't work, chuck that idea and try something else. So that's my big piece of advice.

The best example I have of this is when I was doing two poems on American immigration two years ago. Boy, did I learn a lesson! One of them was the 'Give me your tired, your poor, your...' And I said, 'I want you to illustrate your favorite line in the poems. You've got the Internet, now make a collage of pictures.' I thought I'd make one too. And I made a one-slide PowerPoint. God was watching because I didn't present mine first. They went 'Let me go first. Let me show mine. I want to show what I did.' I brought the projector in and we just plugged our computer in. And I saw these things, and they blew me away. Compared to what they did, my stuff was garbage.

Teachers are not mandated to come to training. That is another part of it. I think if there were a stronger commitment, you would see more participation.

When laptops were new to this school, when the whole use of computers in the classroom were all happening at the same time, we were all new on the journey, so a lot more people were signing up for even the introductory courses on how to do things. That was because we were all brand new to Windows and to Office and to that kind of thing. At the beginning of the new laptop program, teachers could apply for a one-class reduction in teaching and you learned. You learned how to be a technology teacher.

There were five or six teachers who were given that option. They worked, they published, they reported back to everyone. They became part of my teaching tool. And people were looking forward to the next year; hopefully, that it would happen again. It was a great opportunity.

For teachers I have observed using technology in the classroom for specific things that they do, I ask them to teach a class on that. I immediately try to harness them to participate in what we're doing. And usually they are very gracious in sharing their ideas. My one little way to give them a little kudos is to bill them as a Special Guest Star.

I don't think I see fear of the computer. I saw that initially, when they were afraid to break it. And we said, 'I don't care what you do, you're not going to break it.' Part of it is that sometimes they think 'I've always done it with pencil and paper and I'm not going to change.' And I say, 'Could you just try it this way?' 'No.' 'Okay, I guess you're not going to.' I think it's a matter of a comfort level where, this is the way it's always worked for me.

I think some of it is laziness. I think some of it is that you reach a comfort level and it's hard to step out there, that you would risk trying something new. Including even risking teaching in a different way. We have a lot of lecture people here. That is the way they learned in college.

7SeatRulz

With the Science department, at least once or twice, I've given department presentations on the different programs so that they can see how it is used and how I'm using it in my

classroom. I also do a lot of collaboration with at least one of the Math teachers here. She and I both try and overlap some of the computer stuff that we do so

that this way what I have done in my class when they get to her class they have seen it before so this way it makes it easier for her to teach what she needs to teach using the computer.

Genny J. Matt

I think the big thing is to share. We are notorious for sharing and those kinds of things. If I find something that really works, then I do my best to make sure that other teachers are aware that this is a tool that can be used and how it relates to what we are trying to do. I would hope that I could also use other teachers as a resource to help me.

Ara B. Jaamz

I made a presentation on how to do group e-mails. I'm still showing them how to burn CD's in some cases on XP, which is somewhat unfamiliar to me, but I can figure it out.

A problem that happened just this morning, a teacher was trying to print, and it didn't work. So I had to go in, find a print driver, and it still wasn't working. So I set the default to the workroom printer. In terms of making the printouts or using printing, it can be confusing if you're not sure what to do and I help other people with that regularly. Oh yeah, the projection device. If I had a dollar for every time somebody came in my room and said, 'Could you come over to my room real quick and help me set up this

PowerPoint show or set up this projection device so it works?' I mean I would be a little more richer than I am now, not that I'm rich, but you get the point. I enjoy doing it. I don't mind helping people. I like helping people solve problems.

One training class is one thing. You write it all down. You're excited. You go home. But when you're in the middle of teaching a class, you need to use time wisely. If a teacher is using the computer, he may need to be able to get to whatever the exercise is quickly and efficiently. And I think generally speaking, people in my hallway, if they want to get it done now they'll come to me. They are not going to have time to go through that folder of notes from a computer class. So there's something about hands-on and being able to use it and do it that means something and makes a difference. Kids pick up on it sometimes a lot faster than we do because they are working with that machine every moment of their waking day here.

Sally T. Smith

I don't feel that I have enough technical skill that I could consider myself by any means a formal technologist.

Maria Rodriguez

Have a person who is solely dedicated to facilitating faculty use of the web, who is doing either research for them, helping them out, helping them set up web sites, all of those kinds of things. Somebody who is dealing specifically all the time with our concerns and is helping us not just with the problems, but with the improvements; somebody who is always working with the faculty to improve our technology…somebody who is going to take me to the next level, who is working with me to improve and take my class to the next technology incorporation.

Sam

It is totally and completely dependent upon support because if I cannot get this supported I cannot get any other teacher to use it. Support meaning tech support, both in the hardware and in the technical day-to-day tools that are required to do what needs to be done.

Mkad

I help everybody who requests help on the use of the Microsoft Office products. I train teachers and staff on how to use Word, Excel, Access, PowerPoint and the Internet. I train teachers on how to zip files and how to use CD-ROM software. I also train teachers on how to use their printers and computers.

At the district level, I am also one of the proctors for the computer proficiency exam teachers are required to pass in order to be issued a laptop.

Gdad

I share information I've downloaded off the Internet with other teachers.

Sophia Loren

So many computer tech people are derisive of people who are not computer savvy and l look down their nose and they are cold and very territorial. Librarians have a bad rap because the library needs to be neat and clean and quiet and blah, blah, blah, and don't come to the library and make a mess or cause a fuss. Computer techs have that same reputation, I guess is the word. And the abruptness I've experienced from people, you know, 'I've already explained this to you twice, Mrs. Loren,' that type of thing. But our technology trainer is just so generous with his time and he is generous with his computers. He's generous with equipment. He's not territorial. He understands that it belongs to the district and not to him. I mean he's just perfect.

Composite Textural Analysis – Training Other Teachers on the Use of Technology

Trainers challenge other teachers to be risk-takers with the use of technology.

Teacher technologists who train other teachers encouraged those teachers to take risk with the use of technology. Nothing worse can happen that cannot be done over again. With the advent of prompt messages in software such as one asking the user "You have not saved, are you sure you want to quit?" the novice teacher technologist need not fear. The novice teacher technologist is encouraged to use technology, enlisting the help of colleagues or even students. "For new teachers using technology in school for the first time, I say, 'try it. Get out there. Stick your neck out.' If you have a good lesson, then think about how technology would make it a better lesson. Get out from behind your desk, get in there, and walk among them."

Teacher technologists seemed ready to assist the novice teacher technologist who attended technology training classes offered and who made repeated attempts to use the acquired technology information in the classroom. "I'm still showing them how to burn CD's in some cases on XP, which is somewhat unfamiliar to me, but I can figure it out."

Trainers encourage teachers to challenge students to produce using technology.

Students are ready and willing to produce technology-rich projects. Teachers do not have to know everything there is to know about a particular software title or tool before launching a technology-based project or simple classroom assignment. Students do not mind sharing their knowledge of technology with their student peers or their teachers. "Our teachers have said, 'I don't want to teach that because I don't know my way around PowerPoint very well.' So what. You don't have to. The kids know PowerPoint. You're the expert in the curriculum. So let them express that in the language they do best."

Invite teachers who are proficient in classroom technology use to train other teachers.

Teacher technologists who are proficient in the use of a specific software or hardware tool are encouraged to offer their expertise to other teachers. At the private high school academy, proficient teacher technologists are asked to serve as guest star teachers at specific technology training workshops on the campus. They conduct the training class. "For teachers I have observed using technology in the classroom for specific things that they do, I ask them to teach a class on that. I immediately try to harness them to participate in what we're doing."

Some teacher technologists offer their technology expertise to teachers within their department: "With the Science department, at least once or twice, I've given department presentations on the different programs so that they can see how it is used and how I'm using it in my classroom." "I made a presentation on how to do group e-mails." Some teacher technologists offer their assistance informally. The teacher technologist makes him or herself available to novice teachers, such as coming into their classroom during class time to troubleshoot a hardware or software problem so the teacher can continue using the technology during class.

Teachers collaborate with each other on the use of technology in the classroom.

Informal communication on the use of technology in the classroom, is also a way that teachers assist each other with computers. If technical assistance is not readily available through regular channels, teachers conference with each other. "I…do a lot of collaboration with at least one of the Math teachers here. She and I both try and overlap some of the computer stuff that we do so that this way." "If I find something that really works then I do my best to make sure that other teachers are aware that this is a tool that can be used and how it relates to what we are trying to do. I don't mind helping people."

Individual Structural Analyses – Training Other Teachers on the Use of Technology

Bailey Ma

The structures for training other teachers as expressed by Bailey Ma were to take risks and continuously seek new ways to engage students in technology use in the classroom. Training teachers involved not just showing them how to use the software or hardware, but engaging teachers in thinking of ways that they may want to use technology in their teaching and learning processes. Teachers did not seem comfortable with this style of training. They seemed to want technology to come to them as a ready-made package, with no extra effort on their part.

Bailey Ma wanted teachers to allow students to use the technology, even if the teachers did not feel they were not all knowledgeable of how to use it. Her suggestions to teachers were to allow the students the opportunity to express their work using technology and for the teacher to continue concentrating on presenting course content.

7SeatRulz

7SeatRulz's structure for training other teachers was to collaborate with teachers informally. 7SeatRulz shared with other teachers both within the science discipline and also mathematics. Collaboration allowed for comparing ways in which one software tool would be introduced to students in several classrooms. Collaboration strengthened the presence of technology use among teachers and also students.

Genny J. Matt

Genny J. Matt's structure for training other teachers was informal sharing. That is what teachers have always done, shared resources back and forth.

Ara B. Jaamz

The underlying structures for training other teachers as expressed by Ara B. Jaamz included to be patient in working with teachers, offer in-class technology assistance for teachers who need it, and be flexible in lesson planning when the technology does not work properly.

Patience and offering in-class technology assistance to other teachers were also expressed as key ingredients in the daily role of the teacher technologist. When a teacher is in the adoption phase of technology use in the classroom, she is right in the middle of trying to implement the use of technology and teach the lesson simultaneously. She must know her discipline well enough to share it and she must know how to use the tools well enough to share those as well.

What if something went wrong with the technology that was not covered in the technology training a teacher had taken? Ara B. Jaamz expressed that when a teacher was in such a dilemma, she needed to be able to get immediate support.

Sally T. Smith

Sally T. Smith expressed that it is the role of the formal teacher technologist to train other teachers in technology.

Maria Rodriguez

Maria Rodriguez expressed a structure for training other teachers as offering advisory assistance to teachers on incorporating technology into the class lesson.

Maria Rodriguez expressed that the teacher technologist should provide assistance, especially advisory assistance to other teachers. The teacher technologist helps other teachers search for curriculum on the Internet. The role of the teacher technologist is to help teachers create classroom websites.

Sam

Sam expressed that training other teachers first involved an under-girth of technical support from technology personnel.

Mkad

Mkad's underlying structure for training other teachers was to offer campus training on the use of the Microsoft Office products. Most of his time was spent showing teachers one-on-one how to use software for their specific curriculum needs.

Gdad

Gdad's structure for training other teachers was informal sharing of information with other teachers, especially math teachers.

Sophia Loren

Sophia Loren offered that training other teachers was the role of the formal teacher technologist. Training other teachers was something the formal teacher technologist did very well; he was patient and not condescending when he trained her.

Composite Structural Analysis – Training Other Teachers on the Use of Technology

Teacher technologists wanted to be able to give and receive assistance on the use of technology on an informal, ongoing basis. Although structures were in place to train teachers formally in a computer lab configuration and that seemed to be a great starting place for teachers to learn how to use technology, there was not enough support encouraging teachers to continue to share their knowledge of technology outside of the training lab. Informal teacher technologists who appeared as guest star teachers in some training classes were more than willing to share their technology expertise with other teachers. However, there were not enough such teachers to serve the needs of those teachers still hovering around the adoption/adaptation phases of technology development.

Those teachers still hovering around the adoption/adaptation phases of technology development required that a teacher technologist be available just in case software or hardware problems cropped up in the middle of a lesson. If a teacher technologist was not readily available to assist with the problems, chances were that technology would be used less and less by that teacher with each unsuccessful attempt to implement it.

The formal teacher technologists felt the stress of trying to get teachers to accept to the usefulness of employing technology in the classroom on a continuous basis. Teachers were going through the motions of taking several in-house technology courses but not actually following up with full implementation of technology in the classroom. Excuses were offered as to why teachers could not use technology in the classroom: lack of time to plan a lesson that required the use of technology, lack of sufficient technology skills, sheer laziness, no desire to leave their comfort zones – “this is how we have always done it forever,” and fear of taking the risk of not knowing as much as about technology as students might know.

Research Question 6: How do you use professional development to incorporate technology into the curriculum?

Individual Textural Analyses – Using Professional Development to Incorporate Technology Into the Curriculum

Bailey Ma

> That’s probably one of the weakest areas I have. I don’t get a lot of opportunities for professional development. I do try to get to conferences. I went to NECC (National Educational Computing Conference) this summer and that was a great opportunity. I’m going to go to the National Social Studies Conference this year, which is not so much technology, but hopefully I can get some ideas and it will start getting me to think about how I could do the technology that I do.

One of the hardest things that we have here at this school is that we're the ones that are so on the cutting edge. It is kind of hard to go find somebody that is out there further than we are, to go learn something new. One of the things that we've started doing is working with some of the Sacred Heart schools and some of the all-girls schools in

Louisiana. All-girls schools are in the same kind of general style as this school. We have talked about sharing our ideas about doing stuff. That helps energize me when I start to see what somebody else is doing in their school.

I keep saying that we need to have a gigantic technology retreat instead of having a religious retreat. Let's let all of the English people get together and so on, to talk about what they are doing and ways of using different kinds of software and things like that.

<u>7SeatRulz</u>

I will go to a conference, and it depends on the type of conference. The main ones I go to teach us different computer computational tools for modeling in our classrooms.

Every single time I have gone to one of those conferences, I have come back with either a new model or lab to use in my classroom, or I have come back with a new computer program to learn and then I incorporate it into my classroom. I've come up with new ways of thinking, and I restructure my class again.

It depends on whether or not I do that immediately. There was one where I went, I wrote a lab that was a computer-based lab, and once the unit came around, I used it immediately. There are other times where I went and came up with an idea for modeling and it took me six to eight months to develop it.

I used it for that unit, and then it took me another year to develop my entire curriculum where it worked in the same modeling system, with the continuation being able to ask why. And I'm still trying to develop that as more of a true modeling system. Now that I have the thinking process, I just want to work more with the modeling side of it. Usually if I don't implement it within a year, odds are I'm not going to do it.

And one of the other things I found out was that if I had an idea for a model or a lab or a computer unit and I don't develop it immediately and write down all of my thoughts immediately, I will forget it. I'll know I had that idea, but I will have no clue what I wanted to do with it. So I've learned that once I come back with an idea, I have to do it immediately and flesh out the idea for at least a week or so. Then I can put it aside and go back to it later.

<u>Genny J. Matt</u>

There is so much information online such as tools and methods for teaching and even lessons, units, resources, and even original documents. You can even go back to documents to where things were originally written. If you're talking about a certain kind of problem, you can go back to the actual first problem that was ever done and find out about the mathematician who did that problem. And so the resources are so great for teachers to use. I've tried to tap into as many as I can through my professional organizations, the National Council of Teachers of Mathematics, and the National Council of Supervisors of Mathematics. I think there is a lot online that they offer. Their websites are really good, and they do a lot of resources through technology, a lot of training. Professional development can even be done online. There are like academies that you can sign up for and it's all online training. I have signed up for some of these and they are good.

Texas Instruments is another one that has online use of their calculators and lessons and things like that and I've learned how to do some things with the calculator as well and the calculator integrated with the computer, tapping the two together. I've used their materials online.

Ara B. Jaamz

I have taken in-house courses and used that information in my classroom.

I now do guest-appearances as a trainer of that particular session. I did a guest appearance last year with Excel because I use Excel in a couple of different ways. I use it for my personal teacher management stuff, and then I use it for the kids too in terms of as a document analysis device. For the students I also tell them, 'Use this as a way to do style analysis of your paper.'

One thing I did was put all their final exams in and built a splatter graph, where it displays in dot-format, where a student is in relation to the rest of the class, which I post for them to see.

Sally T. Smith

I try if I can to take any professional development courses based on technology just to keep my skills because it changes so fast. I try to take that as an opportunity to learn new skills. I feel like I'm running behind if I don't.

A conference I just came back from, the Texas Art Educators Association, gave two of the workshops I went to that were based on technology and using technology in the classroom. Right now I'm also researching getting the WACOM tablet, which is a tablet that you draw on with a stylus that's hooked up to a USB port, and you can actually scan in a photograph and then draw on it, but you're drawing more like the natural way of drawing, rather than trying to control a mouse. You draw on the tablet.

You can just do freehand drawings and paintings right on this little tablet. It actually has paintbrushes. It has pencils. It has all sorts of drawing and painting tools in color. It's incredible. You click on what color you want to use. It's amazing.

And then another one of the workshops I took was on using the Adobe Illustrator, Adobe Photoshop, and Adobe PageMaker software for the high school classroom. PageMaker is a layout program for brochures and things like that. I'm requesting the software so I can use it in teaching digital design. Students need to have hands-on technical art skills, but they also need to know how to do this kind of thing digitally as well, to be competitive in today's world.

Maria Rodriguez

I went last year to TCSS, which is Texas Council for the Social Studies, and then I went to the ISAS (Independent Schools Association of the Southwest) and then I've also been to the University of Texas at Austin that does the teacher seminar in the summer for a week. I go to these things and I look for the sessions that have to do with technology in my area.

I don't tend to be interested in technology in a general context, but in my areas definitely because I'm always looking for especially web-based things that I haven't found yet.

I've been to the DMA (Dallas Museum of Arts) that does teacher nights and they' ll always give you a resource at the end of the night that incorporates their web site or incorporates art online and that kind of thing. So I'm always trying to look for those kinds of tips.

And I did take a brief training when I first started working here. I even moved here early to take some of the technology classes offered in the summer so that I would learn how to do my web site. And then I thought we would have a listserv because I really liked the idea of there being a conversation outside the classroom about classroom issues. I assumed that we would have it in-house so that my students and I could engage in a listserv. I can't remember the program that I did it in, but there's one that's even an express one. FrontPage. I didn't get a chance in actually doing it because I didn't have my syllabus yet. I didn't have any of those things with me yet. And then I had just started the year and I never got back to it. And I haven't yet either. It's one of those things where I just haven't had the time to dedicate to it.

Last year, remember when I went to the ISAS conference? I ended up speaking to several other people who have laptop schools or who are on their way to having them. And a few issues came up. The first issue being that the teachers in every other school had gotten their laptops first, so that they became experts. And then the students got them. The next thing is that they have a person who is solely dedicated to not just what our technology trainer does with the classes, but solely dedicated to facilitating faculty use of the web. This person is doing either research for them, helping them out, helping them set up web sites, all of those kinds of things.

<u>Sam</u>

I go out on line and put together my own that I have researched. I did that for the microbiology course. I wrote my entire curriculum for that time and I was hoping to use it.

Mkad

I've taken twenty-something clock-hours already this year, fourteen in the summer. They were Microsoft Office XP, PowerPoint classes. I will attend TCEA, the Texas Computer Educators Association conference which is held each year in Austin in

February. This time they are giving us $300 towards TCEA but it costs $110 to be a member so it doesn't leave much money to spend on room and board. But I go every year. I update myself. I also attended a local conference held in Irving this year.

Gdad

I have attended the district workshops in the last three years. Most of the workshops were on using the Internet. I attended one on using the district's grade book program, and one on lesson plans.

I use the district's grade book software to keep up with student grades and I use the Internet a lot.

Sophia Loren

I attended the Technology Immersion Project in '97 where they sent me down to Austin and we had three weeks of total immersion in technology. At the end of the program, I received a Premio brand laptop. They told us it was a Dell brand. I don't use it any more because it has a real bad tendency to do some goofy things. The cursor disappears for long periods of time. It's hard to click things on and off if you don't have a cursor.

I used it a lot when I first got it. I loved it. It was real nice. It's just that what can I do with something that doesn't have a cursor? Not much. And I don't know where it goes and where it stays. I can type but I can't click on anything, and it won't backspace. At first I thought it was the battery, so I went to get a battery but nobody had a battery that fits it. Everybody sent me to somebody else and then I just ended up driving to Austin to get it done and Dell said they didn't even recognize it as one of their machines.

The district does have a new laptop program available and I am going to sign up with another teacher to take the proficiency exam to get one.

Composite Textural Analysis – Using Professional Development to Incorporate Technology into the Curriculum

Help other teachers know what you already know.

Teacher technologists were generous with sharing their knowledge of technology with other teachers. The private high school academy's formal teacher technologist cited, "It is kind of hard to go find somebody that is out there further than we are, to go learn something new. One of the things that we've started doing is working with some of the Sacred Heart schools and some of the all-girls schools in Louisiana."

The formal teacher technologist at the public middle school academy encouraged teachers to attend the Laptop training program offered to his school as one of fifty schools selected in the initial line-up. If teachers at the public middle school academy pass the district's technology proficiency exam, they will receive a laptop computer.

Other teacher technologists at the private middle school academy make guest appearances as a trainer of that particular session. "One teacher technologist did a guest appearance last year with Excel, because I use Excel in a couple of different ways. I use it for my personal teacher management stuff, and then I use it for the kids too in terms of as a document analysis device." A teacher technologist at the public middle school academy was observed assisting a teacher with getting materials off the Internet.

Use new materials and software introduced at the conference right away.

"Every single time I have gone to one of those conferences, I have come back with either a new model or lab to use in my classroom, or I have come back with a new computer program to learn and then I incorporate it into my classroom." "I've used their materials online." "Right now I'm also researching getting the WACOM tablet, which is a tablet that you draw on with a stylus that's hooked up to a USB port. PageMaker is a layout program for brochures and things like that. I'm requesting the software so I can use it in teaching digital design." "I attended the Technology Immersion Project in '97 where they sent me down to Austin and we had three weeks of total immersion in technology. At the end of the program, I received a Premio brand laptop. I used it a lot when I first got it." "I attended one on using the district's grade book program, and one on lesson plans. I use the district's grade book software to keep up with student grades and I use the Internet a lot."

Learn new technology skills.

Teacher technologists continuously update their skills. Technology is an ever evolving field of study. Every teacher technologist can benefit from learning something new, even if it involves just helping others learn new skills. "One of the workshops I took was on using the Adobe Illustrator, Adobe Photoshop, and Adobe PageMaker software for the high school classroom." "I update myself."

Use professional online websites.

Teacher technologists take advantage of the availability of online professional websites. "Texas Instruments is another one that has online use of their calculators and lessons and things like that and I've learned how to do some things with the calculator as well." Some websites offer specific programs to teacher technologists such as "the Dallas Museum of Arts' teacher nights…they'll always give you a resource at the end of the night that incorporates their web site or incorporates art online and that kind of thing." Teacher technologists use Internet resources quite often, as they save time and money.

Individual Structural Analyses – Using Professional Development to Incorporate Technology into the Curriculum

Bailey Ma

Bailey Ma has been at the private high school academy since the beginning of its inception of the Learning with Laptop programs, placing the school above and beyond many schools in its category. Her experience and knowledge of incorporating technology into the curriculum has placed her at the forefront of this program, on the cutting edge.

Being on the cutting edge, made it difficult to pick up new information beyond what she was already doing. She expressed wanting to share her knowledge with other similar all-girls schools, to stay energized.

7SeatRulz

7SeatRulz expressed getting new computer information from professional conferences. In order to make use of the new information, it was important for her to write up any ideas or procedures immediately, even if the information was not going to be used for a while.

Genny J. Matt

Genny J. Matt expressed using the Internet for professional development. Many of the professional organizations offered training on the Internet. This was perhaps more convenient than incurring the expense and time of attending a conference elsewhere.

Ara B. Jaamz

Ara B. Jaamz's professional development was experienced mainly through taking in-house technology training and then guest-appearing to teach. Ara B. Jaamz seemed to have exhausted much of the training offered in-house. His level of use for incorporating knowledge gained from training is high. He not only used technology but also willingly shared those ideas with other teachers.

Sally T. Smith

Sally T. Smith's underlying structure for incorporating technology into the classroom was to learn skills that were useful for digital art. Sally T. Smith expressed wanting to purchase software and hardware tools that would give students a competitive edge in digital design.

Maria Rodriguez

Maria Rodriguez expressed wanting to find Internet web sources. When she attended professional conferences she wanted website addresses that she had not experienced before.

Maria Rodriguez expressed wanting to learn how to build a web page, wanting to pick up more skills doing that.

Sam

Sam developed her entire curriculum for a Microbiology course by searching Internet resources.

Mkad

Mkad expressed using professional conferences to pick up technical software information.

Gdad

Gdad attended the district's technology workshops. He expressed learning how to use the Internet and to use the district's grade book program as a result of attending those classes.

Sophia Loren

Sophia Loren expressed participation in the district's technology immersion program one summer, in which she received a laptop computer. She was excited about the many possibilities and uses of laptop technology in her classroom, but lacked sufficient hardware support for the laptop computer, which no longer works properly. She enrolled to participate again in another district laptop program to receive another laptop.

Composite Structural Analysis – Using Professional Development to Incorporate Technology into the Curriculum

Professional development is an expensive venture for any school. Deciding which teachers will get to partake of the perks to travel and attend a conference is a feat in itself, usually afforded to those teachers who have the most seniority in the school system. Or it could just be a matter of someone deciding that a particular teacher is going to attend some conference. Most of the teacher technologists in this study had attended at least one professional conference, albeit they were conferences for specific disciplines other than technology. Some teachers mentioned that although the conferences they had attended were for their specific disciplines, the conferences offered workshop strands that focused on the use of technology in the classroom.

Professional development in this study took on the meaning of in-house technology training for most of the participants. Even further, professional development was extended to encompass taking Internet-based training courses offered by professional organizations and companies or just an informal sharing of technology skills from one colleague to another. Teachers seemed very comfortable with this last form of professional development. They liked being able to go into another teacher's classroom at will and get assistance or give it. It seemed less intimidating, more favorable to informally learning what one needs when one needs it, rather than attending a workshop, collecting notes and rarely referring to those notes again.

Research Question 7: How does student computer expertise alter the teacher-learner relationship?

Individual Textural Analyses – How does Student Computer Expertise Alter the Teacher-Learner Relationship

Bailey Ma

> Students have learned to share ideas with each other. I know that particularly when we see presentations come through and they bring them in, I ask if there are any questions. It is also in how I couch a project, for example, they had to do virtual websites for
>
> Revolutionary War heroes, and the second one that came out of the chute was phenomenal. These two kids loved to play in HTML. And the other ones are thinking 'Oh, my God.' But it was really interesting. The kids asked, 'How did you do that? How did you make that happen?'
>
> And a kid that doesn't necessarily talk gets to be an expert. Some days, if you can make a globe spin, you're doing real well. They know that they have impressed me when they get what I call the wow factor. They look at me and I go 'Wow!' and I ask for a copy of it. If I don't like it, I don't say I don't like it, I just don't ask for a copy. After a while they wonder what that one had that I asked for a copy of it and they didn't get asked for a copy of theirs. They ask what they did wrong. I say, 'You didn't do anything wrong, but she did this so much more right. She engaged me. She caught my attention. She had a concise thesis. Look at how she connected her ideas. Yours kind of wandered all over the place. I'm not saying it's bad. But this one is a really great example of what I was looking for.'

And then they do one and when I ask for a copy, they just beam when they hit it. They are so proud. They come out feeling really good about themselves as well as doing good work.

7SeatRulz

I have no problem with that. The majority of the stuff that I use is the other way around, but I'm definitely all for if the students can figure out how to use it better than me and teach me how to do it, I'm all for it. I feel the same also for non-technology-based things.

I've actually had students who have come up to me and say 'Well I have this way of doing it and this makes more sense to me." And I look at them and say, 'Well yes, that is easier.' I'm going to now teach that. That way I am continuing to learn the technology. The students are continuing to learn and I actually try to have the students work together in groups to help each other learn.

The experts seem to just kind of surface. Sometimes with the way things are structured, I'll have a group of people become experts on something and somebody else will become experts at some other things. But for the technologists, they just surface either as the class leader and other students will start going to them for help or they will come up and ask me something and I'll look at it and say, 'Oh yeah, you can do it that way, can't you?' And I just let them do it. If it does happen that way, I have no issue with them taking control for that particular thing for however long they need to take control of it.

I teach everybody the same stuff and it just kind of happens that some kids pick up on it a lot faster, and I just go one speed. If they don't all catch it, they don't all catch it. And those kids who pick up on it really fast, when they then break up into groups, they go and they teach the other kids. And usually what I will do, if I realize that one kids picked up on it quickly, they don't know this but, if other kids come up and ask me questions and I'm extremely busy helping somebody else, I'll say 'Go ask her. She knows how to do it. She showed me yesterday. She will explain it to you.' I encourage these kids who I see who have become experts on it, I will encourage them to become teachers for the other students and help everybody get to that level of expertise. It's a lot of fun.

Genny J. Matt

When I first started working with girls, when they first got their laptops in my classroom, I was a freshmen teacher and I was not the computer expert in the classroom, and I told the students that. I said, 'We are going to learn this together. We are all learning how to use the computers together and I am not a computer expert. I am the math expert. I will help you learn mathematics. You help me learn the computer.' We used to have question and answer time whenever anybody would do something, a presentation, or use something in the classroom. At the end we had time for questions and answers that concern math, and then we would have time for questions and answers that concerned technology.

When the girls first began to do PowerPoint presentations, some of them were able to do some pretty nice things with PowerPoint like insert animation, and put a hyperlink to a website, and those kinds of things like that. And when the presentation was over, the girls could say, 'Well how did you do that?' 'How did you insert that hyperlink to this website?' And they would take a few minutes to say, 'Well this is what

I did' and teach them how to do that. Or 'This is how you get it to be animated.'

Sometimes there would be something that we would be working on and someone would say, 'Well I don't know how to create a graph with my computer.' Well if I wasn't real sure how to do it, there was usually somebody in the classroom who would be willing to help. 'Sally really is an expert on how to do graphs. Let's get Sally to show you how to do this.' And we would all kind of listen over their shoulder as to how they were doing it.

We did it for a purpose. We needed it for something, and it wasn't just, 'Let's learn everything there is to know about PowerPoint today.' I mean that's not how it was approached. It was, 'Let's learn how to insert a piece of clipart because we want to illustrate what a parable looks like.'

And that's really worthwhile for me, and that's what I've done ever since. Now I find that the students are a lot savvier about how to use their computers coming in as freshmen. They have had a lot more experience. Most of them know how to do a PowerPoint presentation. They have had experience with spreadsheets.

And not only do they know more, but also they learn it quicker. I don't see the math concepts being learned more quickly, but I certainly do see the computer concepts being learned more quickly. They have more experience with Office and how to write within a Word document, how to create a PowerPoint, how to work in Excel. Those tools they really have had some experience with more and more and more, and how to use the Internet too. They have the tools in their hands, and that's more than it used to be. When I used to ask how many had a computer at home, about half the class would raise their hand, now when I ask all but two or three students raise their hands, so the access is greater.

Ara B. Jaamz

That's the way it should be. You always expect a 13 year-old to kick your butt at John Madden, you know what I mean? Because they are willing to spend so many hours at it, since they don't have so many responsibilities in general and they can spend more hours learning how the technology works while you're out working a job and paying the bills and you come home and they say, 'Hey, you killed a dragon! If you kick the dragon in the foot, it will make him jump.' They know all kinds of stuff. I don't mind.

When it comes to the things that you really need to be able to teach though, I don't think they should be better than you. In fact, if you can learn from each other, it's really the best thing. Like if they say, 'Mr. Jaamz, here's a quick way to do that.' 'I don't do mine in Excel, I do mine in Word.' So next time I teach that lesson I'll say, 'You can do this in Publisher, in Word, or in Excel. Here's what you can expect to see. And some of them will say, 'Oh, I'm familiar with Word' or 'I'm familiar with Excel.' 'Publisher sounds interesting. How do I get it?' 'Well you need to look on your Office disks.'

If I'm giving something out and the girl in the corner can't get it, she'll inevitably turn to her neighbor and ask, 'How do you do this?' If they can't get it from someone nearby, they'll say 'Mr. Jaamz, how do you do this?' And I'll stop and say to the expert, 'What did you do?' And I'll put them into a position of leadership.

One of the things that I didn't do and I probably should do more often is to use the projection when I do stuff on computer. When I do that though, I'll pick someone and tell them to drive. I pick them, make them plug their machine in, and I give them responsibility and say, 'I really need you to listen for my signals and to be in tune to what

I'm saying because I need you to click on things when I want to see them on the screen.' So even though you may not be able to read all the words on this particular device, you can see generally what the screen looks like. You can see generally where you should be on that particular screen.

That is very helpful when I do my English course CD, and I explain the home button, and I show them how things are laid out. I need to have a driver that day. 'Who wants to drive? Who wants to be the student leader with this particular thing?' And they do well. I think they flourish with that amount of responsibility, knowing they are semi-in charge. And I don't mind that. I like them to feel powerful because the next time they come in they'll be excited about doing it again, or they'll feel very confident that they can get the documents, understand what I'm saying by way of description, and if they are goofing off and on the background, I'll call them right there on it.

'I need you to be right here with me. If I'm not saying to go anywhere, that means I need the screen to stay up the whole time.' I'll tell them to go turn your screen saver off. So that person who is in charge for that day, driving on the TV, showing the lesson, that person is my companion then, and then by way of serving the classroom's needs, they understand what I expect of them.

Sally T. Smith

When the students are expert at technology, I don't have to really teach them the basics. They come in with the basic skills and all I have to do is open a door for them and they take off. They're not afraid. They are willing to explore. It's that no fear part that is pretty great.

In the five years I've been here, I think that their competency level is much greater than when I started teaching here.

Maria Rodriguez

I would love that. And it's happened. There were things, especially last year, that I learned from my students, and even this year too, like the whole 'infra-redding' files back and forth to each other. I had no idea. They put their laptops back to back, and instead of having to pass something on disk, you can infrared it to somebody else. It blew my mind the first time I saw it. It's a laser. And I was like, 'Oh my God.' They had to teach me that.

And certain things that they do now where they can see different documents at once, like we'll take the maps online and the way that they would transfer these files. They taught me and they taught the rest of the class, where I had a couple of students that were experts.

I like giving them that kind of power, if you will. It's good for them and it creates ego. And especially for the girls who aren't normally as active in the class. But my fear with the website thing is me not knowing anything, and creating it as part of a lesson makes me nervous. Other things have come up accidentally, things that we've sort of learned as we've gone along. But this would be an actual part of a lesson, and if I can't do it, then how am I going to make sure that we're moving along correctly?

Sam

I think that is sometimes what happens with freshmen. Freshmen come in already in tune with the technology. Maybe one out of six people will be unfamiliar with something and the other students peer-teach.

I hand out the assignment, hand out the rubric, and allow them some time to read it, and then when it's time for them to begin to execute and they, for instance don't know how to use draw, then we have set aside class time to work on that. I walk from student to student and if I see two of them with the same problem, I'll put one person in the middle to solve that one while I go over there.

Mkad

Just listen to them right now helping each other. I gave them an assignment to do 20 names, and one of them did five and only thought they had to do five, and the other one let them know that you do all of them. They do their own teaching. Technology comes alive for them.

Gdad

In the future there's going to be no other way. The student will be using the computer and the emphasis will be on that. The need for the instructor is going to be de-emphasized.

I think there will be always be a need for instructors to continue with the academics, although some people say there will not be a need for instructors.

I don't have a problem with students being more computer-savvy than me. I think it's great.

It certainly takes a lot of work off of you.

Sophia Loren

I think these children feel very comfortable with using it. These are just wonderful tools that they'll use when they go to high school and their work will be beautiful and that they'll already understand how to use Word, how to use Excel. I'm quite impressed with them, and they teach me. They know more than I do. They're great.

However, not everybody is at the same pace, and some of these kids have been using computers at their elementary schools; they did the required three hours a week or whatever it is. And others of them have no computers at home and the elementary school didn't put a big emphasis on it, so they're really at a beginning stage. So I've got all levels. Our kids are pulled from all over the district. They didn't come from just one or two feeder schools. They came from probably 50, 60, maybe even more different elementary schools.

Composite Textural Analysis – How does Student Computer Expertise Alter the Teacher-Learner Relationship

It gives any student an opportunity to become an expert in the classroom.

An expert student technologist has spent a lot of time mastering the features of the software or hardware he or she has learned. Hours can pass learning how to use the computer. Students who spend an exorbitant amount of time using technology can show others how to use technology more efficiently, such as how to use shortcut hotkeys and how to avoid some of the nuances of a particular software title. "A kid that doesn't necessarily talk gets to be an expert." As one teacher technologist cited, "I've actually had students who have come up to me and say "Well I have this way of doing it and this makes more sense to me." And I look at them and say, "Well yes, that is easier."

Expert student technologists are usually more than willing to show others how to use technology. Several students in one class may have expert technical knowledge of different software or hardware tools. "There was usually somebody in the classroom who would be willing to help." Teacher technologists share the classroom teaching process with expert student technologists by allowing them to conduct impromptu sessions on how to use technology just in time for the learning objective at hand.

It empowers students.

When students are allowed to be teachers for the other students, they “help everybody get to their level of expertise” and are empowered by such as feeling of accomplishment. Different students may be experts at doing different technical procedures. A student may be an expert on doing graphs on the computer, while another is expert at using the comment feature in Microsoft word. One teacher technologist shared that she “ walks from student to student and see if two of them have the same problem.” She puts one expert student in the middle to solve that one while going over to work with the next group of students.

Teachers and students learn from each other.

“Students have learned to share ideas with each other.” Whether they are working in groups are working informally, they very easily share information on how to use the technology. The teacher may become a learner in this situation, also. The teacher allows the student to explain and demonstrate to the class how to use the technology feature. “Maybe one out of six people will be unfamiliar with something and the other students peer-teach.”

Individual Structural Analysis –How does Student Computer Expertise Alter the Teacher-Learner Relationship

Bailey Ma

Students were invited to share computer knowledge, history knowledge, contemporary information with each other. Students who did not normally talk in class suddenly became popular because of their knowledge of computers. The teacher was not sought after as the only one who could impart information. Every student had the opportunity to teach another, including teach the teacher.

7SeatRulz

All students in 7SeatRulzl's classes had the opportunity to become experts at something. Students were appointed to learn a particular part of the curriculum and then teach it to each other.

The technology experts just seemed to surface. 7SeatRulz encouraged students to seek their assistance.

Everyone including herself was a continuous learner in 7SeatRulz's classes. Students were given opportunities to learn. Students were given opportunities to teach what they learned as a way of reinforcing that knowledge.

Genny J. Matt

Genny J. Matt saw herself as the math expert; her students were the computer experts. They taught each other. Time was allowed for both exchanges. Students conducted technology how-to question and answer sessions towards the end of class.

Ara B. Jaamz

Ara B. Jaamz called upon students' technology skills by allowing a student to drive or operate his computer during a lecture or literature analysis class session. This provided the opportunity to keep freshmen students focused on the task at hand.

Ara B. Jaamz saw himself as the English expert; his students were the computer experts.

Sally T. Smith

Sally T. Smith expressed her students as becoming risk-takers in the use of technology, not being afraid to explore and use technology in a variety of ways in the art classroom. She expressed that the students are the experts in technology. They learn technology much more quickly.

<u>Maria Rodriguez</u>

Maria Rodriguez saw her students as being more knowledgeable of technology than she. She seized this opportunity to allow students to teach each other, learn from each other. She expressed concern that she should know as much, if not more about technology than her students.

<u>Sam</u>

Sam employed the expertise of students' knowledge of computers by assigning an expert assistant for students when working in groups.

<u>Mkad</u>

Mkad saw himself as a facilitator, the listener. Students in his Computer Literacy classes worked alongside each other in the computer lab. They assisted each other, taught each other.

<u>Gdad</u>

Gdad expressed that the traditional student-teacher relationship will be no more in the future. He expressed that there will be a need for academicians acting in a facilitative role.

<u>Sophia Loren</u>

Sophia Loren's concern was for the variation in student computer knowledge. Although most of the students were computer savvy and could teach her, she shared that students were coming from a variety of elementary feeder schools, some having been exposed to continuous use of computers in elementary school while others came with fewer skills.

Sophia Loren saw herself as the expert in science and acknowledged most of her students as experts in computers.

Composite Structural Analysis - How does Student Computer Expertise Alter the Teacher-Learner Relationship

The basic fear that the teachers would lose control of the classroom and lose the respect of students seemed to be least of concern to the participants in this study. As long as it enhanced learning the course material, students were encouraged to use the technology available to them in any way possible. The teacher technologists in this study embraced students teaching other students and also students teaching them how to use technology.

Eight of ten teacher technologists in this study made the distinction between themselves as the experts in their discipline and their students as the experts in the use of technology.

Five of ten teacher technologists in this study expressed that students were students-as-teachers in their classrooms as well as student-learners; the teachers were learners, also. Students could be considered experts in the use technology and also were encouraged to become experts in the subject matter.

Five of ten teacher technologists in this study pointed out that in their classes, one or two technology experts seemed to surface. Not all students exhibited equal skill level as users of technology. The experts were the students who readily approached the teacher with a demonstration or explanation of a technical skill. They were the students who were sought after by others to problem-solve technical challenges.

Synthesis of Findings and Discussions

Research question 1: What is the role of the teacher technologist?

Finding 1: *The role of the teacher technologist was categorized as being a fast technology problem solver for school staff and students, being prepared to use technology, being* *knowledgeable of how to use technology in the classroom, and sharing technology information with students and teachers.*

The distinction between the formal and informal teacher technologists was primarily an official one: the formal teacher technologists received a stipend for performing technology training and technology-related duties and were looked upon as the official teacher technologist in the building; the informal teacher technologists did not receive a stipend for performing teacher technologist duties. Whether informal or formal, the role of the teacher technologist can be categorized as: 1) being a fast technology problem-solver for school staff and students, 2) being prepared to use technology, 3) being knowledgeable of how to use technology in the classroom, and 4) sharing technology information with students and teachers. Table 12 provides a list of technology duties observed and specified by the teacher technologists.

Teacher technologists have to be prepared in order to assist with the incorporation of technology in the classroom. Ways of being prepared included being flexible in allowing teachers and students to interrupt planning and classroom time without becoming upset about such interruptions. Being flexible without becoming upset was expressed as assisting teachers, staff and students *willingly*, not grudgingly. The two formal teacher technologists seemed to have tolerance for the staff's urgency when called upon anytime. They seemed willing to assist. Although the formal teacher technologists expressed being flexible and were observed to be naturally warm and genuinely helpful, this researcher experienced in their eyes and mannerisms the tiredness of over-exertion suffered by both. Bailey Ma expressed that she would like to spend more time "looking at incorporating technology" into the classroom, but has to attend to the urgent, first aid requests instead.

Table 12

Technology Roles of the Teacher Technologist

Role of The Teacher Technologist	Specific Duties Of the Formal Teacher Technologist	Specific Duties of the Informal Teacher Technologist
Fast Technology Problem solver	- provide first aid for hardware difficulties - provide first aid for software difficulties	- provide assistance with hardware difficulties - provide assistance for software difficulties
Technology-Prepared	- Multi-task - Be flexible - Prepare for Training Classes - Post Training Classes - Prepare for Classroom use of Technology - attend conferences and training workshops	- Be flexible - Prepare for Training Classes - Prepare for Classroom use of Technology - attend conferences and training workshops
Technology-Knowledgeable	- know how to use and integrate word processor, presentation, spreadsheet, database, e-mail, Internet browser software in the classroom - know how to use and integrate various subject-specific and other tool software in the classroom - know how to operate the computer and peripheral equipment used in the school	- know how to use and integrate word processor, presentation, spreadsheet, database, e-mail, Internet browser software in the classroom - know how to use and integrate various subject-specific and other tool software in the classroom - know how to operate the computer and peripheral equipment used in the school
Sharer of Technology Knowledge	- facilitator to teachers - facilitator to students - collaborator with teachers - collaborator with other technology personnel	- facilitator to teachers - facilitator to students - collaborator with teachers

All of the teacher technologists expressed the role of being technology-prepared. Technology preparation was revealed as

- making sure the technology in the classroom was set up and working correctly.
- finding material and preparing for training and the classroom.
- attending conferences and workshops to learn new ideas and software uses.

All of the teacher technologists in this study expressed technology knowledge of Microsoft Office's word processing, presentation, spreadsheet, and Internet browser software. They were all knowledgeable of other subject-specific or tool software such as STELLA, Geometer's Sketch Pad, PhotoShop, WinZip, and BioInquiry; and peripheral devices such as the data projector, the TV and VCR as a projection unit, and the WACOM stylus pad. All of the teacher technologists had working e-mail addresses that they used for communication with teachers, administrators, staff and students, with the exception of the formal teacher technologist, Mkad, and informal teacher technologist, Gdad, at the public middle school academy, who do not e-mail students. The other formal teacher technologist, Sophia Loren, at the public middle school academy e-mailed one student once. The district's failure to provide e-mail accounts for students was the reason cited by the public middle school teacher technologists for not corresponding with their students via e-mail.

All of the teacher technologists in this study supported sharing technology knowledge, whether as a facilitator with teachers or students or as a collaborator with other colleagues. Gdad, Sophia Loren and Mkad floated in and out of each other's classrooms, as did other teachers in the building. Mkad allowed teachers to come into his computer lab classroom to seek assistance with technology problems. Sometimes Mkad allowed them to bring their classes into the computer lab, along with his Computer Literacy class. Mkad provided mini-lessons on technology to teachers and students in other classes. Gdad was observed sharing math website addresses and math activities downloaded from the Internet with another math teacher. 7SeatRulz conducted a guest star class on the interdisciplinary uses of the STELLA software. She also collaborated with other teachers in Math on the use of STELLA. She instructed students on the use of STELLA as well. Ara B. Jaamz provided immediate assistance to teachers on his hallway concerning printer and data projector problems.

He conducted a guest star class for teachers on how to manage group e-mail. He instructed his freshman students on the basic use of the laptop computer such as how to save a document, how to organize files in the Windows Explorer. Genny J. Matt shared her technology expertise with other teachers and expected them to do the same.

This researcher discovered that the teacher technologists viewed their major role as being a facilitative teacher for the student. They were especially concerned with how the student was learning and especially viewed the computer as a vehicle for increasing student knowledge of the course content.

Students were encouraged to seek out information on the Internet and using other traditional resources, to analyze, synthesize and evaluate information, use the higher order thinking skills. Using technology, students were exposed to real-life data in Algebra, U. S. History, Computer Literacy, Chemistry, English, Art, World History, and Environmental Science classes. Students sought out information from the Internet often in these classes because they were allowed to explore, evaluate websites for useful information applicable to project-based lessons. Students were constantly engaged in the teaching and learning process by ready access to technology-based information. The teacher was available as a guide, a leader to students in the appropriate use of whatever tools were needed to get the best job done.

Discussion of Finding 1

According to Moursund's (1992) research on the duties of the technology coordinator from 1985 to 1992 when his research was published in The Technology Coordinator, the duties of the technology coordinator today are more pressing than in that era. With the constant evolution of computer technology and the replacement and/or addition of expensive new computers and software to the school campus, the technology coordinator (or formal teacher technologist as defined in this study) is more pressed to train teachers on *how* to incorporate technology into the curriculum, yet can not attend to that role as much as they need. The role of the formal teacher technologist in this study seemed to be focused mainly on helping teachers *use* the technology: the software and hardware, rather than how to incorporate it as a vehicle for curriculum and instruction.

In accordance with phenomenological methodology in a recent study, Denise Woods (2000) assumed the role of technology coordinator at an elementary school for one school year and categorized the duties of the technology coordinator as three types of requests made by teachers: troubleshooter, resource/answer person, and integration advisor. Examples of a troubleshooter request were: printer does not work, how can I use the projector system to display screen, and do not know where cable should be connected. Examples of a resource/answer person type request were: show how to create, delete bookmarks, explain how to insert clip art into documents, give list of Web sites with lesson plans. Examples of an Integration Advisor type request were: how can I use the Accelerated Reader program, how can I incorporate Ultimate Reader into my writing class and using the Internet to view progress of Iditarod (p. 66). She stated that of the 16 teachers involved in this study for the school year, 52 requests were from the category of troubleshooter, 33 were from the category of resource/answer person and only 4 requests were made from the category of Integration Advisor.

According to Moursund (1992), the role of being a fast problem-solver is consistently providing "timely help to teachers and students who are having problems with the computer system" and "nearly precludes a person being able to simultaneously fill the roles of teacher and technology coordinator" (p.28). He goes on to define an important role of the technology coordinator is to "help teachers to develop curriculum materials and specific lesson plans so that the teachers can carry out their part of the overall school's instructional computing plan" (p. 28). The formal teacher technologists in this study do not seem to have enough time to dedicate to curricular integration of technology.

Sharing technology in a facilitative role was echoed by each of the teacher technologists in this study. In Technology Applications in Education, such a role is referred to as "anchored instruction" (O'Neil, 2003). Anchored instruction allows for focusing teaching and learning around complex problems or anchors. This allows the teacher technologist to provide problem-solving opportunities or activities for students using technology as part of the instructional design. For the students in this study, Bailey Ma provided anchored instruction by having students use the Internet to explore different points of view to "see for example, how three or four different sites or services are going to treat Yassar Arafat." Sophia Loren used the e-Buddy miniature laptop computers in her classroom for students to work on their Science Fair projects to research a topic on the Internet and type information up using Word Art. Gdad used anchored instruction in his classroom using the WACOM stylus pen hooked up to his computer to demonstrate the system of equations in Microsoft Paint while students practiced problem sets from their seats. Mkad allowed students to come use the computer lab to research and build a brochures on famous scientists and to construct a "then and now" PowerPoint slide show of all of the eighth grade students morphing from seventh to eighth grade. 7SeatRulz used anchored instruction in a Chemistry project to have students submit a molecular orbital request to a University of Illinois server, where two high school chemistry teachers downloaded the requests, constructed the orbitals and sent the structures back to 7SeatRulz's students. They were able to explore the structures further using the computer, asking and answering questions put forth as part of the lab assignment.

<u>Research Question 2: What is it like in a typical school day, as a teacher technologist in your school building?</u>

Finding 2: Both students and teachers were actively engaged participants in the teaching and learning process using technology, but the schools still lag in adequate technology for all in the school environment and/or adequate teacher training.

In this researcher's observation of the classroom and general school environment of the teacher technologists in this study, technology was used to engage both teachers and students in the teaching and learning process. In observing the classroom set-up of each of the teacher technologists, a variety of configurations were present. Bailey Ma, 7SeatRulz, Sam, Mkad and Sophia Loren maintained traditional classroom arrangements with student desks faced forward. Although the desks were small tables, they offered a flat surface for placement of computers, if needed. Gdad's classroom consisted of the older student desks, in which seat and desk are connected. His student desks were facing the back of the classroom, away from his teacher desk. Bailey Ma and Sam both were floating teachers, using another teacher's classroom and room arrangement for their classes. Ara B. Jaamz's individual student tables were arranged in two rows each facing each other, separated by an aisle down the middle for him and students to pass. Sophia Loren's classroom configuration consisted of student tables facing forward with two students to each table. Sally T. Smith's classroom consisted of medium sized tables arranged in a U-shape, around the front of the classroom. Maria Rodriguez and Genny J. Matt grouped individual student tables together in fours; the individual student tables could be re-arranged easily when necessary.

Classroom arrangement did not seem to matter, as long as students could verbally, visibly, audibly or kinesthetically attend to the instruction process. Regardless of the room arrangement, students were actively attending to the instruction by

- listening and typing in notes on the computer from the teacher technologist,
- examining a file on the computer screen simultaneously with the teacher technologist while discussing the lesson,
- searching a website and reading for reflection and discussion,
- watching the teacher technologist demonstrate a procedure on the computer via data projection and practicing with pencil and paper or with the computer at their seats,
- analyzing lesson content using computer files and providing explanations through discussion,
- synthesizing information read, watched and discussed in the classroom lesson by journal writing in a Word document and sharing it with the instructor by e-mail,
- searching the Internet websites for material and typing it in a Word document,
- doing calculations on the computer,
- watching a video and discussing issues raised in the video as a lesson,
- listening, watching and discussing a PowerPoint presentation lesson,
- using the digital camera to take environmental photos in the school in groups and later downloading those to PhotoShop picture files,
- moving about the room, sharing and teaching each other how to do the lesson or a technical skill.

In further exploration of this question of what a typical day is like in the school building, each of the teacher technologists were asked to complete a School Technology and Readiness

(STAR) online questionnaire promoted as a useful tool by the CEO Forum (2000), a panel of computer company managers, CEOs and education experts, to provide answers. The responses to this questionnaire as with any self-reporting questionnaire rely on the truthfulness of its respondents. The results, however, did assist in identifying what a typical day was like in terms of technology availability and use in the school's environment from the perspectives of the teacher technologists. In order for teacher technologists and students in schools to be effective day-to-day users of technology, computers must be available, efficiently used in instruction, and adequate instruction provided on how to use them. From the perspectives of each of the teacher technologists, each of the schools was categorized in one of the four profiles as shown in Figure 14, Chapter 4: early tech, developing (mid) tech, advanced (high) tech and target tech.

The informal teacher technologists from the public middle school academy reported that there are five or fewer students per instructional computer connected to the Internet, whereas Mkad the formal teacher technologist reported one student per instructional computer connected to the Internet. In further exploration of the differences in these two perspectives, Mkad reported that there are 28 networked computers in the computer literacy lab, 37 e-Buddy laptops available for student classroom use although only two teachers' classes would be able to use them at one time because only two of the *Mothership* configurations are available to allow the use of the e-Buddies. He also reported that the school owns 25 wireless Dell laptop computers, and one hundred twenty RCA Softbooks for a total of 210 computers available to students in a school of 171 students. He reported that the Dell and Softbook computers were in a closet and had not been requested or used during the 2002-2003 academic year by any of the teachers. The Softbook computers were purchased to load textbook cd-roms to lighten the load of students carrying heavy textbooks.

Although there is physically more than one computer per student, the variation in the computers' configurations accounts for students not being able to use them in the classroom or anywhere else on a daily basis. The 28 networked computers in Mkad's computer literacy lab account for the most used standardized computer equipment in the building; students can readily access the Internet and Microsoft Office software (Word, Excel, PowerPoint, Access), and save information to a diskette. When this researcher observed Sophia Loren's class using the e-Buddy miniature laptops, students experienced many problems with the e-Buddies maintaining a charge so they could stay on and since they have only enough disk space to store Windows and Microsoft Office software, students could not save to the C: drive or hard disk. The e-Buddies did not have A: drives or drives for diskette storage so students could not store on diskettes either. Students seemed to be very frustrated after having been excited about using the computers that day. The informal teacher technologist also appeared frustrated, especially since they spent critical time researching for Science Fair projects due very soon. Students had to print (only a few pages) to Mkad's computer literacy lab printer and run around to the lab to get the printed pages. This inefficient use of the computers meant that the students would have to re-type information again.

When this researcher observed Gdad's use of computers in the classroom, he used his teacher desktop computer to project his demonstration of systems of equations to students. Each student had access to a graphing calculator although this researcher observed only two of them using them. Gdad reported that he had sent students to Mkad's computer literacy lab to construct brochures on famous mathematicians this school year, but other than that students do not get to use computers in his classroom on a regular basis. He stated that until each individual student has a computer, the use of computers in his classroom would be limited.

In the private high school academy, although all of the teacher technologists answered that each student had access to a laptop computer, only Bailey Ma, Sally T. Smith, Genny J. Matt and Maria Rodriguez responded that students have equitable access to technology anytime, anywhere and 100% of students use technology to develop 21st century skills. Sam and Ara B. Jaamz responded that students can access digital content at times other than school hours and 75% or more of the students use technology to develop 21st century skills. 7SeatRulz responded that students can access the Internet at times other than school hours and all teachers are appropriately trained to integrate technology.

Discussion of Finding 2

The 10 teacher technologists in both schools were actively engaged in teaching and learning, using facilitative teaching and learning processes to help students develop 21st century skills. Facilitative teaching and learning to help develop these skills is constructivist instruction that seeks to activate cognitive processing that leads to understanding (O'Neil, 2003). This constructivist atmosphere of teaching and learning allows instructional technology to "serve as a cognitive guide to help learners on authentic academic tasks – such as comprehending a text, solving a challenging mathematics problem, or conducting a scientific experiment" (O'Neil, 2003, p. 128). According to O'Neil (2003), the crucial question in using instructional technology is "does it foster appropriate cognitive processing in the learner." In constructivist learning, a student could gain as much understanding from passively viewing a multimedia video, as from searching the Internet for information for a paper. Constructivist teaching is not about more hands-on or learning-by-doing for students, but about designing instruction that builds student understanding. The use of computers in the classroom has been discovered to be a useful exciting tool to expedite this process by helping build student understanding and interest.

In order for students and teachers to have that opportunity, they need to have access to computers anytime, anywhere. Anytime, anywhere learning is fostered in the private school academy's environment by each student's purchase of a laptop computer as a requirement of the school's academic program. One of the strong points of the laptop program at the private school academy is its standardization of hardware and software tools. As stated by the Director of Technology at the private school academy, in a case study report on Microsoft's educational website:

> We knew standardization of hardware and software was crucial if we were to use the computers as a natural part of the classroom. You can't do that with a home PC, or with non-standard software, because each computer will have different capabilities, making it impossible to give uniform assignments. And non-standard machines would make maintenance a nightmare (Microsoft, 2000, p. 2)

The other component to this program is teacher training:

> There are several cogs that must work together if a program like this is going to work. Standardization of hardware and software is one. Access to technology is another. Teacher training is the third. If teachers are not comfortable with the tools, then they won't use the tools (Microsoft, 2000, p. 2).

One hundred and seventy-one students at the public middle school academy have 210 computers, most of which are underused. Standardization of computers in the public middle school academy would help alleviate such a waste of resources. Students *want* to use the computers. As reported by Mkad:

> Students meet me at the metal detectors when I come in mornings. They are already asking if I'm going to be coming into the lab. They are asking me for lunch passes and

enrichment passes, which I don't give out until a certain time, during my second hour just before lunch. The computer lab is pretty much in demand every day.

According to O'Neil (2003), this country must not lose sight of the potential that "technology applied to education could create inequality rather than reduce it" (p. 26), if it is not incorporated to enhance maximum use for students. Gordon (2000) states that it is a myth to think that "equity can be achieved by ensuring that schools in poor communities have the same student-to-computer ratios as schools in wealthier communities" (p. 13). Making computers available in poorer communities is only the first step to bridging the digital divide – the gap between information haves and have-nots (Gordon, 2000). Other components, such as standardization; technology hardware and software support and maintenance; and adequate teacher training and support that must go along with supplying schools with computers (Gordon, 2000; Microsoft, 2000).

The teacher technologist is the key to maximizing and supporting the appropriate use of technology at schools. More appropriately, each of these schools could benefit from a fulltime formal teacher technologist with at least one classroom teaching assignment, along with a designated team of informal teacher technologists among the faculty to assist with appropriate implementation of technology on the school campus. As recommended by one interviewee in David Moursund's (1992) case study of technology coordinators:

> Always keep in contact with the classroom. Teach at least one class that relates to your experience and technology. Lack of classroom experience on a regular basis leads to lack

of attention to detail and one quickly forgets what teaching is all about. The lack of contact also leads to an attitude towards teachers that can be counterproductive (p. 128).

The private high school academy is in its sixth year of the laptop program. In this present study, the teacher technologists (Bailey Ma, Genny J. Matt, Sally T. Smith, Ara B. Jaamz, and 7SeatRulz) at the private high school academy who have been with the program for several years now are aware and do laud the benefits of the program for both teachers and students. However, several of the teacher technologists alluded that the teacher-training component needs to be revisited to reflect the current needs of teachers.

Bailey Ma, formal teacher technologist and key technology trainer at the private school academy seemed to feel pressured to be an end-all supplier of the technology needs of teachers along with specific learning strategies for incorporating technology into the curriculum, rather than solely providing technical software and hardware tool training. Teachers seemed to be at the point where they were asking for strategies to incorporating technology into the curriculum, whereas the technology trainer said "I can't do all this and do technology too." As cited by Maria Rodriguez, informal teacher technologist at the private school academy "I want somebody who is going to take me to the next level, who is working with me to improve and take my class to the next technology incorporation. It's more of like an advisor almost."

Research question 3: How do you incorporate technology into your curriculum as teacher?

Finding 3: *The teacher technologist used the Internet to research, build, present, organize and evaluate curriculum.*

In this present study, all 10 of the teacher technologists cited using the Internet to do research, build, present, organize, communicate and evaluate curricular lessons. The teacher technologists restructured their teaching from traditional lecture to constructivist teaching, with the use of the Internet as one of the main resources. All of the teacher technologists used the computer to type and store lesson plans.

Discussion of Finding 3

The increase of teachers' use of Internet resources is helping to make teaching a less lonely job by connecting teachers with each other and by becoming a warehouse of resources (O'Neil, 2003). The projection is that by the year 2007, teachers will be receiving the bulk of their professional development from the Internet, and that curriculum lesson, project and unit plans aligned with the state's standards will be available online (O'Neil, 2003). Mkad, the formal teacher technologist at the public middle school academy already constructs his lessons from the state's new online curriculum program for computer literacy. Textbook companies and a variety of professional organizations offer a wealth of online information. Each of the teacher technologists in this study offered their favorite bookmarked Internet resource websites as shown in Table 13. Just sharing these sites with other teachers is an immense benefit. It takes time and energy to search out reputable website resources, websites that are useful, that remain and are updated regularly. The explosion of the Internet as a resource is so recent that there is the challenge to provide new research to keep up with its evolving uses in education. How does one evaluate the quality of a website as a resource? As teachers turn to the Internet as a major source of information, questions such as this must be addressed. One suggestion by Genny J. Matt is to constantly evaluate sources used from the Internet and teach students this skill.

Table 13

Internet Resource Websites used by the Ten Teacher Technologists

Teacher Technologist	Resource Websites	Useful For
Mkad, Computer Literacy	http://www.google.com	Search engine
Gdad, Algebra	http://www.discovery.com ; http://www.ticalc.org	Mathematics
Sophia Loren, Environmental Science	http://www.edwardsaquifer.net/species.html	Endangered Species of the Edwards Aquifer System
Bailey Ma, U. S. History	http://www.dallasnews.com ; http://www.cnn.com ; http://www.csmonitor.com	Dallas Morning News; CNN news; Christian Science Monitor
7SeatRulz, Chemistry	http://www.hps-inc.com ;	STELLA
Genny J. Matt, Algebra	http://www.mathforum.com ; http://www.nctm.org http://www.pbs.org	Mathematics
Ara B. Jaamz, English	http://www.school.discovery.com/quizcenter.html	Online quizzes
Sally T. Smith, Art	http://www.batguano.com/bgma/skoglund.html http://www.getty.edu	Artist Sandy Skoglund; Art research
Maria Rodriguez, World History	http://www.google.com ; http://www.lanic.utexas.edu ; http://www.fordham.edu ; http://www.nytimes.com ; http://www.cnn.com	Search engine; Latin American studies; History; New York Times; CNN news
Sam, Biology	http://www.cellsalive.com	Biology

Research Question 4: How do you incorporate technology into your curriculum for the student?

Finding 4: Most students were using tool software on computers in the classroom with the lesson centered around project-based activities.

With more than 30 years of incorporation of technology on school campuses, students continue to use tools such as word processing, spreadsheet, and database software on computers (Moursund, 1992; O'Neil, 2003). More recent additions include presentation and online browser software such as PowerPoint and Microsoft's Internet Explorer or Netscape browser software. The 10 teachers observed and interviewed in this study reported they incorporate technology into the curriculum for students using the Microsoft Internet Explorer for online research, Microsoft Word to type up the findings from the research, and Microsoft PowerPoint slides to present those findings. Sam and Genny J. Matt also mentioned using subject specific software such as Geometer's Sketch Pad for mathematics and the BioInquiry cd-rom in Biology to supplement the textbook material. 7SeatRulz also used STELLA, an interdisciplinary flowchart tool.

Discussion of Finding 4

The introduction of computer literacy as a course offered in middle school or lower grades, spearheaded by businesses and industry to prepare students for the workforce in the 1980s (Moursund, 1992), has consistently remained as part of most schools' curriculum. Students learn keyboarding, word processing, Internet use and other software tool skills in elementary schools today. The early acquisition of these skills has enhanced students' abilities in technology tool use in the middle and high schools in more challenging academic subjects. By middle and high school, students have had opportunities to practice the use of these skills over and over, so that they become mindless activities. O'Neil (2003) refers to this seemingly mindless attention to technology as technology fluency. Fluency means expertise exercised in a flowing manner or with automaticity (p. 246). Teacher technologists in this present study verified students' technology fluency in referring to the ease with which they used software tools to produce great looking presentations, reports and projects. However, student mastery of the content of the discipline was questioned by teachers. Teachers in this study struggled to ensure technologically sophisticated presentations represented content knowledge gained. Whether students are reading text on the Internet or text from a book, they still must read for understanding. Teachers must still continue to reinforce, draw out, and enlighten students.

A suggested way of keeping students on track with learning the subject matter at hand and not necessarily being "carried away by the technological possibilities –the fancy stuff, the colors, the audio, the cuteness - and ignoring the subject matter," as offered by Diane McGrath

(2003, p. 53), is to have students' projects formatively evaluated by an outside audience, other than their teacher. Invite others in not only to just evaluate the end result of a project, but also the beginning phase. McGrath (2003) suggests the outside audience might consist of another class of students, parents, community people, or professional experts. Sometimes the audience would be there to appreciate, sometimes to judge (McGrath, 2003). When students know that they are being evaluated by such an audience, they are encouraged then to be more attentive to what they must know and effectively communicate. Too, according to McGrath (2003), this strategy "spreads around the evaluative audience so evaluation and feedback are not the sole responsibility of the teacher" (p. 52).

In this present study, project-based learning was supported by the use of technology in the classroom. Students with their computers readily grouped themselves or were grouped by the teacher technologists to work on assignments in class. According to Rockman *ET AL* (1998) the use of laptops leads to more participation in project-based instruction. The researcher reported that three-fourths of the 144 teachers from both private and public schools, who also responded to a survey, stated that project-based instruction has increased since the introduction of laptops in their classrooms. In this present study, all students were engaged in some form of project-based instruction, with the least amount of project-based instruction observed in Gdad's classroom. His students were not using computers; he used his teacher desktop computer to present a lesson. Even in his class, however, students collaborated with each other at their seats in solving the equation problem sets given them. Gdad did state that if his students had the use of computers, they would be doing more computer-related math activities.

Sophia Loren's students collaborated and readily grouped with students sitting nearby. Some of the students got up to go work with another, as one would do in the workplace. It was very fluid, very natural (O'Neil, 2003). Students were engaged, focused and on-task in her classroom, yet unlike a tradition classroom setting whereby students usually remain seated during instruction time. When using laptop computers in Sophia Loren's classroom (and also observed in Mkad, Bailey Ma, Sally T. Smith, 7SeatRulz, Maria Rodriguez, and Sam's classrooms), students got up to go assist and share information on the computer with others.

Research Question 5: How do you train other teachers to use technology?

Finding 5: Teacher technologists train other teachers to be collaborative, risk-takers in using technology in the classroom, who also challenge students to turn out quality products.

All of the teacher technologists in this study, in some manner or another were active, willing participants in promoting classroom teaching and learning using technology. Teacher demographic data such as the number of years of teaching, ethnicity, gender or school environment did not matter.

What seemed to matter is that these teacher technologists cared about and responded to the benefits offered in using technology in their classrooms. They were also more than willing to share these ideas with other teachers when called upon. The formal teacher technologist at the private school academy called upon several of the informal teacher technologists in this study as guest star teachers to assist in teaching some of the technology courses offered at the school. At the public middle school academy, this researcher observed Gdad and Mkad sharing resources and allowing teachers to come into the classroom with technology questions and concerns. Sophia Loren, at the public middle school academy offered comments concerning Mkad, the formal teacher technologist. Sophia Loren's experience with some technologists was that they "are cold and very territorial" unlike the formal teacher technologist at the public middle school academy who is “generous with his time…and his computers…he is not territorial…he understands that the equipment belongs to the district and not to him.”

<u>Discussion of Finding 5</u>

Training other teachers on the use of technology in the classroom is a daunting task. It involves the trainer giving respect to the teacher-trainees as to where they currently are in the learning curve. According to the CEO Forum (STAR 4, 2003) as adopted by the Apple Classrooms of America (ACOT), when teachers attend technology training, they are in one of several phases of training as shown in Table 11. Technology training needs for a teacher in the beginning phase of learning to use technology are quite different from the training needs of a teacher in the invention phase. The challenge, of course, in this age of swift technology innovation in schools is to meet the needs of both as well as of those who fall in between.

One such school, the American Embassy School, a middle school in New Delhi, India has started this process by establishing a technology mentoring program, where a team of teachers advanced in the risk-taking job of integrating technology into the curriculum were identified to mentor other teachers on how to use technology (McCombs, 2003). The team of mentors consisting of teachers from each department in the school, meet with the technology coordinator of the school to develop a training plan, and act as liaisons and mentors for their departments for the year. The mentors are compensated with an annual stipend and receive release days or time off to develop strategies for the integration. (p. 55). Although the report does not indicate how many teachers were involved in the school’s technology integration program, results of a survey of the program’s usefulness reported that 69% of the teachers exhibited positive feelings about the plan, 12% were neutral and 19% expressed negative feelings about the program. A web-based copy of the program is maintained at http://aes.ac.in/ms in the Administration section under Tech Integration (p. 57).

Research Question 6: How do you use professional development to Incorporate Technology into the Curriculum?

Finding 6: Whether attending a conference, in-house training, or taking an online web course, share what you have learned with someone else as soon as possible.

There is much to the adage that "You learn best what you teach." When teachers teach the same concepts year after year, of course they are knowledgeable of the material. The same goes for anything that one wants to retain or remember; use it or lose it. The teacher technologists in this study offered a variety of ways in which they attained professional development. All of them attended some form of professional development to stay abreast of developing technologies: 1) by visiting websites established by professional organizations within their discipline, 2) by taking online courses offered within their discipline, 3) by attending a national professional conference, and 4) by attending in-house and district training courses offered. None of the teacher technologists at the public middle school academy reported attending a national conference, whereas all of the teacher technologists at the private middle school academy reported attending at least one national conference.

Discussion of Finding 6

Professional development is offered as the key ingredient in order for teachers to stay abreast of current trends and best practices for classroom use of computers. However, according to the CEO Forum's fourth year report, in year 1999-2000, 63% of educational budgets are allocated to hardware and connectivity costs, 20% to the purchase of digital content, and only 17% for professional development (2003). The CEO Forum recommends 45% for hardware and connectivity, 25% for digital content and 30% for professional development. As reported by the CEO Forum:

> Well-trained teachers are the key to creating dynamic digital learning environments. Students with more highly skilled and talented teachers score higher, every time. Of teachers who receive eleven or more hours of training on integrating technology into the curriculum in the previous year, 48% say that they rely on software, digital content, and the Internet to a "very great" or "moderate" extent. Schools and districts must continue to make the commitment to professional development by providing the necessary support, resources and time for teachers to learn both how to use technology, and more importantly, how to integrate it into the curriculum to achieve educational objectives (2002).

Research Question 7: How does student computer expertise alter the teacher-learner relationship?

Finding 7: Students could be student-learners or student-as-teachers; teachers could be teacher-learners.

In this present study, students could play either role of student-as-learner or student-as-teacher in the classroom. In the same vein, teachers could play the role of teacher or expert, or teacher-as-learner, allowing students to teach them or other students in the classroom.

The common thread echoed by all of the teacher technologists to varying degrees was that they were comfortable with students being experts in the classroom, especially when it came to the use of technology. The student-as-teacher seemed to surface as the expert in the use of technology in the classroom. The student-as-teacher was encouraged to demonstrate, share information in the classroom, usually just in time, fluidly throughout the classroom session.

When students presented well-constructed technology projects that included sound content material, they received commendations from the teacher technologists. The teacher technologists did not seemed threatened by students who produced projects using technology features beyond the teacher's expertise in technology.

Some teacher technologists in this study made a clear distinction between students being allowed to teach them technology, but not the subject material. The four teachers who especially made that distinction were Genny J. Matt who taught Freshmen Algebra, Ara B. Jaamz who taught Freshman English, Gdad who taught eighth grade Algebra, and Sophia Loren who taught seventh grade Environmental Science, all lower middle and high school grade level students. Interestingly the teacher who taught upper level students expressed more freedom in allowing students to be the experts in any knowledge in the classroom.

<u>Discussion of Finding 7:</u>

When the roles of student as teacher and teacher as learner are played out in the classroom, teachers need not panic, according to Civello (1998). In her personal account of being removed from her throne as the all-knowing in the classroom by students in her English class at the private school academy, she revealed that it turned out to be the best for both her and her students. The introduction of technology in her classroom was not a denial of her importance or expert knowledge of the English curriculum, but served to extend learning opportunities for both her and her students, Civello (1998) was a teacher at the private school academy during its early years in the laptop program. In her report, she cites that English teachers' unfounded apprehensions regarding integrating technology in the school at that time centered around three losses:

- student loss of reading and writing

- teacher loss of authoritativeness
- an overall loss of ambiance (p. 2)

What teachers may experience as losses may be just reluctance to share the power.

Students are empowered by the use of computers in the classroom. According to Rockman *ET AL* (1998) laptop students expressed significantly more so than non-laptop computer users that they prefer to use computers to do school work, and that "computer made their schoolwork more fun and/or interesting" (p. xvi). Rockman *ET AL* (1998) reported

> Several teachers noted that their Laptop students interact more as peer teachers by giving more presentations in class and by sharing their expertise with technology. According to one teacher, this type of interaction helps poorer students gain confidence as they "teach A students about technology" (p. 35).

Summary

This chapter has provided the results and discussion of findings for this study. An analysis of each research question was provided using interview transcripts from each of the 10 teacher technologists. The analysis involved the process of phenomenological reduction which included individual textural and structural descriptions and composite textural and structural descriptions for research questions 1, 3, 4, 5, 6 and 7. For research question 2, classroom observation notes were analyzed. The 10 teacher technologists also completed a School Technology and Readiness questionnaire which was analyzed for research question 2.

The last step in the process of phenomenological reduction is synthesis. A synthesis of each research questions was provided, revealing seven findings:

First, the role of the teacher technologist was categorized as being a fast technology problem solver for school staff and students, being prepared to use technology, being knowledgeable of how to use technology in the classroom, and sharing technology information with students and teachers.

Second, both students and teachers were actively engaged participants in the teaching and learning process using technology, but the schools still lag in adequate technology and/or adequate teacher training.

Third, the teacher technologist used the Internet to research, build, present, organize and evaluate curriculum.

Fourth, most students were using tool software on computers in the classroom with the lesson centered around project-based activities.

Fifth, teacher technologists train other teachers to be collaborative, risk-takers in using technology in the classroom. These trained teachers in turn also challenge students to turn out quality products.

Sixth, whether attending a conference, in-house training, or taking an online web course, teacher technologists emphasize sharing with other teachers and/or students as soon as possible.

Finally, students could be student-learners or student-as-teachers; teachers could be teacher-learners.

Chapter five outlines the conclusions drawn from these seven main findings.

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATIONS FOR FOLLOWUP RESEARCH

The purpose of this study was to explore the practices of formal and informal teacher technologists in two school settings, a private high school academy and a public middle school academy. This investigation clarified the role of the formal and informal teacher technologist. The role of a formal teacher technologist, also referred to as technology coordinator, was defined in several studies (Moursund, 1992; Kohler, 1995; Woods, 2000). However, with the influx of more technology on school campuses and classroom technology integration, the need for informal teacher technologists has been identified by this study.

The review of literature included studies about the role of the teacher technologist and the use of computers. In reviewing the role of the formal teacher technologist, Moursund (1992) identified 13 possible duties of the formal teacher technologist but did not identify or include duties of the informal technologist. Kohler (1995) surveyed the perceptions of the technology coordinator's campus duties as sole or shared responsibilities, as reported by district computer specialists, principals, and technology coordinators. This present study explored the daily duties of the formal teacher technologist. A conclusion of this present study supports Kohler's recommendation that "each district develops policies and procedures to enable every school to have the assistance of a technology coordinator, either on a full or part time basis" (p. 107). Woods (2000), who also employed phenomenological methodology to examine the role of the technology coordinator on an elementary school campus, assumed the role of technology coordinator for two semesters. Whereas Woods examined the role of the technology coordinator from her perspective, this study examined the roles of both formal and informal teacher technologists from the perspectives of the teacher technologists themselves.

Four areas of instructional influence affected by the role of the teacher technologist were examined in the review of literature also: teacher as guide, student as expert; constructivist learning; technology availability; and professional development and teacher training. In the area of teacher as guide, student as expert, students are reported to be as knowledgeable of technology as is the teacher (Civello, 1998). In the area of constructivist learning, the Rockman *ET AL* (1998) study comparing laptop users to non-laptop users reports that in classes where students use laptop computers, the role of the teacher technologist in the classroom changes from "director of learning to facilitator of learning" (p. *x*), and students work as collaborators in the classroom. In the area of technology availability, Rockman *ET AL* (1998) attribute the major benefit of laptop computers to portability, i.e., students can use the computers anytime, anywhere. In the area of professional development and training, one of the duties of the teacher technologist is to lead in training and model how to use technology in the classroom (NCREL, 2002). This present study found that both formal and informal teacher technologists could assist in meeting the training needs of school faculty for technology classroom integration.

Two formal and eight informal teacher technologists were interviewed face-to-face three times each. A 30- to 45-minute preliminary interview, a 15- to 30-minute pre-classroom observation interview, and a 15- to 30-minute post-classroom observation interview were conducted with each participant. Each teacher technologist was also observed at least once in 85- to 90-minute classroom sessions and teacher training classes.

The methodology utilized to investigate this study was transcendental phenomenology. The processes of transcendental phenomenology included: *epoche*, phenomenological reduction, imaginative variation and synthesis. Each of these processes was applied to the responses from the 10 teacher technologists' interviews. Each of the teacher technologists completed a questionnaire to gather background demographics and information pertaining to teaching responsibilities and the practices and procedural use of computers and software in the classroom. Each of the teacher technologists completed an on-line K-12 School Technology and Readiness (STAR) questionnaire located at http://www.ceoforum.org/starchart.cfm to explore their perspectives on their school's technology presence in the areas of hardware, software, connectivity, professional development, and the integration and use of computers.

In response to the research questions asked in this study, the results of this study revealed seven key findings. The first question answered in this study is "What do you see your role as teacher technologist to be?" In the two schools investigated, this researcher observed the current role of the teacher technologist as being a fast technology problem solver for school staff and students, being prepared to use technology, being knowledgeable of how to use technology in the classroom, and sharing technology information with students and teachers. The formal teacher technologists' main role at both schools entailed providing knowledgeable technology first-aid to other teachers, administrators, staff, and students for hardware and software difficulties; the informal teacher technologists provided hardware and software assistance to teachers and students. First-aid assistance provided by the formal teacher technologists included providing immediate assistance, regardless of what the formal teacher technologist was doing, i.e., teaching a class or preparing to teach a training class. The formal teacher technologists were expected to provide immediate answers to hardware and software questions asked by other teachers, administrators, staff, and students whereas the informal teacher technologists willingly provided hardware and software assistance whenever they could but did not seem to feel the pressure of being expected to do so.

The second question answered in this study is "What is a typical school day for you as teacher technologist?" The researcher visited the teacher technologists at their school campuses during active teaching and learning instances in order to ascertain the nature of a typical school day of a teacher technologist. During those classroom visits, the researcher observed that 5 of the 10 teacher technologists began the class with a data projector connected to a computer. One formal teacher technologist began her class by standing in front of the class to give an animated introduction; she sat down to show students a video. She stopped the video at various intervals to have class discussion. The remaining 20 minutes of class were spent discussing and visiting on-line websites and a textbook website. Four teacher technologists began the class by asking students to turn on their computers. Two of these four teacher technologists passed out computer disks and asked students to copy specific files that they accessed during class. One of the four teacher technologists asked students to load a textbook cd-rom that they accessed during her lecture. Another teacher technologist had students visit the Internet to conduct research for a science fair project.

In 9 of the 10 teacher technologists' classrooms students used computers during class time with varying success. For example, at the public middle school academy, the e-Buddy laptop computers did not maintain adequate battery charges during classroom use, nor were alternative ac adapters available for students' to use. The 10 teacher technologists reported that successful use of technology in the classroom was dependent upon available hardware and software for both teachers and students; all 10 reported that their schools were at the target tech level for hardware availability and Internet connection.

On a typical day in school, six of the eight informal teacher technologists in this study cited the provision of voluntary technology assistance to other teachers. Four of the eight informal teacher technologists provided in-class assistance to other teachers during class time. Three of the eight informal teacher technologists were observed providing one-on-one technology training to other teachers. Six of the eight informal teacher technologists cited helping other teachers use Microsoft Word, Excel, Internet Explorer, Outlook, and PowerPoint during the course of the school day. One of the teacher technologists provided informal assistance in using the STELLA software tool to other teachers in the math and science department at the private high school academy. Two of the informal teacher technologists at the private high school academy assisted the formal teacher technologist in training other teachers in the technology courses offered before and after school.

The formal teacher technologists in both schools provided training to teachers but felt pressured to be the end-all suppliers of technical hardware and software support and the providers of strategies for incorporating technology into the curriculum. The formal teacher technologist at the public middle school academy provided technology assistance to other teachers and administrators 25% of the school day and spent 75% of his school time teaching students in five computer literacy classes. The formal teacher technologist at the private high school academy taught three history classes and also conducted teacher training classes after school on Mondays for one hour and classes on Tuesday and Thursday mornings for one hour. The formal teacher technologists wanted to give more attention to teacher training, but their dilemma was well stated by one formal teacher technologist at the private high school academy: "I can't do all this and do technology too."

The third question answered in this study is "How do you incorporate technology into your curriculum as teacher?" The teacher technologists used the Internet to conduct research and to develop, present, organize, communicate, and evaluate curriculum. All of the teacher technologists lauded the Internet as a useful tool for teachers in incorporating technology into the curriculum as teacher. The Internet was used to visit websites to plan lessons, include graphics and information in Powerpoint presentations, develop on-line quizzes, and provide students with website links for project assignments.

The fourth question answered in this study is "How do you incorporate technology into your curriculum for the student?" Most students were using tool software centered around project-based activities. In this study, students used word processing, spreadsheet, database, presentation, and on-line browser software to construct classroom assignments. Project-based learning was supported by the use of these tools. Students readily worked together very naturally when using the computers in the classroom. Students were observed to be actively attending to instruction by engaging in activities such as listening and typing notes on the computer as the teacher technologist lectured, examining a file on the computer screen simultaneously with the teacher technologist while discussing the lesson, searching a website and reading for reflection and discussion, watching the teacher technologist demonstrate a procedure on the computer via data projection, practicing with pencil and paper or with the computer at their seats, analyzing lesson content using computer files, and providing explanations through discussion.

The fifth question answered in this study is "How do you train other teachers?" Teacher technologists trained other teachers to be collaborative risk-takers in using technology. Apple Classrooms of America (STAR 4, 2003) identified five stages of professional development that teachers learning to use technology in the classroom may experience: entry, adoption, adaptation, appropriation, and invention. In this study, the teacher technologists provided training to other teachers. The formal teacher technologists provided scheduled training sessions. At the private high school academy, informal teacher technologists were guest star teachers to assist in teaching some of the technology courses offered. Seven of the informal teacher technologists provided one-on-one training to other teachers.

The sixth question answered in this study is "How do you use professional development to incorporate technology into the curriculum?" Teacher technologists shared what they learned with students and other teachers. All of the participants either attended professional conferences, in-house training, or on-line web classes on the use of technology in the classroom. Immediately sharing what they learned with other teachers and students was a recurring theme in this study for successful incorporation of technology into the curriculum.

The seventh question answered in this study is "How does student computer expertise alter the teacher-learner relationship?" Students could be student-learners or student-as-teachers; teachers could be teacher-learners. The student-as-teacher, especially of technology skills, was a common theme in this study. The teacher technologists reported allowing students to teach them and other students during class time. Expert student-as-teachers surfaced in the classroom when a technical problem arose. Teachers looked to them to provide assistance to other students. Students were empowered, and teachers were learners as well.

Conclusion

Technology is the tool of the 21^{st} century to be used in classrooms of any type of pedagogical instruction, but it is especially useful when teamed with the constructivist model of learning. Teachers should no longer weigh whether or not to use technology in the classroom. Just as the pen, pencil, dry erase markers, overhead, and whiteboards have become standard tools of education in the classroom, so have computers become a standard classroom tool in most schools.

The constructivist approach allows teachers to concentrate on subject matter, yet use technology to build a knowledge base. According to Means and Olsen (as cited in Waxman & Walberg (1999), p. 300) "teachers find that technology's chief benefit is its use as a tool to support student thinking and productivity." In the process of using technology to build knowledge, teachers have to be given the opportunity to learn new computer techniques through instructive resources and teaching aids. Traditional staff development clings to the idea that technology is separate from curriculum and instruction (Gordon, 2000). For teachers (and therefore students) to be effective users of technology, the mindset has to be that technology is just another device-- a tool, the same as an overhead or whiteboard, to be used whenever needed. In this present study, both the formal and informal teacher technologists were key players in using technology as a tool, helping to incorporate technology seamlessly into the classroom.

The teacher technologists in this study engaged in collaborative learning methods when using computers. What this researcher observed in their classrooms was the seamless use of technology as it should be. Both teachers and students seemed at ease and familiar with the computers and the software. Instructions to turn on the laptop computers and access Internet websites or a Microsoft Word file were no more met with no more difficulty than were instructions to students directing them to take out their books, paper, and pencils. Students readily shared information with each other and helped each other with technical nuances such as accessing the correct Internet website, printing a select number of pages, and searching for information on the Internet for a science fair project.

Both schools in this study were evolving in providing necessary support and attention to the teacher technologist plays to ensure the efficient use of expensive hardware and software purchases for technology integration. Teacher technologists need to take professional courses and attend professional conferences to stay abreast of the constant challenges that technology education presents.

Schools need to employ at least one fulltime technology coordinator or formal teacher technologist who may also teach *one* class. This is even more a necessity today than when first suggested by Moursund in 1992. Schools have acquired more technology but have not kept up in the area of adequate personnel to address the mounting needs of training and incorporation of technology into the curriculum (CEO Forum, 2002). The main role of the new formal teacher technologist is to assist teachers in incorporating technology into the curriculum.

Along with employing a fulltime teacher technologist with a one-class teaching assignment, schools would benefit from forming teams of informal teacher technologists to help spread the use of technology in the classroom. Such teams, with guidance from the formal teacher technologist, would develop a tailored training program for the specific campus especially centered on mentoring other teachers. Informal teacher technologists could be compensated monetarily and with release time to plan, develop, and implement the program (McCombs, 2003).

Each student in the public middle school academy should have access to a laptop computer to use at school and home, anywhere and anytime. Laptop computers in the hands of all students would provide a greater incentive to student achievement, responsibility, and use (Rockman *ET AL*, 1998). Laptop computers are portable, convenient, and useful in extending student learning outside the classroom. Currently, the public middle school academy has enough computers to serve each student but the computers are not being used sufficiently because of lack of standardization. Standardizing the computers involves making sure the software and hardware are compatible with what teachers and students need and use the most rather than purchasing random computers on a whim. The purchase of laptops should coincide with the district's recommended standards for computer software and hardware purchases. That is, the same software should be installed on the laptops as is installed on the district's 28 networked computers in the computer lab. In doing so, the school spends funds more efficiently and maximizes the use of laptop technology for students. Standardizing hardware and software purchases made at the public middle school academy allows students and teachers to use the computers more consistently. Students can be effective users of technology at the public middle school academy when they can access the technology anytime and anywhere.

Hardware purchases made at the public middle school academy included underused Softbooks purchased for textbook file storage only. Teachers and students were not using them. Also, the Dell and e-Buddy laptop configurations did not match the needs of the teachers and students. The laptops lacked adequate computer memory, hard drive and diskette medium storage, ac adapters, and a completely installed software tool package such as Microsoft Office 2000. Each student and teacher needs access to a maximized laptop configuration for effective, fluid integration of computers into classroom learning. Students at the public middle school academy were overusing the computer literacy lab because it provided adequate hardware, software, network, and file storage capabilities. However, there were only 28 computers available in the lab, an insufficient number of computers for each of the public middle school students to use anytime, anywhere.

The CEO Forum in its third year of operation stresses the importance of the provision of adequate computers, Internet connections, and digital content by schools in order to classify teachers and students as "seamless technology users" (2000). Schools need to be able to conduct realistic self -assessments to "gauge progress toward integrating technology to improve education" (CEO Forum, 2000). The forum developed a School Technology and Readiness questionnaire (STAR), that helps schools and/or school districts identify their technology profile. Thus, the results from the questionnaire can be beneficial in closing the digital gap since schools can set goals, measure their progress, apply for appropriate technology grants, and determine where to concentrate technology most efficiently (CEO Forum, 2000).

In examining the role of the formal and informal teacher technologist in two school environments, a private school and a public school, this study found that both formal and informal teacher technologists were key influences in the successful integration of technology in the classroom. Whether in a private or public school setting, this study found that teacher technologists who attend professional development and technology training are knowledgeable about technology and its use in the classroom. Both formal and informal teacher technologists need to pass this knowledge on to other teachers on the campus to help relieve the formal teacher technologist of the sole responsibility for training and being on-call for teachers, administrators, staff, and students' technology difficulties. The informal teacher technologist can provide ready assistance and training also.

The technological differences between the two schools surfaced. Although both schools seemed to have an adequate number of computers for student use, there was a marked difference in the availability of technology. The public middle school academy offered several different configurations of computers to students; however, only 28 of those 210 computers were used consistently. This indicated that the school needs to standardize the purchase of computers, using the money more efficiently to benefit the students. This present study found that students who have laptop computers available to use anytime, anywhere utilized the opportunity to extend their learning beyond the classroom and developed better research, presentation, reading and writing skills. Inequalities in the school system continue to exist (Scherer, 1992). In order for the poor students to have equal higher educational opportunities, they must have state-of-the-art tools to aid in this process.

Recommendations for Follow-up Research

The following suggestions are offered for further qualitative studies. Further research could investigate the role of the formal and informal teacher technologist over a longer time period. The duration of this study was approximately 4 weeks. A study for a longer period with participants from a larger school sample could further define the traditional role of the technology coordinator.

Further studies could be conducted to determine the need for schools and school districts to offer classroom teachers on-line technology training programs as an alternative choice to physical class attendance. With the availability of the Internet and e-mail to teachers, a study could be conducted to determine the best approach for offering convenient technology training to teachers who otherwise may not readily avail themselves of professional development opportunities because of costly travel expenses and lack of structured class time. There are several ways by which teachers could use the advantage of on-line technology training: they could take on-line courses offered through a university's teacher education department, professional organizations, and educational service centers. Colleges and universities already offer on-line courses in lieu of classroom classes. School districts could add this to their training agendas as an alternative teacher-training medium.

Although there are studies on students' perspective of the use of computers in the classroom, such as the Rockman *ET AL* (1998) laptop computer study, additional qualitative studies are needed to ascertain changing student perspectives as technology rapidly changes. One of the fastest evolving technologies is e-mail, and its sister, instant messaging (IM). At the private high school academy, IM was akin to sending paper notes to a friend during class. IM students could be chatting on-line with someone at another school, in another state, or in another country for that matter, while simultaneously attending to classroom activities. From the students' perspective, are they being served sufficiently with the current computer configurations? How can teacher technologists best teach them using current technologies?

Students in this study were not given the opportunity to express their perceptions of the role the teacher technologist played in classroom integration of computers. Students were not interviewed, nor were the focus of observations solely on them. Instead the investigation concentrated on the teacher technologists' use of computers as they interacted with the students. An interesting component could include what students think about how computers are currently being used in their classrooms.

Limitations

The sample of opportunity of 10 participants in this study limits generalizability to only teacher technologists involved in this study. Two of the 10 participants were formal teacher technologists, and 8 were informal teacher technologists. Each participant was observed in the classroom at least once, with observations supplemented with other documentation such as technology portfolios, lesson handouts, and teacher training logs. Each participant was interviewed at least three times.

This researcher was limited in that she was employed as a full-time computer science teacher at the private high school academy. The observation data were collected and scheduled at the private school academy where she was employed. These sessions were scheduled at times when the researcher had planning periods that coincided with scheduled classes of the other seven teacher technologists. Interviews for the seven teacher technologists were scheduled when both the teacher technologist and the researcher had the same planning period. This researcher used scheduled time off to conduct the observations and interviews at the public middle school academy. Thankfully, the public middle school academy was less than 15 minutes away from the private high school academy.

These two schools were chosen based on the similarity in their mission to prepare students for college. The mission statement for the urban academy school was "On time, on task, on a mission and excellence without an excuse!" An excerpt from the private academy school's mission stated: "the Academy encourages each student to develop her individual talents, interests, and potential through programs focused on academic excellence, spiritual formation, physical development, leadership, community building and service in a caring and challenging environment of students, parents, and educators."

APPENDIX A

School Technology and Readiness (STAR) Online Questionnaire
(http://www.ceoforum.org/starchart.cfm)

1. How many students per instructional computer?
   a. More than 10
   b. 10 or less
   c. 5 or less
   d. 1 student per instructional computer connected to the Internet

2. How long does it take to receive technical support?
   a. Takes several days
   b. Takes place next day
   c. Takes place same day
   d. Tech support available 24/7

3. What percent of instructional rooms and administrative offices are connected to the Internet?
   a. More than 10
   b. 10 or less
   c. 5 or less
   d. 1 student per instructional computer connected to the Internet

4. What is the quality of your school's connection to the Internet?
   a. Dial up access on some computers
   b. Direct connectivity on campus and in some classrooms
   c. Direct connectivity in most classrooms; adequate bandwidth
   d. Direct connectivity in all classrooms with adequate bandwidth to prevent delays

5. What is the use and availability of other forms of hardware technology?
   a. VCRs, cable TV, projection devices, calculators
   b. VCRs, cable TV, telephones, voicemail, projection devices, digital cameras, calculators
   c. Wide variety of VCRs, cable TV, telephones, voicemail, random access video, projection devices, digital cameras, scanners, portals, personal digital assistants, two way video conferencing, calculators
   d. There is a broad use of a wide variety of other technologies such as a two-way video conferencing, VCRs, cable, TV, telephones, voicemail, random access video, personal digital assistants, projection devices, digital cameras, scanners.

6. What forms do delivery and format of professional development take?
    a. Trainer-led instruction
    b. Trainer-led instruction; embedded help within applications
    c. Online mentoring
    d. Anytime, anywhere

7. What percentage of the technology budget is allocated to professional development?
    a. Less than 10%
    b. 11-15%
    c. 16-29%
    d. 30%

8. What is the understanding and use of digital content by educators?
    a. 100% at entry or adoption phase; a few use for lesson planning
    b. 100% at adaptation phases; some begin to use with students
    c. 100% at appropriation phases
    d. 100% at appropriation or invention phases

9. What is the content budget allocation to purchase digital content?
    a. Use some supplemental instructional materials funds only
    b. Use significant instructional materials budget, but little to no textbook budget
    c. Scrutinize entire budget and shift funds from textbook budget to acquire digital content
    d. 100% instructional materials budget is available to purchase 'most appropriate' content

10. Software format:
    a. Receive information/tools from pre-packaged software
    b. Receive information from CD-ROM and searchable, online content
    c. Manipulatable digital content and tools available commercially and on the Web
    d. Full range of digital content and tools structured to support production and collaboration

11. What is the role of the educator and degree to which digital content is integrated into instruction?
    a. Teacher centered; supplement instruction with digital content
    b. Teacher-directed; beginning to integrate into instruction
    c. Teacher-facilitated in local or distant classrooms; fully integrated into instruction and use for research, planning, multimedia presentations and simulations, and to correspond and communicate
    d. Student centered in local or distant classrooms; teacher as guide; digital content changes the teaching process, allowing for greater levels of inquiry, analysis, interest, collaboration, creativity, and content production

12. Do the students employ digital content to enhance learning?
    a. Reinforce basic academic skills
    b. Use for research, communications and presentations
    c. Use for research, to solve problems, to analyze data, to collaborate and to correspond with experts and peers and to become content producers
    d. Digital content changes the learning process, allowing for greater levels of collaboration, inquiry, analysis, creativity and content production

13. What percentage of students are using digital content and what is their frequency of use?
    a. 50% or more, weekly
    b. 75% or more, 3-4 times a week; 20% have online course units available to expand opportunities
    c. 100% use digital content daily, but activities are isolated by grade, disciplines, classes; 30% or more have online course units available to expand opportunities
    d. Seamlessly integrated throughout all classes and subjects on a daily basis; 100% have online course units available to supplement and expand school course offerings

14. How does technology help student achievement and 21st century skills?
    a. Demonstrate improved basic skills
    b. Demonstrate some improved mastery of 21st century skills
    c. Demonstrate mastery of 21st century skills
    d. Demonstrate improved achievement and mastery of 21st century skills

15. What percent of your school or district aligns standards, curriculum, assessment and/or uses technology for continuous improvement?
    a. 25% align standards, curriculum and assessment using technology
    b. 50% aligns standards, curriculum and assessment and report results; 25% monitor and measure results to inform new instructional decisions
    c. 100% align standards, curriculum and assessment using technology; 50% monitor and measure results to inform new instructional improvement
    d. 100% align standards, curriculum and assessment using technology; 100% monitor and measure results to support teaching and learning and link to continuous improvement

16. What percent of your school or district integrates digital strategies into assessment and/or measures 21st century skills?
    a. No use of digital strategies for assessment
    b. 25% or more use digital strategies for assessment
    c. 50% or more use digital strategies for assessment; experimenting with technology for measurement and accountability
    d. Systematic continuous improvement using digital content and tools; use of

technology for measurement and accountability

17. What percent of students has continuous access to technology?
    a.
    b.
    c. Can access digital content at times other than school hours;; 75% or more of students use technology to develop 21st century skills
    d.

18. How is research used?
    a. Schools inconsistently apply ad hoc research
    b.
    c.
    d.

19. How do administrators use technology?
    a. Communicate objectives w/other administrators and teachers
    b.
    c.
    d.

20. How do parents and the community use technology?
    a.
    b.
    c. Communicate two-way via email, and privacy protected web tools, e.g., to access some school information and resources from home
    d.

APPENDIX B

Observation Format

5/2/02

Classroom Observation of Participant (JR):
Number of students: 13 girls: 1 Chinese, 1 South African and 11 Caucasian
Grade: 9
Course: English I
Class began at 9:37a
Class ends at 11:07a

Handout: Act V Worksheet

Computers Used: Toshiba Satellite GeniuneIntel with 120MB RAM, DVD player and a Netwave Card.

Computer Equipment in the Room: The room has a computer network box, that allows students to go online and use the Internet, email and other online features.
The room also has three printers (HP 850C) that students are allowed to use to print out their assignments. Actually, one printer is for the teacher and the other for the students. JR points out that the printer works half of the time; he has put a request (nasty letter as he calls it) to the Technology Department to come and repair it. There is a desktop Compaq computer for teacher use.

The two printers sit on separate tables near the front of the room; the desktop computer and teacher printer sits on the teacher's desk in the front of the room.

I wanted to get to JR's class right at the beginning, but I got there late**. I proceeded to find a seat in the back of the room, preferably near a plug. That presented a challenge, because the room is a old one, so there is only one outlet out where the students can use them**. All the other outlets are on the wall behind JR's desk. He has to run an extension outlet with 6 plugs on it for student use. That is what I plugged into. All freshmen have laptops that can be battery-used, but may need plugs.

JR's classroom is located in the old part of one of the older buildings. There are happy face decoration themes on the walls and bulletin boards. There is an Honorbound plaque on the wall, a digital clock and PA system box.

Bookshelves line the front wall of the room.

One bulletin board has "Be patient, no complaining" on it. A description of developing a paragraph and fire/tornado drill instructions. One wall has a poster of Malcolm X and Martin Luther King, Jr. on it.

One bulletin board has a collection of cd-roms for decoration.

JR stands at the front of the room; he has a lectern with a laptop he purchased sitting on top of it. He gives instruction for the Act V Worksheet and answers questions regarding the assignment. Students have the whole period to complete the project.

JR speaks very clearly, when giving out directions. He has as affable, pleasing attitude and approach to giving out instructions. He has humor.

The atmosphere of the room is one of relaxed, yet focused on the assignment. Students are busy writing or typing in assignments, involved and on task. The temperature started out being just pleasant, but toward the end of class began to get very cold. A student voiced her concern about it being too cold; JR humored her with a response to wear her khaki pants; students were uniform red , white and blue plaid skirts and white shirts, saddle oxford shoes and white socks.

Students that are on the computers are using Microsoft Word to type in enumerated responses. **Two students flips back and forth using AOL's instant messenger (AOL's instant messenger is a chatroom program that allows students chat online with anyone).**

Students are free to ask questions, work on their computers or handwrite answers; if they choose, they can also answer the bonus question on the board:

> Bonus question: Name 2 characters whose names maybe metaphorical or symbolic. (1) Identify the character; (2) explain how/why their name holds 'other' meaning.

Student chairs are the regular student desks with an attached desk top.

Students have nowhere to put their backpacks; they are placed all over, in the aisles, around their desks.

With the small desk top areas, students have to juggle positioning their computers in a limited space, along with their book "Macbeth."

Seven students have their laptops on and are directly typing in questions to the assignment given (Act V Worksheet). Five students are writing their responses on paper. **Students have the option to turn in the assignment handwritten or typed.**

After students began their lessons, JR answers more questions; then sits at his desk to take attendance using the attendance software; attendance is taken on the computer., JR invites student questions; students may approach his desk quietly and ask questions. All questions except for three were about the book references or the content of the assignment; the other three questions asked were computer related.

Towards the end of the class, students began printing out their typed assignments; showing JR their worksheet answers. The assignment is about building their latest thesis statement on MacBeth, Act V. Students are allowed to exchange papers if they choose and evaluate each other's work.

APPENDIX C

Teacher Technologist Questionnaire

Name____
Last First M.I
School_____________________________ **Date** _____________**Ethnicity**__________
Email address ___________________________**Phone#** ___________**Gender**_______

NOTE: Thank you again for participation in this study. I would like to learn about your experiences as an informal or formal teacher technologist in your school environment. **All information will be kept confidential; no names will be used in this project**. I may also contact you by phone for further clarification, if necessary.
Please feel free to continue any of your responses on the back of a page, if you are printing this out and filling it out manually; otherwise, you are welcome to type your responses on this form, save it and send to me as an attachment via email. **Please return your completed questionnaire by October 18, 2002 to:**

Jennifer Herring
1709 Aurora Drive
Richardson, Texas 75081
Email: jherring@ursuline.pvt.k12.tx.us cc: to jessemh@swbell.net

Thanks!

BACKGROUND

1. For how many years have you taught? O <5 O 6-10 O 11-15 O 16-20 O 21+
2. For formal teacher technologists: How many years have you been a teacher technologist? O <5 O 6-10 O 11-15 O 16-20 O 21+
3. How many clock hours of technology training (in-house or professional development) have you received in the past 3 years? ____
4. How many technology conferences have you attended in the past 3 years? ____
5. How many conferences in your discipline have you attended in the past 3 years? ____
7. List any professional organizations in which yo u have current membership:
____
____
____

3. When (month/year) did you begin using computers for classroom instruction?
____

4. How would you rate your current level of enthusiasm (mark below) for using computers in the classroom?

unenthusiastic somewhat enthusiastic very enthusiastic

1 2 3 4 5 6 7

TEACHING RESPONSIBILITIES AND GENERAL PRACTICES

5. Complete the following chart for EVERY class you teach during a typical day at school. ***You may continue your responses (indicate the corresponding class period number) on the back of this page.***

Period	Subject(s)	Grade	#of Students	Do you use a computer to prepare or teach this class? (yes/no)	Do students use computers for this class? (yes/no)	% of class time students use computers?	% of homework assignments per week involving computer use?	What tasks do students accomplish with the computers? (e.g. note taking, presentation etc)
1								
2								
3								
4								
5								
6								
7								
8								

6. How long (in minutes) are the class periods at your school? ______________________

7. On average, what percentage of time do students in your classes spend working in groups, working independently, and working as a whole class?

Group _____% Independently _______% Whole Class _______%

USE OF COMPUTERS IN THE CLASSROOM’S EFFECTS ON LEARNING AND INSTRUCTION

Please base your responses to the following questions on your experiences teaching classes in which students use computers.

8. In what ways, if any, has the instructional process in your classroom been most directly affected by the use of computers?

What evidence can you provide to show that this instructional process has changed?

9. In what ways, if any have the products of your students’ work been most directly affected by the use of computers?

10. Can you state any ways in which the use of computers for classrooms’ impact is different from classrooms that do not use computers?

USE OF SOFTWARE TOOLS

11. Please indicate how often and for what purposes each software application is used. ***Please feel free to continue your responses (indicate the corresponding tool) on the back of this page.***

Tool	Average # of times you use each tool per week: To prepare lessons	Average # of class periods you use each tool per week: To teach lessons	Average # of class periods your students use each tool per week: In Class	Average # of times your students use each tool per week: For homework	Rank the tools (1-6) from most to least useful for improving students' learning.	List the tasks you most frequently accomplish with each software tool.	List the tasks your students most frequently accomplish with each software tool.
Word							
Excel							
Power-point							
Internet							
Access							
Email							
Other tool1*							
Other tool2*							
Other tool3*							

*Name of other tool1____

*Name of other tool2____

*Name of other tool3____

12. Please choose a software tool that you frequently use during instruction with computers, and DESCRIBE a lesson or project you've conducted in which use of the tool was particularly effective in accomplishing your instructional goals. ***Please feel free to continue on back of this page or to attach a separate sheet of paper if you prefer to type your description and responses to our questions.***

____

____

____

____

____

____

____

After describing your lesson, please respond to the following questions:
a) Did use of the computers for this lesson or project support students' use or development of higher-order thinking skills? If so, how?

____
____
____

b) How did you access the learning outcomes for this lesson or project?

____
____
____

c) What advantages, if any did the computers offer for this lesson or project over the use of pencil and paper?

____
____
____

I'd like to hear about other lessons you've successfully taught using the laptops. Please send lesson descriptions by email to jherring@ursuline.pvt.k12.tx.us (cc to jessemh@swbell.net) or call Jennifer Herring at 469-232-1842(work) or 972-699-1437 (home) to tell me more about what you've accomplished in your classroom using computers. THANK YOU!

APPENDIX D

Participant Letter

October 7, 2002

To: Study Participant

From: Jennifer C. Herring, M.Ed.
Doctoral Student – University of North Texas

Re: "An Investigation into the Current Practices of Effective Formal and Informal Teacher Technologists on the use of Computers in the Classroom in an Urban Academy School and a Private Academy School"

Thank you in advance for your participation in this study! Enclosed please find the following:

(1) The Research Consent Form, signed and approved by the University of North Texas' Institutional Review Board (on the last page). Please read it first, sign your initials on all three pages, sign your name on the last page and return in the enclosed, envelope.

(2) Teacher Technologist Questionnaire – using a pseudo-name, fill out the questionnaire, answering as thoroughly as possible. If you have any questions or need further clarification concerning the questionnaire, do email me at jherring@ursuline.pvt.k12.tx.us or call me at 469-232-1842(w) or 972-699-1437(h). Please return the questionnaire in the enclosed envelope.

(3) School Technology and Readiness Questionnaire – to gain your perspective on your school's technology environment, please complete the survey online at http://www.ceoforum.org/starchart.cfm . Print out the results of your survey and return in the enclosed envelope.

(4) Parent letter – a copy of a letter to go home to parents of students who will be in your classroom when I observe, just to let them know I am conducting the study.

Please return items (1), (2) and (3) by October 18th. After I receive your consent form, Teacher Technologist Questionnaire and School Technology and Readiness Questionnaire, I will contact you for an appropriate time to interview and observe you in the classroom, the last two weeks of October, the first two weeks of November.

Again, thanks for your participation; I look forward to your responses and talking with you soon.

APPENDIX E

Preliminary Interview Questions
First Set of Interview Questions for Teacher Technologists

Pseudoname: ______________________ School: ________________ Date: ________

1. What grade levels do you teach?

2. Which subjects do you teach?

3. How many periods per day do you teach each subject/grade?

4. For which classes do you use computers:
   a. to prepare lessons?
   b. to teach lessons?
   c. how do you use your computer? (for what? When? Why?)

5. How much help do you need when you use each software program/tool?

Word	I always need help.	I sometimes need help.	I rarely need help.	I never need help.	I help other people. I am an expert.
Excel	I always need help.	I sometimes need help.	I rarely need help.	I never need help.	I help other people. I am an expert.
Power Point	I always need help.	I sometimes need help.	I rarely need help.	I never need help.	I help other people. I am an expert.
Access	I always need help.	I sometimes need help.	I rarely need help.	I never need help.	I help other people. I am an expert.
Internet	I always need help.	I sometimes need help.	I rarely need help.	I never need help.	I help other people. I am an expert.
E-mail	I always need help.	I sometimes need help.	I rarely need help.	I never need help.	I help other people. I am an expert.
CD-ROM	I always need help.	I sometimes need help.	I rarely need help.	I never need help.	I help other people. I am an expert.
Zipping Files	I always need help.	I sometimes need help.	I rarely need help.	I never need help.	I help other people. I am an expert.

6. For which classes do your students use computers:
    a. For class work?
    b. For homework?
    c. Are students required to use computers for their assignments?

7. What would you say has been the most substantial impact of computers in your classroom? Where would I look to see this impact? What's different because of it?

8. Do you feel the computers have changed the way you teach? If so, how?
    Have the computers had an impact on…
    - Planning?
    - Classroom organization?
    - Assignments?
    - Collaboration?
    - Instruction?
    - Grouping practices?
    - Feedback to students?
    - Assessment?
    - Relationship/contact with parents?
    - Internet use?

9. Have the computers led to changes in the kinds of work that students do? Describe.
    Probe if needed with:
    - The work and thought required of students now
    - Time spent on tasks that utilize computers
    - Tasks (note taking, running models, internet research, word)
    - Ways students work (independently, collaboratively, from home, etc.)
    - How students are learning (attention span, ability to understand concepts, interaction with peers).

11. What do you see your role as teacher technologist to be?

12. What is it like in a typical school day, as the designated teacher technologist in one's school building?

13. How do you incorporate technology into your curriculum for you as teacher?

14. How do you incorporate technology into your curriculum for the student?

15. How do you train other teachers?

16. How do you use professional development to incorporate technology into the curriculum?

17. How does student computer expertise alter the teacher-learner relationship?

APPENDIX F

Pre-Observation Interview

Second Set of Teacher Technologist Interview Questions

PseudoName: ______________________ School: ________________ Date: _________

1. Did you use a computer to prepare the lesson(s) you're teaching today? How did you use it?

2. How do you plan to use your computer as a teaching tool?

3. Will your students use their computers?

4. Is there anything unusual / non-typical about the lessons you'll teach today in regards to technology? If so, what?

5. Is there anything in particular that you feel I should pay attention to in any of the classes you'll be teaching today in regards to the use of technology?

APPENDIX G

Post Observation Interview

Third Set of Teacher Technologist Interview Questions

Pseudo-Name: ____________________ School: ______________ Date: ________

1. How did you feel about how your classes went today using technology?

2. Any highlights?

3. Any low points?

4. Did your lessons go as planned? Why or why not?

5. Were your lessons typical of other lessons you teach?
    a. What was typical?
    b. What was unusual?

6. Could this lesson have been taught without computers?
    a. If yes, what would have been different if your students did not have access to computers?
    b. If no, why not?

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