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TEACHER PROFESSIONAL DEVELOPMENT IN TECHNOLOGY INTEGRATION

A Project

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Education:

Instructional Technology

---

by

Geraldine Lee Soderquist

December 2003

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ABSTRACT

The purpose of this project was to design, create, and produce a web site for teachers that instructs them on the creating, developing, and sharing of web quests. Web quests utilize the wealth of information on the Internet to provide a means of moving the teacher away from lecturer and more toward facilitator.

One primary goal of education is to produce citizens that are able to work, compete, and communicate effectively in today's technological society. In order for this to be accomplished, teachers must first acquire the skills and knowledge required to effectively prepare students for this environment. This project addresses the need of providing teachers with the necessary training to enable them to integrate technology into their curriculum. The project further addresses the need for a training opportunity that incorporates necessary key elements for teacher motivation and success with technology on a long-term basis.

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I would like to thank all of my professors for their encouragement and excitement about the possibilities of technology use in education. I would like to thank Dr. Baek for her guidance and patience. I would like to thank Dr. Monaghan and Dr. Leh who were inspirational and thoughtful. Finally, I would like to thank my family and friends who always supported and encouraged me throughout my college endeavors. Thank you Stephen, Jane and Eugene for pushing me when I felt like giving up. Thank you mom for always being there for me.

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CHAPTER ONE

INTRODUCTION

Background of the Problem

It is impossible to ignore the impact that new technologies in our society have had on the way we conduct business, communicate, teach and learn. Today's workplace requires that workers be able to use technology effectively. Business leaders put this responsibility on schools and educators. The leaders of the United States, state legislatures, and other groups responsible for policy-making are pushing toward the use of technology to reform education and increase student achievement (The National Council for the Accreditation of Teacher Education, 1997).

The effects of this rapid technological growth are evident in our schools. In recent years there has been a tremendous influx of suggested resources, technology tips, and interactive CD-ROM programs that accompany school's new book adoptions. Other educational sources also push for the use of technologies in the classroom. The California State Board of Education (1999) now includes a chapter on "The Use of Technology" in all of their framework books. It is their desire that students learn

how to use computers, computer applications, and the Internet in a manner that propagates student learning. Further evidence of this technology explosion can be seen in the number of classrooms now wired to the Internet. The U.S. Department of Education, National Center for Education Statistics (NCES), (2000) conducted a survey which revealed that as of spring 1999, 99 percent of full-time regular public school teachers had access to a computer or the Internet at their school site. A 1998 national survey conducted by the Center for Research on Information Technology and Organizations (2000) concluded that 31 percent of teachers had modem access to the Internet from their classrooms, and 28 percent had high-speed access.

Technology was introduced into the educational setting as early as the 1980's with the microcomputer (Votek & Vojtek, 1999). Computers were viewed as the next new educational tool. Technology and the use of computers were viewed as instruments useful in supporting learning that would be meaningful. Jonassen, Peck, and Wilson (1999) agree that "if we accept that our goal, as technology-using educators, is to support meaningful learning, then we should use technologies to engage

students in active, constructive, intentional, authentic, and cooperative learning" (p. 7).

Knowing that technology is no longer the future, but is now the present, and that students must be educated in ways that are radically different than textbook-oriented instruction, Votek and Vojtek (1999) pose the question of "...why are we still wondering how to use technology?" (p. 89). They compare teacher technology training to a pinball machine. Teachers are like the ball bouncing around quickly from skill to skill unable to stop long enough to learn how to successfully integrate technology into their classrooms and curriculum.

The link that binds together our technologically demanding global economy and the future citizens capable of surviving in this society is the educator. The Report of the Web-Based Education Commission (2000) identifies the skill of the teacher as being the number one determining factor in the technology success of the student. The commission goes on to say that "creating high tech educational tools without training teachers to use them would be as useless as creating a new generation of planes, without training pilots to fly them" (p. 39). Unfortunately, we are not spending enough to fulfill this educational obligation. The U.S. Congress, Office of

Technology Assessment, (1995) estimated that approximately 15 percent of a district's average technology budget went toward teacher technology training. The trend for spending money on technology training remains low. A similar report found that by 1996 only 6 percent of total money spent on technology went toward teacher training. Furthermore, by the 1999-2000 school year, this increased to only 17 percent. The National Education Association recommends that 40 percent of technology budgets are set aside for technology training (Report of the Web-Based Education Commission, 2000).

The lack of funding for technology training is creating a large segment of the teaching population feeling not prepared to use computers and the Internet in their classrooms. The U.S. Department of Education, NCES, (2000) reports that 66 percent of teachers feel either not at all prepared or only somewhat prepared for integrating technology into their curriculum. The commission goes on to estimate that "almost 65 percent of teachers had never used a computer before being introduced to one in the classroom" (p. 39).

Contributing to the need for teacher training is the fact that new teachers are not much better off than veteran teachers are. Teachers with 3 or fewer years of

teaching experience felt only slightly more prepared to use technology in their instruction (The U.S. Department of Education, NCES, 2000). Thus, the issues that surround technology training impact new teachers as well as veteran teachers. Further complicating the problem is the lack of importance of technology in teacher education programs. Most new teachers that graduate from teacher preparation programs do not know how to integrate technology into their teaching (U.S. Congress, Office of Technology Assessment, 1995).

Colleges of education also face challenges in the integration of technology in their teacher education programs. Addal-Haqq (1995) along with Baron and Goldman (1994), suggest that these challenges include access of equipment, limitations of funds, training, instructional and technical support, and availability of equipment (as cited in Duhaney, 2001). Furthermore, teacher education programs offer training that is too basic and too brief to help teachers develop the skills necessary to meet technology teaching goals and challenges (Report of the Web-Based Education Commission, 2000).

The issues surrounding technology training for teachers are astounding when given the statistics on the number of current teachers and the number of new teachers

expected to enter the profession in the next ten years. Currently there are three million k-12 teachers in our nation. Over the next ten years it is estimated that two million new teachers will be needed to replace retiring teachers and meet new growth in enrollment (Report of the Web-Based Education Commission, 2000). In California alone it is estimated that over 300,000 new teachers will be needed in the next ten years. Furthermore, San Bernardino County, where the web site project will be introduced, needs over 2,500 new teachers just to cover projected enrollment for 2002-2003 (California Department of Education, 2002). It is crucial that we find ways of meeting these challenges and preparing our new teachers and veteran teachers to use technology as a teaching tool.

Statement of the Problem

Teacher technology training experiences, whether preservice or inservice training, are not preparing teachers to effectively integrate technology into their teaching practices. Training efforts are lacking the very components that could make them successful including: flexibility of professional development opportunities, adequate learning time, self-paced teacher learning that deviates from the "one-size-fits-all" training style,

"hands-on" experiences, sharing and collaboration with peers, and creation of curriculum-supported materials that teachers can actually build and take back to the classroom and use. The underlying problem is the lack of funding for training at the district level coupled with inadequate training at the teacher preparation level.

Purpose of the Project

There is a need for innovative and creative training opportunities that incorporate successful elements for teacher motivation and success with technology on a long-term basis. The purpose of this project was to develop a web-based training opportunity that instructs teachers on the creating, developing, and sharing of web quests. The training component of the web site allows for self-paced teacher learning in a "hands-on" environment. It also provides many opportunities for collaboration among teachers. The sharing of web quests produced in the process contributes to a professional development relationship with an instructional technology mentor teacher and other colleagues. Flexibility of professional development opportunities and adequate learning time are taken care of due to the on-line learning environment. The application used in the training is available to all

teachers, thereby taking advantage of already existing resources that reduce the need for funds. While this project was developed to train teachers at Del Vallejo Middle School, any school, district or other training facility can use it.

To achieve the desired results, the major research question investigated in this study is: What elements need to be present in technology training to increase the motivation and capacity for teachers to successfully integrate technology in their lessons on a long-term basis?

Significance of the Project

This project is significant in that it considers the key factors for successful technology integration on a long-term basis. Technology continues to comprise a large portion of school districts' budgets, and historically, training teachers to use these technologies has been a slow process. This project will benefit Del Vallejo Middle School by providing an opportunity for teachers to create curriculum-supported materials that use technology. At the same time, it can provide a fantastic network of appropriate resources that teachers can collaborate on and share. By utilizing the product built for this project,

the school will save time and money through teacher technology training that incorporates elements successful in other training programs.

Assumptions

The following assumptions were made regarding the project:

1. Users had adequate hardware and software.
2. Users had an understanding of basic computer fundamentals and possessed basic computing skills (mouse control, key recognition, basic navigation strategies, etc.)
3. Users had the necessary skills to access information on the Internet and locate particular web sites.
4. Users included those who were novices in their ability to integrate technology into their lessons.
5. Users were seeking innovative ways of integrating technology into their classrooms.
6. Users were seeking flexibility in training opportunities regarding availability of equipment and time.

Limitations and Delimitations

During the development of the project, several limitations and delimitations were noted. These limitations and delimitations are presented in the next section.

Limitations

The following limitations apply to the project:

1. Computers need to have Internet access in order to access the instructional web site.
2. Netscape Composer needs to be available on the computer in order to complete the on-line training.

Delimitations

The following delimitations apply to the project:

1. The number of teachers participating in this project is limited.
2. The study is being conducted at one particular middle school.
3. The project mainly targets teachers with limited technology experience.

Definition of Terms

The following terms are defined as they apply to the project.

Constructivism - The theory proposing that students create a personal understanding (construct their own knowledge) by interpreting their experiences (Grabe & Grabe, 2000).

Hardware - The physical parts of a computer system, ex. monitor, keyboard, scanner.

Hypermedia - Multimedia that can be examined in a nonlinear manner. The user can typically move at will from one information source to several others (Grabe & Grabe, 2000).

Inservice training - Training provided through release time from the school day.

Multimedia - A communication format that integrates several media (such as text, audio, and visual) (Grabe & Grabe, 2000).

Netscape Composer - A program that is used to build web pages. Composer software is part of Netscape Communicator, which is a popular application program that provides a way to look at and interact with all the information on the World Wide Web.

Preservice training - Refers to individuals with no prior classroom experience that are being trained to become teachers.

Professional development - (see staff development)

Software - Software is a general term for the various kinds of programs used to operate computers and related devices.

Staff development - Refers to any training or courses offered to staff by the school site or district. In this study, technology is emphasized.

Technology - Applying a systematic technique, method, or approach to solve problems. In this study, technology refers to the use of computer hardware and software.

Web quests - A type of structured Internet problem-solving activity developed by Bernie Dodge (Grabe & Grabe, 2000). For example, web quests can allow students to use the Internet to investigate, collect information, compare data, explore museums, and track weather patterns.

World Wide Web - A system that allows access to Internet resources that include multimedia and hypermedia. A single web site can include a number of web pages (Grabe & Grabe, 2000).

Organization of the Thesis

The thesis portion of the project was divided into four chapters. Chapter One provides an introduction to the context of the problem, purpose of the project, significance of the project, limitations and delimitations and definition of terms. Chapter Two consists of a review of relevant literature. Chapter Three documents the steps used in developing the project, a discussion of the final product, and results from the formative evaluation. Chapter Four presents conclusions and recommendations drawn from the development of the project. The Appendices for the project consist of: Appendix A Teacher Questionnaire Prior to Web Site Construction; Appendix B Teacher Questionnaire One Results; Appendix C Web Site Home Page; Appendix D Teacher Questionnaire Upon Completion of Web Site; Appendix E Teacher Questionnaire Two Results. Finally, the project references.

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

Developing an on-line learning environment for teachers requires a great deal of planning and preparation. Numerous decisions must be made when attempting to create motivational, inspirational, and meaningful instructional materials. Materials need to be carefully designed and implemented in order to create a successful educational program.

If the web-based training product is to achieve the objectives stated in the previous chapter, it must be grounded in the elements that are considered important by many of the experts in the field of technology training. This chapter will show the link between these objectives and the design of the on-line learning environment. The topics to be reviewed include teacher preparation programs, challenges facing staff development, motivational factors, and alternative training programs.

The Current State of Preservice Teacher Preparation Programs

There is a great need to prepare teachers to be effective users of technology before entering a classroom.

Many preservice teachers are taught computer skills and applications, but are not taught how to effectively use technology to support teaching and learning. The Office of Technology Assessment (1995) reported that the majority of technology instruction, in teacher preparation courses, was related to teaching about technology rather than how to teach curriculum with technology. The need to produce technologically competent teachers has also been at the forefront of The National Council for the Accreditation of Teacher Education's Task Force on Technology and Teacher Education (NCATE). The Task Force of NCATE has joined with ISTE, the International Society for Technology Education, to establish standards for teaching about technology in education for teacher candidates and for accredited education (NCATE, 1997).

Furthermore, in its report, Technology and the New Professional Teacher: Preparing for the 21st Century Classroom, NCATE (1997) noted that research indicated that most teacher education programs have a long way to go in preparing student teachers to teach in the "tomorrow's" classrooms.

Programs Offering Limited Experiences

Knowing that technology is an integral part of education and the working world of the 21st century, it is

necessary to assess the current practices of teacher preparation programs and identify current needs.

One problem mentioned over and over again in the literature is the limited experiences offered to teacher trainees. Spitulnik and Krajcik (1998) noted these limited experiences in a study. The researchers assumed that teachers, from using technologies to plan lessons, would want to incorporate technology uses in those plans. The research was conducted in a science methods course with emphasis on constructivist learning and inquiry.

The results of integrating technology into lesson design, with the intentions of promoting further technology based educational instruction, were varied. The preservice teachers were successful at using technology to create their lessons; however, most of them did not include the use of technologies in their project designs. The limited technology exposure resulted in the technologies being used as a teacher productivity tool, but did not extend to use in an actual classroom lesson to be utilized by either teacher or student. The researchers also noted that they did not anticipate the amount of time that would be required to teach the teachers on all the different technology tools (Spitulnik & Krajcik, 1998).

Limited time is a problem cited by many researchers in contributing to limited experiences offered in teacher preparation programs. Cleland, Wetzel, and Zambo (1999) agree that the time to fully integrate technology-rich practice into meaningful educational experiences is an important problem to tackle. They also predict that technology instruction must be an integral part, not only for student teachers, but practicing teachers as well.

These researchers set up a traineeship program that involved collaboration among preservice teachers and inservice teachers. The two-week project consisted of one week of building technological skills and the second week was devoted to development of computer-based instructional units. Although the basic needs of technology training were addressed in this preservice training, two weeks of training was not enough time for teachers to fully realize the potential of technology integration. Through classroom observations, the researchers found that 50% of the technology lessons were used for retrieving information. Higher order thinking skills linked to the lessons were limited, especially in mathematics (Cleland et al., 1999).

Again increased teacher training time was mentioned as a key factor for allowing teachers to effectively develop technology-rich plans and lessons to promote and

encourage higher order thinking skills from students. If teacher training is not continuous, collaborative, and expected, how long will teachers, with limited training, engage in higher order, critical thinking integration of technologies? This question was asked by these and other researchers including Peters and O'Brien (1996).

Peters and O'Brien (1996) mention the importance of constructivist learning along with time to benefit from hands-on learning. Several hundred elementary and middle school preservice teachers participated in a program that focused on hypermedia instruction and construction in a science methods course. Most of the teachers had very little computer experience and were somewhat apprehensive in the beginning. The goal of the project was to have the teachers build multimedia stacks to use with their students to encourage an inquiry and problem-solving environment in the classroom.

The results appeared positive in the use of the program HyperStudio and the researchers claimed that the use of technology transferred easily to the classroom. Several weeks into the study, observations and questions revealed that the teachers were beginning to see the educational potential of their work. Finally by the end of the study, the participating teachers were excited about

their projects and the unlimited possibilities of integrating hypermedia creations into their lessons. However, there were concerns on the part of the researchers on issues such as time-intensive strategies, contact hours with students during their preparation for teaching, multimedia as only one aspect of computing experience, and a focus on long-term technology integration (Peters & O'Brien, 1996).

In order to achieve long-term technology integration, teachers must feel prepared to fuse technology with curriculum. Based on current studies regarding technology and teacher education, many researchers agree that teacher preparation programs must integrate technology experiences throughout preservice programs and not limit technology exposure to a single course. Grabe and Grabe (2000) observed that an analysis of the causes for the poor preparation of teachers to use technology included the:

1. frequent situation in which colleges of education are less equipped than the elementary schools where their graduates will work;
2. large number of college faculty members unable to make appropriate use of technology in their own classrooms and unwilling to try because of anxiety or lack of interest; and
3. common teacher preparation curriculum in which most experiences with technology are focused in a single course that concentrated on learning to use the

> technology rather than learning how to facilitate learning with technology. (p. 20)

Encompassing these three issues is the need for innovative, motivated, and technology literate teacher educators.

Training Teacher Educators in New Technologies

Recognizing that college instructors face the same barriers to technology integration as do preservice and practicing teachers at K-12 positions, Dusick and Yildirim (2000) investigated training needs for teacher educators. These researchers understand that college faculty play a key role in the success of integration of instructional technology into the classroom.

The purpose of the study conducted by these researchers was to attempt to identify a relationship between demographics and computer use, as well as attitudes toward computer use and subsequent use of computers for instruction. The information gained could be used to identify factors that would have a positive impact on technology competency for instructors. Therefore, a survey was given to 550 full and part-time faculty at one urban California community college (Dusick & Yildirim, 2000).

The results of the study indicated that the majority of faculty used computers for tests, handouts, and homework assignments. The number of computer courses taken by faculty was significantly correlated with computer use. On the other hand, none of the demographic variables were significantly correlated with computer use. The results of open-ended questions revealed that factors that contributed to positive computer attitudes included workshops, conferences, availability of equipment, and peers with computers. When asked what if anything had prevented users or nonusers from obtaining formal training, both groups indicated lack of time as the most important factor (Dusick & Yildirim, 2000).

The researchers in this study concluded that competency, and adequate training time were important factors for computer use in the classroom (Dusick & Yildirim, 2000).

The need for adequate training time was addressed in a recent study of college faculty given opportunities to expand their use of instructional tools with technology. Rups (1999) investigated a series of weeklong events called ETTI (Enhancing Teaching with Technology Institute) at Western Michigan University. The organizers of this training hoped to provide in-depth coverage of technology

topics, provide more hands-on experiences, acquaint staff with available technology, help faculty build useful projects to take back to the classroom, and provide the necessary time required for the training.

The weeklong institute includes instruction, lab time on computers, project sharing, and demonstrations of current technology instruction. Faculty can incorporate their own material and projects into their work and instructors learn how to use scanners and digital cameras. The sessions are held between semesters to allow faculty time to meet and work on their projects. For faculty unable to attend the weeklong training, basic versions of the courses are offered as regular two-hour faculty-only computer workshops every semester (Rups, 1999).

This type of training has now been in place for 3 years and 67 faculty members have attended the classes. Many attendees have built projects or have web sites. Faculty members share ideas and help each other with technology. Topics have changed, instruction had been refined, and lab use has increased due to the classes and feedback from participants (Rups, 1999).

This university is leading the way in innovative methods for training instructors in new technologies and providing time and support for those who want to work on

personal technology projects. It is only through these innovative measures that faculty will be prepared to teach preservice teachers to integrate appropriate uses of technology into their teaching after graduation and serve as leaders for other teachers.

Due to the attention given to effective uses of technology in education, the focus on technology standards among professionals, and the money and technology equipment pouring into the schools, more pressure is placed on teacher training programs to produce computer literate teachers. The pressure is to move away from the traditional one time technology class in preservice education, to the integration of technology throughout the entire training experience. Because of these demands, faculty of teacher training courses also must learn new ways of teaching and learning. Therefore, technology is not only transforming the workplace in the 21st century, but it is transforming education and those who will be educational leaders in the classrooms of tomorrow.

Transforming Preservice Teacher Education

Innovative models of teacher technology training are invading the literature on preservice education. Recognizing the limited experiences offered in many programs of teacher education and the need for change from

instructors of teachers to students, many colleges are beginning to offer alternative approaches for preparing technically competent student teachers. One priority that permeates the literature is the need for technology integration throughout preservice courses of teacher education. Halpin (1999), in a study of computer literacy integrated into elementary math and science teacher education, found the experience to be a critical tool in integrating technology into instruction.

This current study compared two technology integration models with preservice teachers. One group was required to use technology, including completing technology-based assignments, and technology was integrated throughout their methods courses. Teachers in this group were required to complete interdisciplinary teaching assignments using a variety of technology applications. These teachers created effective and meaningful materials that could immediately be used in their teaching assignments (Halpin, 1999).

The other group learned computer skills in an isolated manner, learning more of the mechanics of using technology, and was not required to use technology to complete assignments. The purpose of this study was to

compare the two groups with their use of technology one year after teaching (Halpin, 1999).

The results of a questionnaire after one year of teaching were very different for the two groups of teachers. The teachers from the first group reported feeling more confident in their abilities to incorporate technology into the classroom as an instructional tool with 94% having students using technology for projects. The percentage for the second group was only 33%. Furthermore, 78% of the first group used technology as a professional tool, as opposed to 48% of the second group (Halpin, 1999).

The researcher suggests that preservice teachers will teach in the same way they are taught and this is evident in the results of this study. By observing the way the teachers reported using the computer as an instructional tool, the researcher emphasizes the need for preservice teachers to experience exactly how technology can be an integral part of the daily operations of the classroom (Halpin, 1999).

Doty and Hillman (2000) agree with the previous researcher on the need to integrate instruction on technology and modeling of instruction with technology throughout the course work in preservice training. These

researchers investigated this approach during an innovative college program called Teacher Technology Portfolio Program.

The goal of the program was to have teachers build a technology portfolio that began with their introductory courses and continued all the way to their student teaching semester. Teachers were given opportunities in each of their courses to build technological competence, investigate technology and curriculum links, and develop and implement units integrated with technology. Lesson and unit plans involving technology integration would be a major part of the student teachers' portfolios. Therefore, the entire program was built upon technology integration that was relevant and meaningful to teachers in their classrooms (Doty & Hillman, 2000).

The pilot test of the program revealed that students wanted workshops to include a greater focus on integrating technology into the curriculum, more hands-on opportunities, and additional sessions for those who were not as familiar initially with technology. Evaluations also revealed that faculty needed more training on infusion of technology into their courses. The college has made numerous revisions in their program and continues to support the technology component. Faculty continue to

implement and learn new strategies, new courses are being added to administer to student needs, follow-up training for faculty is available at the end of each semester, and portfolio guidelines and templates are available to all students (Doty & Hillman, 2000).

The Teacher Technology Portfolio Program represents the innovative, creative, and technologically infused programs that are needed for current educators. The program included the entire school faculty and the technology committee members were diligent in their efforts to revise and reform the program continually. The focus was on technology competence of students and faculty and every effort was made to mold training to the needs of these individuals.

In a study conducted by Stuhlmann and Taylor (1999), similar innovative components were found in a university in Louisiana. This school also felt that technology training should be infused throughout the preservice teacher training program and took it one step further to include the involvement of kids. The program they developed was called Project KITES, Kids Interacting with Technology and Education Students. Those involved in the program saw a need for providing preservice teachers with

opportunities to not only learn about technology, but how to apply what they learned in classrooms with real kids.

The first semester of KITES involved preservice teachers and fourth-grade students creating multimedia presentations including the use of scanners and cameras. The second semester of KITES consisted of the preservice teachers working in classrooms with third and fifth grade teachers helping students with technology-based language arts projects. Finally, during the third semester preservice teachers served as facilitators and provided technical support to practicing teachers who were learning to use computers. They also worked as instructional specialists helping teachers and students with various technology projects (Stuhlmann & Taylor, 1999).

The results of this program were very positive. The participants felt confident and capable of integrating technology into their work. They were confident in their career choice and felt their experiences to be invaluable to their future work with children. They held experiences that had been tested in actual classrooms that were successful and could be repeated in their own classrooms. The researchers further concluded that student teacher experiences would be enhanced if they were placed in schools where the attitudes and computer competency levels

of cooperating teachers were positive (Stuhlmann & Taylor, 1999).

This final point was emphasized in a study conducted by Hicks and Young (2001). These researchers were interested in the particular aspect of a study that placed preservice teachers in classrooms with their cooperating teachers. They anticipated increased technology use from preservice teachers being placed in environments that supported and contributed to their technology training. This innovative program, called the InterNet Academy, was one teacher education program's efforts to provide technology training to cooperative teachers who would be working with student teachers trained at the same institute.

The InterNet Academy's goal was the immediate application of technology skills by newly prepared teachers from their preservice education program. Hicks and Young (2001) emphasized "to provide for this invaluable experience, there is a need to build the knowledge base of cooperating teachers as well as preservice teachers and to identify immediate applications so that the use of this resource becomes as commonplace as more traditional sources" (p. 64).

The results of this innovative program were encouraging. Many of the cooperating teachers, working with student teachers, were using technology for professional purposes. Hicks and Young (2001) reported that teachers "created school and classroom homepages, investigated shipwrecks, Monarch butterflies, and sea turtles, hooked up with a geography contest, e-mailed projects with students from many parts of the United States, Canada, and New Zealand, collected lesson plans and on-line math/science projects, set bookmarks for student use on yearly themes, joined lists such as Kidsphere, and started an Internet Club" (p. 70).

This innovative program created to support teacher education brings to light the importance of training teachers who are already in the classroom. One element considered important to new teacher success with technology integration is support from staff in a teacher's first school placement.

Challenges Facing Inservice Training

According to the U.S. Congress, Office of Technology assessment, (1995) the lack of teacher training is one of the greatest roadblocks to integrating technology into a school's curriculum. In this same report, it is estimated

that school districts spend less than 15 percent of their technology budgets on teacher training and development. In a new report, The Power of the Internet for Learning, produced by the Web-based Education Commission to the President and the Congress of the United States (2000), almost two-thirds of all teachers feel they are not at all prepared or only somewhat prepared to use technology in their teaching. The report asserts that the money now spend on training is just a fraction of what is needed.

A review of the recent literature on professional development of teachers and educational technology provides insights into the key components needed for successful staff development programs on educational technology. These key components include adequate training time and flexibility, long-term training and integration, appropriate funding, access to technology materials, and on-going technology support.

Time for Successful Training

The literature suggests that one reason for the lack of successful technology integration in schools is the lack of time given to technology training. Brand (1997) lists the number one element to define an effective staff development program for teachers focused around technological development to be sufficient learning time.

Sufficient learning time is so crucial that one study found computer learning time to be a major indicator of exemplary computer-using teachers. In this study, characteristics of exemplary computer-using teachers were studied. The researcher found in schools where these teachers were identified, the amount of computer time devoted to professional development was 2.5 times greater than in other schools (Becker, 1994).

Sullivan and Keating (1998) suggest that schools have yet to create the kind of training and practice time teachers need in order to learn how to effectively integrate technology into the curriculum. In a computer technology survey returned by 187 principals, one of the questions asked was on the frequency of inservice training in computer technology. Only 13% said training happened weekly or monthly. Almost 50% responded that training occurred only once or twice a year. Furthermore, an additional 19% left that answer blank leaving investigators to feel that blanks were due to the fact that there had been no training.

Michael Milone (1999) reports that technology lives up to its potential in schools based on the strength of the staff development in place. Again, time was found to be a critical piece in the success of staff development.

He investigated one school district that found success in getting teachers, no matter what their level of expertise, to integrate technology into the classroom. This particular school district boasted round-the-clock training.

The Alief Independent School District in Texas supports technology training fully. Teachers, administrators, staff, and other identified groups are offered technology training that is on-going, flexible, and project-based allowing teachers immediate integration. This district is willing to put the time into training and their efforts are reflected in the positive impact technology has with students in their district (Milone, 1999).

Long-term Training and Integration

Innovative and supported long-term technology training, such as the training at Alief Independent School District, should be the model of future staff development programs. Without long-term goals and support, staff development will fall short of the intended mark. Just as the lack of long-term technology training in preservice education lead to a lack of technology integration, the same will be true for lack of long-term inservice training for current educators.

This idea of long-term technology training for teachers was the aim of one such program developed by The Center for Improved Engineering and Science Education (CIESE) at Stevens Institute of Technology in 1993. Holahan, Jurkat, and Friedman (2000) investigate the development of the Mentor Teacher Model which involves training mentor teachers, who then train new teachers to be mentors, and so on. This type of training has an exponential effect and is a viable approach for long-term training.

CIESE realized that training teachers on technology was not enough to develop permanent and lasting change. They felt that if they were to really affect a change in educational technology, it had to be an invested interest from the top down and it had to be a phased-in approach over a long period of time. Each year of the project, the CIESE trainers spent about 150 contact hours with 39 mentor trainees. During the three-year project, the 39 original mentor teachers went on to train another 212 teachers on technology integration in mathematics. It was emphasized by these researchers that successful technology integration takes time and future projects may want to take a five year approach (Holahan et al., 2000).

Kimmel and Deek (1999) agree that a long-term focus is needed to ensure successful technology training for teachers. They presented a study that focused on professional development for improving the skills of regular education and special education teachers in math, science, and technology.

The New Jersey Institute of Technology developed the three-year program. Each year, for three years, a new group of teachers entered the project, while the previous groups continued with the program. The long-term focus of the training allowed teachers to plan and implement technology lessons. A computer-based instructional lab was created for the program with access to the Internet and a wide range of software. Access to technology materials led teachers to request further technology instruction (Kimmel & Deek, 1999).

Access to Technology Materials

The researchers Kimmel and Deek (1999) touch upon another important component of successful technology training and integration. This component is access to technology materials. According to the U.S. Congress, Office of Technology assessment, (1995) only 3 percent of instructional rooms such as labs and media centers in public schools are connected to the Internet. Furthermore,

even though U.S. schools have almost 6 million computers in use for instruction, about half of them are older 8-bit machines. These machines cannot support CD-ROM-sized databases, network integrated systems, or run complex software.

Even when more powerful computers are available, teachers complain of lack of curriculum-supporting software and other technology materials such as printers and computer projectors. Many teachers only have access to one computer in their classroom. Further complicating access to technology materials is reported by the Center for Research on Information Technology and Organizations in its 1998 National Survey report. They state that computer distribution is not uniform with some schools having more computers than students and others having only 1 computer for 2,000 students.

In a study concerned with factors that influence teachers' use of computer based technology, access to technology materials contributed to teachers use of computers for instructional purposes (Jaber & Moore, 1998). Knowing that access to materials leads to an increase in technology integration, schools are trying to find innovative ways to expose teachers to technology materials.

The Anderson County Schools in Tennessee is one such place implementing innovative staff development. Teachers in these schools have access to materials for training in flexible and convenient times. Training is offered before, during, and after school, on staff development days, and in the summer. Time and access are inseparable components to successful training as indicated by this school's 43,000 hours of training offered in the last 5 year. Half of this training has been voluntary proving that well developed inservice training is well received by teachers (Milone, 1999).

The strength of staff development programs including time, access to materials, trainers, and long-term support for training and integration requires money. If school districts are not willing to spend more of their technology budget toward teacher training, other innovative measures must be taken.

Funding for Technology Training

According to the report, The Power of the Internet for Learning, produced by the Web-based Education Commission to the President and the Congress of the United States (2000), schools and districts need to devote at least 30% of technology budgets to teacher training and

support. Currently, most districts are only spending half of this amount on training.

One solution to the lack of funding for inservice training is the acquisition of grants and scholarships. One university in New York was recently awarded a five year, seven million dollar Federal Technology Challenge Grant. The goals of this program, called TIPS, Teaching for Interdisciplinary Problem Solving, included an extensive professional development component that integrated technology and curriculum training (Mulqueen, 2001).

The TIPS program has been very successful already. The TIPS professional development staff contributed its success to the assessment given by participating teachers, the availability of funds, and the long-term nature of the project. The expected number of teachers to be trained by this program over the five years is 500 (Mulqueen, 2001).

Another solution to the funding problem is the availability of scholarships. The state of Alabama funds a program called TSPAT, Technology Scholarship Program for Alabama Teachers, which prepares teachers to integrate technology into their teaching. This particular program allows teachers to apply for a scholarship that would pay the cost of either a three course sequence in technology

or an entire maters degree in education that includes the three course technology sequence (Rice, Wilson & Bagley, 2001).

While grants and scholarships are not always available to all schools and teachers, ways to combat funding issues are available to those who are willing to be creative and innovative. Brown (2001) defends the use of computers to deliver training, stating that his research on computer-delivered training revealed that learner-controlled environments had added benefits. These benefits included learner choices on practice level, time on task, and increased attention. Furthermore, computer-delivered training reduces the cost of training.

These results are confirmed in an innovative program started in a district in Ohio. This district realized the difficulty for teachers to attend on-site training and the cost of training. They used Title 1 funds and worked with Performance Learning Systems to develop an on-line training program that is followed up with on-site training (Barkley & Bianco, 2002).

This program has shown great success. Teachers spend a significant amount of time with on-line learning, researching, reviewing sample lessons, and developing their own lessons. They send their work to the district or

university for documentation and accountability. The follow up at the site is for sharing, collaborating, and hands-on training. Supporters of the program agree that teachers could learn a great deal with on-line training. They also concluded that on-line learning can save a great deal of money and is convenient. However, the researchers contend that even with on-line training, there must be on-going technology support for the teachers at their school site.

Limited Support for Technology Infusion

Becker (1994), in his study of exemplary computer-using teachers, explains that one of the most consistent findings associated with exemplary teachers were school districts that had invested heavily in staff development and on-site staff support for computer-using teachers.

Research shows that administrator support for technology use is a major indicator of technology use by teachers. One school in Florida, recognized as a top technology school by the U.S. Department of Education, has tremendous support by administration. This administration supports its teachers by providing 60 inservice hours of technology training and setting up a partnership with the local community college to teach classes on the school's

campus. In addition, the school made two new positions to support the teachers, technology resource teacher and technician (Milone, 1999).

This type of technology support is not the typical example. According to the report, The Power of the Internet for Learning, produced by the Web-based Education Commission to the President and the Congress of the United States (2000), technology support for teachers is limited, if available at all. They report that a study of 27 states found that it took from 7 to more than 14 days to fix a technology problem in a school or classroom. Furthermore, they said that fewer than 20 percent of schools have a full-time technology coordinator. To make it worse, these technology coordinators spend on average only 3 to 4 minutes helping teachers with technology integration. Most of their time is spent on technical support.

Support for technology integration by administrators, district personnel, and technology experts is not at the level that is needed for teacher support and success. Therefore, innovative measures must be taken to encourage technology integration. The literature suggests that some of the creative ways that this has been accomplished is through mentor teachers, on-line training and support, and students teaching teachers.

Hruskocy, Cennamo, and Ertmer (2000) researched one such innovative plan to use students to become technology experts for teachers and peers. In one elementary school, a group of students were trained in specific technologies to help combat the limited support teachers had for technology integration and development. Students were quick learners and teachers began learning along with their student helpers. Technology became a team effort and there was increased excitement and motivation for technology use. Student teachers freed up time for teachers, became more confident in their own technology use, and were able to relate to the students on their level. The program was positive and successful. This kind of collaborative effort provides the necessary motivation for teachers to continue using technology with their curriculum.

Teacher Motivation for Successful Technology Integration

The research shows that teachers are much more successful with technology integration when they have the opportunity for collaboration. Because teachers vary in their level of expertise at the time of their training, a collaborative setting provides a non-threatening atmosphere of sharing, which motivates many teachers.

Coupled with collaboration is the need for hands-on experiences. Many teachers contribute their successful technology integration and motivation for technological development on their hands-on learning experiences. When researchers compare constructivist learning experiences with passive learning experiences, encouragement and stimulation is missing from the latter.

Finally, when these factors are combined with building relevant and meaningful materials, research shows the highest levels of teacher motivation. Teachers who can see the immediate positive results of technology in their classrooms are more likely to continue to find ways to use it.

The Need for Collaborative Experiences

Miller and Castellanos (1996) looked at a pilot project involving teacher and student collaboration. Their pilot project was focused on students and how they engaged in a groupware assignment. Thirty high school juniors and two science teachers set up a "hypothetical class" for a two-week summer program.

The researchers set up a problem focused on the topic of optimal growing environments for corn in various regions. The students used a category of software called groupware that allows for collaboration similar to

experiences found in the real world. Students were given training on The Virtual Notebook System Trademark (VNS Trademark) and a high performance programming language. The VNS Trademark is highly graphical, integrates information from other programs, and is an electronic notebook where users can create and share notebook pages. With these two pieces of software, students could create, share and modify notebook pages. Students in different locations could view a notebook page simultaneously, thus creating a "virtual classroom" (Miller & Castellanos, 1996).

This project is a great example of how students can interact and learn from appropriate use of technology. A project such as this one allows educators and researchers to analyze a real learning situation involving students before using it in an actual classroom. Not only were the educators motivated, but also the students were motivated by the potential of technology in this collaborative setting.

Another current study emphasizes these ideas. Peters and O'Brien (1996) mention the importance of collaborative learning, not only for students but teachers as well. Several hundred teachers participated in a project with teachers working in small groups. The goal of the project

was to have the teachers build multimedia stacks to use with their students to encourage an inquiry and problem-solving environment in the classroom.

The results appeared very positive and the researchers claimed that the collaborative atmosphere provided incentive and motivation for technology construction. Several weeks into the study, observations and questions revealed that the teachers were beginning to see the educational potential of their work. Finally, by the end of the study, the participating teachers were excited about their projects and the unlimited possibilities of integrating hypermedia creations into their lessons. Another advantage of using the hypermedia projects concerned the lack of appropriate and accessible software. By creating their own products, teachers could make their lessons more personal and particular for the topic they were teaching. The projects could later be changed, improved, or redesigned to match the needs of a particular group of students (Peters & O'Brien, 1996).

Hands-on Projects for Positive Learning Experiences

Collaboration and hands-on learning appear inseparable in much of the current research. Howard, McGee, and Schwartz (2000) insist that technology

integration will not be successful until teachers change their beliefs on how students learn and which instructional approaches best support constructivist type learning styles. These researchers placed the emphasis on epistemologies regarding constructivist learning and training teachers with technologies and methodologies to bring about the changes in those beliefs.

This current study focused on a class sponsored by the NASA Classroom of the Future [trademark] (COTF). Teachers in this study lived for a month at a campus in a type of community created specifically to encourage an environment of collaboration, discussion, and support. Classes were held six days a week in the morning and afternoon. Teachers were given daily assignments and were graded on a multimedia product designed and constructed during the course. During the afternoon classes, teachers worked individually and collaboratively on their multimedia products. More experienced teachers acted as tutors for the less experienced, and all teachers participated in managing the lab and solving technical problems (Howard et al., 2000).

The results of this study indicated that teachers in the program had moved toward constructivist beliefs and away from more traditional objective teaching beliefs.

These findings suggested that constructivist approaches to teacher training allowed teachers to grasp and internalize the importance and need of teaching strategies consistent with constructivist learning modalities. Furthermore, the researchers found that teacher-held beliefs had changed in just one month (Howard et al., 2000).

Wang (2000) cites further evidence of the motivation caused by hands-on training. This researcher conducted training to teachers in one elementary school. He found that by making training relevant to teachers' work he could get them hooked into technology. From there, he made their training task oriented, giving them hands-on tasks of learning how to use computers to write lesson plans, prepare quizzes, create word puzzles, design classroom newsletters, and record student grades.

Wang (2000) described the teachers as "highly motivated" once they learned how to use the computer as a useful tool. From there teachers learned to integrate the computer into the curriculum. Some of the hands-on lessons included designing spreadsheets, using digital cameras and photo scanning with multimedia software, and designing student computer projects.

This researcher noted that collaboration, hands-on experiences, and the ability to use technology for

meaningful and effective materials were all factors in this successful teacher-training project.

The Development of Effective and Meaningful Materials

Integrating all of these ideas and the ideas of the previous researchers, James and Lamb (2000) assessed teacher-student collaboration, hands-on training, on-going training and implementation, and unit and lesson development. These ideas were the key components of the GTECH project. The GTECH project was funded by a grant from the GTE Foundation. It involved 80 teachers over a two-year period and impacted thousands of students.

Over the two-year period, teachers and students were involved in creating instructional units and lessons integrating mathematics, science, and technology. The program instructions were not limiting or restrictive and only required that the teams use technology to integrate content. Teachers were given time to collaborate, and were given technical support when required. Over the course of the program, the teams developed, field-tested and integrated 16 units. Students were involved in the testing of units in the classroom and some students were trained on software. Some teams even had the students train other

students and teachers on the software (James & Lamb, 2000).

The strategies used in the GTECH project proved to be successful at starting and sustaining technology use among teachers and providing the means to create effective and meaningful materials to be used immediately in the classroom.

In a similar study, Pugalee and Robinson (1998) investigated how practicing teachers responded to Internet training in creating meaningful and effective teaching materials. These researchers saw the potential impact of the Internet to education and viewed it as a powerful tool for educators.

This study involved twenty-five teachers representing grade levels ranging from lower elementary to community college. Training was based on selected Internet applications developed by the Consortium for International Earth Science Information Network (CIESIN). The first part of the training included introduction of the applications, demonstrations, and hands-on guided practice. During the second part of the training, teachers used Internet resources to produce lessons appropriate for the grade level they taught. The lessons incorporated data from

CIESIN and were integrated mainly into mathematics lessons (Pugalee & Robinson, 1998).

The researchers found that the teachers' attitude, confidences, and abilities to use the Internet as a resource had improved greatly over the course. Furthermore, finished lessons, evaluated by the instructors and CIESIN personnel, provided evidence of appropriate use of Internet applications (Pugalee & Robinson, 1998).

Once again key elements and common themes permeated this research project. The teachers were motivated due to the hands-on experiences in using the Internet and constructing lessons. They were excited over the possibilities offered by the Internet and felt they could introduce their students to interesting real-world activities.

The Benefits of On-line/Computer Training

After reading through the literature, it is apparent that districts and colleges are slowly moving in the right direction with innovative ways to provide appropriate technology training to teachers. However, researchers are left with unanswered questions regarding funding for more training and materials for training. Due to this dilemma,

it is crucial to continue to find ways to motivate and increase teacher preparation in technology without the high costs. One innovative way to train teachers, reduce costs, increase flexibility in training, motivate learners, and provide appropriate materials is through on-line training. The Internet provides a great wealth of resources for teachers to learn and teach with.

Time and Flexibility for Successful Training

Some districts are realizing the potential of the Internet for delivering on-line training and instruction as an option to teachers. One of the greatest problems for training is to provide it at a time that accommodates teacher needs. Research shows that many teachers are reluctant towards training because of the times when it is offered. One solution is to provide teachers with on-line training. This allows teachers to work at their own pace and at their own time.

One such district provides teachers with just this type of training. Rhode Island's Bristol Warren Regional School District has found success with its staff development training by providing training that focuses on the expressed needs of their teachers. In addition to training sessions held at the schools, training and support is provided through e-mail, listservs, and

district-sponsored web pages. By providing the time and flexibility requested by their teachers, this district has seen positive growth and enthusiasm towards technology usage (Milone, 1999).

Other researchers agree that training opportunities need to provide flexibility and not be based on a "one-size-fits-all" philosophy. Opportunities to complete staff development and training sessions on the teacher's own schedule and time reveals a well-structured staff development program (Brand, 1997).

Solutions for Training and Hardware Costs

According to the report, The Power of the Internet for Learning, produced by the Web-based Education Commission to the President and the Congress of the United States (2000), the "one-size-fits-all" model of staff development is giving way to self-directed models of staff development due to the power of the Internet. The Internet is making possible on-line training opportunities without the expense and hassle of face-to-face meetings. Furthermore, the commission goes on to report that teachers working in an on-line environment gain an added benefit of learning important technological skills.

One such on-line environment is the TAPPED IN program supported by the National Science Foundation. Through

TAPPED IN, educators can participate in on-line courses, take their own students on-line, participate in group discussions on specific topics, share lessons and materials, and experiment with new ways to teach. TAPPED IN is free for educators and their students (Report of the Web-Based Education Commission, 2000).

As the literature has repeatedly shown, districts are spending only a fraction of what is needed to cover the cost of staff development and technology training. The on-line teaching and learning environment is a solution to this dilemma. By using the Internet as a means for training, districts can save money on training and hardware.

One school uses money saving on-line training because of a lack of substitutes for release time. The Ashtabula County district provides an on-line program coupled with on-site training for immediate application in the classroom. The on-line training involves teachers reviewing sample lesson plans, developing their own lesson plans, putting their lessons on-line, and using their developed lesson in their own classrooms. The follow-up training allows participants to share in their on-line experiences and have professionals answer questions (Barkley & Bianco, 2002).

The previous study points out that on-line learning can save money and it is convenient. They explained how learners progressed at their own pace and on their own schedule. They even suggested that some on the teachers learned better on their own, away from a group setting. Finally, an added benefit is that users can retain the on-line resources and revisit them anytime they need to (Barkley & Bianco, 2002).

The Ability to Review and Access Materials

Accessing materials is not always an option for teachers. Many school sites have limited materials and software is available in minimal amounts or often is needed by multiple teachers. Teachers are not often given the opportunity to review or select software before it is purchased.

In a study conducted by Holland (2001), it was discovered that "because software decisions are made from the top-down at the district level, teachers do not have an opportunity to review and evaluate new programs for adoption. Nor can they select software for such activities as drill and practice, tutorials, or simulations to help students meet specific learning objectives because district level curriculum coordinators have reservations about such uses of technology" (p. 258).

This lack of resources and access to materials requires teachers to find other ways to obtain materials to use in their classrooms that support the state standards and curriculum. This is why Sullivan and Keating (1998) suggest that teachers need to be able to search the Internet and develop materials for their classrooms from the Internet. They need to be able to show their students how to use the Internet as well. Thus, the Internet will allow teachers to review and access a wealth of materials not available by any other means.

Sharing Products and Technology Ideas

The Internet not only provides a wealth of materials, but it also provides a means of sharing products and technology ideas with other educators as previously described by the innovative TAPPED IN environment. Teachers can feel isolated in their schools without the time and opportunity to meet with other colleagues. The on-line environment can provide one solution to this isolation.

The National Teacher Training Institute (NTTI) trains teachers to use video and Internet resources to enhance math and science instruction. These teachers develop lessons and hundreds of these lessons are available to educators on-line at the NTTI web site. This site also

offers information on training opportunities offered by NTTI (Donlevy & Donlevy, 1999).

According to the report, The Power of the Internet for Learning, produced by the Web-based Education Commission to the President and the Congress of the United States (2000), the Internet allows isolated teachers to make connections. Four hundred teachers in Indiana are connected through an on-line environment called the Inquiry Learning Forum (ILF). This on-line environment is similar to TAPPED IN as it provides a place for teachers to share materials and ideas, to participate in discussions, and to access a host of materials in an on-line library. The unique aspect of ILF is the opportunity to virtually "visit" classroom episodes that are being taught in Indiana classrooms.

There are numerous other professional Internet sites where teachers share lesson plans, science projects and experiments, examples of student work, and teaching ideas. Teachers can start their own professional development group with colleagues at their own school. This would enable teachers to work together to build and share technology products specific to their curriculum and student needs. The Internet has become an inexpensive,

easily accessible way to communicate, distribute information, train educators, and conduct research.

Summary

The literature important to the project was presented in Chapter Two. Developing technology-training programs that are successful is a complex undertaking. In order to accomplish this task many considerations must be taken, and many challenges must be met. The research shows that developers must consider obstacles such as time, funding, support, and long-term integration. When these issues are overcome, developers must then consider the motivational factors that contribute to successful technology integration by teachers. Until preservice teacher preparation programs are transformed, much of the burden of training will remain with those responsible for inservice training.

The literature reveals that many of these obstacles can be overcome with innovative, creative learning environments such as on-line training. Web-based training can be cost effective and flexible while providing authentic materials that can be reviewed and shared. A collection of effective and meaningful materials can be

created to specifically match curriculum and student needs.

The research shows that teachers are more comfortable learning at their own pace, in a hands-on environment, rather then feeling made to learn in a "one-size-fits-all" environment. With web-based training, teachers have the best of both worlds - on-line flexible learning with face-to-face collaboration with peers at their school site.

CHAPTER THREE

DESIGN AND DEVELOPMENT

Introduction

Chapter Three documents the steps used in developing a web-based training opportunity that instructs teachers on the creating, developing, and sharing of web quests. The first step in the instructional design of this project was the analysis phase. This step includes establishing an instructional goal, defining the learners, determining what must be taught in order to satisfy the learners' needs, and setting the scope of the content to be covered.

The second step involves the actual design and development of the project. This step includes diagramming the layout of the web page, locating appropriate links and designing content that targets the users and their specific needs, and deciding on a program to build the project.

The final step in the instructional design of the project involves the evaluation of the project. This includes teacher feedback before, during, and after the construction of the instructional web site. This step allows the web site to be examined and modified as needed.

Analysis

The first task in completing the analysis phase was to establish an instructional goal (Dick, Carey & Carey, 2001). The instructional goal of the project is for teachers to build web quests through an on-line learning environment by researching web sites, and designing an Internet problem-solving activity for their students. The teachers will be working independently in a web-based environment with technology support, when needed, by a teacher at their school site. The tools needed to complete the construction of the web quest will be available to the teachers in the form of on-line instructions and examples.

The next step in the analysis phase was to define the population that would benefit from this project (Dick, Carey & Carey, 2001). The research in Chapter 2 revealed that many teachers are lacking technology integration skills and many teachers want relevant materials to use with their students. Therefore, all teachers comprise the target population for this project. However, the main focus is on teachers with limited technology experience who are eager to learn to use technology and want flexible learning opportunities.

In order to gain useful information about the target population, a questionnaire was developed and approved by

the Institutional Review Board before it was administered to eight teachers at Del Vallejo Middle School in San Bernardino, California as shown in Table 1.

Table 1. Teachers Surveyed

Teacher	Grade level	Computer exp.	Gender	Years teaching
1	7th and 8th	Basics	F	5 years
2	7th and 8th	Basics Plus	F	12 years
3	8th	Basics Plus	M	6 years
4	6th and 7th	Basics	F	6 years
5	6th	Novice	F	3 years
6	6th	Novice	F	14 years
7	6th	Advanced	M	9 years
8	6th	Basics	M	1 year

In order to protect the anonymity of the teachers, only the researcher would view information collected and names would not be given on the questionnaires. These teachers were surveyed in February 2003 (see Appendix A). The information gained from the questionnaire was used in determining what must be taught in order to satisfy the learners' needs and be used as a guide in the development of the web site.

The teacher questionnaire was geared toward the teachers' feelings on the use and benefits of technology for instruction. Teachers were asked about their attitudes toward technology, what elements would benefit them in

technology training, and what method of training would suit them best (see Appendix B). The questionnaire revealed that 88% (7/8) of the teachers questioned felt they were novices in their technology skills. Furthermore, 100% of the teachers were willing to participate in training with 50% eager to do so.

As shown in Figure 1, 50% of the teachers preferred on-line training with staff support.

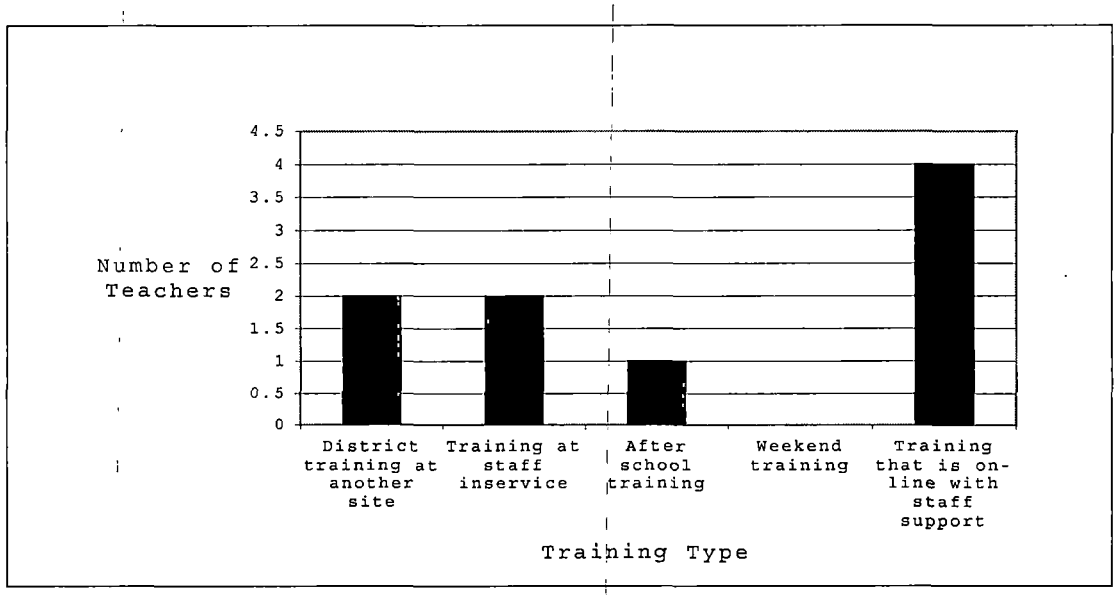


Figure 1. Type of Training Preferred

These results coincided with the responses to the question regarding what type of training the teachers felt most comfortable with. Training by a school site teacher and a combination of on-line training and school site support was ideal for 75% of the teachers. So it is

but still like training that is from a peer at the same school site.

The final step of the analysis phase was setting the scope of the content to be covered (Dick, Carey, & Carey, 2001). The questionnaire helped to guide the scope of the content to be covered by revealing that 63% of the teachers wanted an easy to follow instructional guide that allowed for more hands-on choices, and 75% of the teachers preferred training that allows for building of support materials for existing curriculum. Furthermore, 100% of the teachers were motivated to participate in training if it lead to building a library of resources to be shared with other teachers.

Design and Development

Based on the questionnaire results, it was determined that the scope of the content to be covered would include an easy to follow instructional guide with step-by-step instructions. Content would include links to already created web quests. Addressing how standards could be incorporated would also be included in the content, with ideas and self-help links. Finally, because the web site would focus on novice computer users, a template would be available for those whose skills are very basic. This

would allow for users at multiple levels to benefit from this instructional web site.

After careful consideration, it was determined that Netscape Composer would be used to build the web page and the web quests. This program was picked because of its availability to all teachers, whether in the PC or Mac platform, and it would satisfy the basic needs of a novice computer user. The only other requirement for learners would be access to the Internet.

Several web-hosting sites were considered to host the web page for the web quest instruction. The web-hosting site Yahoo!GeoCities was chosen based on several features it offered. One feature is the step-by-step guide for novice users and additional packages for users who are more advanced and want more advanced features. The web-hosting service is free with more advanced packages offered at reasonably low prices. Another nice feature of Yahoo!GeoCities is the absence of advertising, which could create problems when viewed by students. Finally, features such as on-line assistance, file manager, easy upload, tools for beginners, and templates are great for the novice user. For advanced users there is an HTML editor, web site add-ons, and site statistics.

Setting up a web site account with Yahoo!GeoCities is simple. If the user already has an e-mail account with Yahoo!, they use the same user identification and password. If not, there are a few simple steps in obtaining an identification and password.

The first goal of building the web page for web quest instruction was to locate and identify the necessary tools and options provided by Netscape Composer. This program has easy to use tools and is very similar to using a writing program with text, font, text size, and color choices. The buttons are easy to understand such as left and right justify or center, spell check, paragraph style, and inserting images. The other useful buttons are the insert link, insert target, insert horizontal line, page properties, and browse page.

Based on the teacher questionnaires, conversations with school personnel, and personal experience as a teacher, the next step was designing the home page with a list of content links that would be crucial to the success of the instructional web site (see Appendix C).

The first part of the web site defines a web quest and where the idea of a web quest originated. Links provide information on the objectives of a web quest and the educational value that a web quest provides. There are

links to example web quests, which include a web quest built with Netscape Composer. Teachers using this web site are also given a link to the California Content Standards that are crucial in guiding an instructor's curriculum and lesson development. This link explains how teachers can integrate the standards into the design of their web quest.

The next design decision of the web site was to guide teachers on the creation of a web quest using Netscape Composer. This part of the web site gives teachers ten simple steps on creating a web quest of their own. The instruction comes with an explanation of each step, pictures of screens and buttons they will use, and helpful links to locate images, videos, or examples. For more advanced technology users there is a section for advanced features, and for novice users there are template options as well as on-line support.

The final sections of the instructional web site include how to put a finished product on the web, rubrics for grading and assessment, and on-line net tools for teachers. The web site is easy to follow and contains everything a teacher might need to create a web quest of his or her own. The final analysis of the web site included a review of the teacher questionnaire to be sure

that the requests of the teachers, on what they wanted or needed in an instructional web site, had been included.

When this was completed, the web site was put on-line by using Yahoo!GeoCities. Once this was accomplished the web site was once again reviewed and revised as necessary and checked to ensure that all links were working properly.

Formative Evaluation and Results

The purpose for creating this web site was to motivate teachers to use technology in a way that is beneficial and exciting for their students. At the same time, it allows teachers to be creative and learn how to implement technology into their teaching. Due to lack of funding and support materials, this project allows for the creation and sharing of materials at minimal or no cost. The challenge was to evaluate the final project and determine if the goals had been achieved and if the web site would be successful among educators.

In order to evaluate the usefulness and success of the instructional web site, a post questionnaire was given to the same eight teachers at Del Vallejo Middle School who responded to the initial questionnaires prior to the development of the web site (see Appendix D). The post

questionnaires were administered in May 2003, and they were collected in totality in June 2003. The post questionnaire focused on the on-line learning experience, whether or not the training was motivational, and the cost effectiveness and flexibility of this type of training.

One hundred percent of the teachers felt the on-line learning experience was a positive one. The responses included comments that the on-line learning experience was loaded with help and information, was easy to use and navigate through, and included multiple resources. One teacher liked using the model web quests to review. Another teacher loved the idea that students could actually do research and learn about a subject without the use of books and worksheets.

One hundred percent of the teachers felt that this type of training would motivate them to continue learning about and implementing technology into their teaching. One teacher thought that a web quest would be a great lab station for her science class. Another teacher commented that this type of site would make her feel not afraid of using this type of technology instruction.

All of the teachers felt that the web site was user friendly. One teacher commented positively on the pictures showing what you should see when you were using Netscape

Composer. In one or two of the responses I felt that there was still some concern over the availability of school site support of technology. Teachers like to know that there is someone at their school site that they can turn to if they need help. Sometimes this may be teachers who use technology in their own classrooms or teachers who are known to be efficient with technology. Some school sites do not have a technical support person at the site.

One of the survey questions asked about the changes that the teachers would like to see in the web site design or delivery of instruction for future novice users. Seventy-five percent of the teachers could not think of any changes they would make. One teacher commented that he would like to see some links that students would be able to use to do science homework. Another teacher felt that the web site page was rather long, but still easy to navigate through.

All of the teachers felt that the use and sharing of web quests was a possibility in the future and something that they would be willing to be a part of. There was a slight sense of apprehension in a couple of the responses such as they would like to preview more web quests before making one of their own. Another teacher said they would like to use some that were already made in order to get a

feel for a web quest before making one. Most of the apprehension was a result of limited prior technology use. However, all of the teachers sounded positive and enthusiastic in their responses of using this type of technology with their students (see Appendix E).

There was total agreement among the teachers that this type of instruction is cost effective and flexible. However, two teachers had similar comments regarding the desire and drive of teachers to use technology. It is true that teachers must see a need for technology integration and have the determination to make it a part of their curriculum and instruction.

Overall, the responses to the web site were very exciting and positive. It was surprising that none of the teachers had heard about web quests before. Many of the teachers like the idea of sharing web quests and commented on how sharing them would further reduce the amount of time required of one teacher to participate in this type of project. One teacher is already making plans with another teacher to collaborate on a math web quest.

CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The researcher's personal experience along with the literature reviewed contributed greatly to the hypothesis that a flexible, cost effective, user friendly, on-line learning experience could lead to innovative and creative new ways of introducing technology into instruction. The research shows over and over again that teachers will not integrate technology into their classrooms unless they can see evidence of its usefulness.

The responses to the questionnaires revealed that teachers are not sure what to do with the technology once they have it. Teachers want concrete examples of technology being used by other teachers. They are excited over the possibilities and are willing to use technology if they have continual support and instruction. The research indicated that teachers work best on collaborative activities and feel most comfortable when they have colleagues to share ideas and products with (James & Lamb, 2000). The teachers who participated in evaluating this project were very interested in technology

use. However, they did not know where to begin or how to integrate standards into technology lessons.

Technology use is international and ever advancing. With the increase of technology use in the workplace and the nature of the fast paced changes in technology, it is the responsibility of the teacher to stay apprised of new advancements and to utilize available technology resources for instruction. Students are becoming increasingly immersed in technology and computers and as they progress through school, teachers need to guide the advancement of the skills of their students. After all, the core of education is to prepare students to be successful in the world.

Today's technology not only aids in achieving student success, it also allows teachers time to be coaches and takes away the need for long lectures and boring book and worksheet activities. Hands-on experiences lead to student centered creations and allows students to take responsibility for their learning. This project shows that there are ways to be creative with technology despite the issues of time, funding, lack of training, and computer expertise. If teachers work together they can do amazing and wonderful things for the future generations.

Recommendations

Because the development of an instructional web site is an ongoing process, this project will continue to take on new dimensions. As educators become more familiar with creating web quests, new activities will continue to be added to the web site. Because of the demands made on teachers to address standards, standards will be identified in each of the created web quests. Grade level categories and standard and subject categories of web quests will be created so teachers can access and share curriculum-supported materials.

Other additions to the web site will include web quests that require students to explore other technology resources such as homework helpers, on-line experts, web-cams, museums, virtual tours, and sharing information with other participating schools. Furthermore, due to teacher comments, an additional web site will be added that uses multiple pages so teachers can compare a one-page web site with one that uses multiple pages. This will accommodate both novice and advanced computer users.

When using web quests with my students, I have found that students access them from home to finish their work without being asked to do so. In the future, it would be exciting for teachers to promote the use of web quests

with their students by having them do assignments at home. This way, parents can be more involved with their student's work and also learn more about technology. Students can access the web quests from any computer with Internet capability. It is exciting to see students so enthusiastic about using computers for learning.

Through the process of designing and constructing this web site, several recommendations can be made to others who are attempting similar web sites or other similar projects.

Developing an on-line learning environment for teachers or students requires a great deal of planning and preparation. Numerous decisions must be made when attempting to create motivational, inspirational, and meaningful instructional materials. Materials need to be carefully designed and implemented in order to create a successful educational program. A great deal of forethought, planning, and mapping should be conducted as to the specific features to be incorporated into the project.

Another recommendation is to spend a certain amount of time researching other web sites and looking at materials that have already been tested and are being used

by other educators. The wonderful thing about technology is that the possibilities are endless.

APPENDIX A

TEACHER QUESTIONNAIRE PRIOR TO WEB SITE CONSTRUCTION

Questionnaire Prior to Web Site Construction

Please answer the following questions to the best of your ability and place completed questionnaire in Ms. Soderquist's box. Information is confidential and there is no need for you to identify yourself.

1. Do you presently use technology in the classroom, lab, or at home? Check all that apply.
   1. Use in the classroom
   2. Use in a lab
   3. Use in my home
   4. Do not use any computers or technologies

2. Which of the following best describes your technology skills?
   1. Novice (a beginner, know some basic computer skills)
   2. Not a novice

3. Please check what you think are the greatest benefits of using technology for instruction.
   1. Students learn more
   2. Individualized instruction
   3. Motivates students
   4. Helps students be competitive
   5. Classroom management
   6. Helps students become computer literate
   7. Students become more responsible for their learning
   8. Allows teacher to move from lecturer to coach

4. Which of the following best describes your attitude towards technology in schools?
   1. I enjoy leading technology initiatives; I would like to learn to identify uses of technology in my classroom and would be willing to participate in training that meets my needs.
   2. I prefer to wait and watch initiatives that are being used in other classrooms. Then I choose to slowly integrate those initiatives that I believe promise success.
   3. I reject the idea of integrating technology into my teaching style and or learning environment.

5. What would make it easier for you to use technology?
   1. More training support
   2. Having a computer in your classroom
   3. More software that supports curriculum
   4. More time
   5. More support materials
   6. Having easier access to computers
   7. Other _____

6. Which type of technology training would you be willing to participate in?
   1. District training at another site
   2. Training at staff inservice
   3. After school training
   4. Weekend training
   5. Training that is on-line with staff support

7. Which do you feel more comfortable with regarding training? Check all that apply.
   1. Training by district personnel
   2. Training by a school site teacher
   3. Training in a large group setting
   4. Training in a small group or individual instruction
   5. Flexible training when needed
   6. Combination of on-line training and school site support
   7. Other _____

8. What type of training would motivate you to use technology? Check all that apply.
   1. Training on basic software programs such as word processing, drawing, spreadsheets, and multimedia
   2. Training that allows hands-on participation
   3. Training on the parts of the computer
   4. Training on troubleshooting hardware problems
   5. Training that allows you to produce a product of your design to be used immediately in your classroom
   6. Training for a product for students to use in a lab setting
   7. Training for you to use as a presentation of materials
   8. Training that allows you to build support material for your curriculum

9. If you were offered on-line technology training to build curriculum-supported materials, with support from peers at your school site, what would you like to see?
   1. A template that requires fill in the blanks.
   2. An easy to follow instructional guide that allows for more hands-on choices in design.
   3. Instructions and support but flexibility to make more complicated decisions in my project design.
   4. Other _____
   5. I am not interested in making my own curriculum-supported materials; I would just use someone else's creation.

10. How important do you feel it is for teachers to learn to make their own curriculum-supported materials?
   1. I think it is very important and leads to teacher professional growth in using technology.
   2. I think it is somewhat important.
   3. I don't feel it is very important. Teachers should just use what is available to them.
   4. I don't feel it is important at all. It is not the teacher's responsibility to make curriculum-supported materials.

11. If you could share your product with other teachers and build a "library" of resources, would you feel more motivated to participate in technology training?
   1. Yes
   2. No

12. What would you like to see in an on-line training site?

13. What would help you with on-line training?

14. What would motivate you to participate in technology training and what incentives would you feel were necessary?

APPENDIX B

TEACHER QUESTIONNAIRE ONE RESULTS

QUESTIONNAIRE ONE RESULTS

1. Do you presently use technology in the classroom, lab, or at home? Check all that apply.
   1. Use in the classroom √√√√√
   2. Use in a lab √√
   3. Use in my home √√√√√
   4. Do not use any computers or technologies

2. Which of the following best describes your technology skills?
   1. Novice (a beginner, know some basic computer skills) √√√√√√
   2. Not a novice √

3. Please check what you think are the greatest benefits of using technology for instruction.
   1. Students learn more √√√
   2. Individualized instruction √√√√
   3. Motivates students √√√√√
   4. Helps students be competitive √
   5. Classroom management
   6. Helps students become computer literate √√√√√
   7. Students become more responsible for their learning √√√√
   8. Allows teacher to move from lecturer to coach √

4. Which of the following best describes your attitude towards technology in schools?
   1. I enjoy leading technology initiatives; I would like to learn to identify uses of technology in my classroom and would be willing to participate in training that meets my needs. √√√√
   2. I prefer to wait and watch initiatives that are being used in other classrooms. Then I choose to slowly integrate those initiatives that I believe promise success. √√√√
   3. I reject the idea of integrating technology into my teaching style and or learning environment.

5. What would make it easier for you to use technology?
   1. More training support √√√
   2. Having a computer in your classroom √√√
   3. More software that supports curriculum √√√
   4. More time √√√
   5. More support materials √√√√
   6. Having easier access to computers √√√
   7. Other _____

6. Which type of technology training would you be willing to participate in?
   1. District training at another site √√
   2. Training at staff inservice √√
   3. After school training √
   4. Weekend training
   5. Training that is on-line with staff support √√√√

7. Which do you feel more comfortable with regarding training? Check all that apply.
   1. Training by district personnel
   2. Training by a school site teacher √√√
   3. Training in a large group setting √√
   4. Training in a small group or individual instruction √√
   5. Flexible training when needed
   6. Combination of on-line training and school site support √√√
   7. Other _____

8. What type of training would motivate you to use technology? Check all that apply.
   1. Training on basic software programs such as word processing, drawing, spreadsheets, and multimedia √√
   2. Training that allows hands-on participation √√√√√
   3. Training on the parts of the computer √
   4. Training on troubleshooting hardware problems √
   5. Training that allows you to produce a product of your design to be used immediately in your classroom √√√
   6. Training for a product for students to use in a lab setting √√√
   7. Training for you to use as a presentation of materials √√
   8. Training that allows you to build support material for your curriculum √√√√√√

9. If you were offered on-line technology training to build curriculum-supported materials, with support from peers at your school site, what would you like to see?
   1. A template that requires fill in the blanks. √
   2. An easy to follow instructional guide that allows for more hands-on choices in design. √√√√√
   3. Instructions and support but flexibility to make more complicated decisions in my project design. √√
   4. Other _____
   5. I am not interested in making my own curriculum-supported materials; I would just use someone else's creation.

10. How important do you feel it is for teachers to learn to make their own curriculum-supported materials?
    1. I think it is very important and leads to teacher professional growth in using technology. √√√√√
    2. I think it is somewhat important. √√
    3. I don't feel it is very important. Teachers should just use what is available to them.
    4. I don't feel it is important at all. It is not the teacher's responsibility to make curriculum-supported materials.

11. If you could share your product with other teachers and build a "library" of resources, would you feel more motivated to participate in technology training?
    1. Yes √√√√√√
    2. No √

12. What would you like to see in an on-line training site?
    √ Fast, non-time consuming
    √ Self-help links, ideas, examples
    √ Curriculum-supported materials
    √ Finished examples
    √ Not a lot of baby steps
    √ Templates or examples on addressing the standards

13. What would help you with on-line training?
    √ Appropriate for my level of learning
    √ School site training/observing another teacher using this technology
    √ Time
    √ Step-by-step instructions
    √ On-line help for answering questions
    √ Access and time

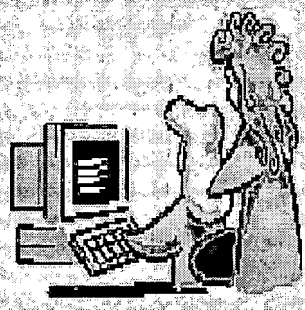
14. What would motivate you to participate in technology training and what incentives would you feel were necessary?
    √ Inservice or paid training
    √ Professional growth credit
    √ Hands-on training
    √ Training that is not time consuming
    √ Training at my level of instruction
    √ No incentives are necessary

APPENDIX C

WEB SITE HOME PAGE

Creating Web Quests:

A Great Place for Educators to make and share technology created resources to use with their students



ABOUT THIS WEB PAGE

WHAT IS A WEB QUEST

EXAMPLE WEB QUESTS

ADDRESSING THE STANDARDS

CREATING A WEB QUEST

PUTTING YOUR PAGE ON THE WEB

HELPFUL LINKS

- RUBRICS
- Net Tools for Teachers
- For on-line support e-mail: gsoderquist@yahoo.com

URL for this web site is http://www.geocities.com/gsoderquist

APPENDIX D

TEACHER QUESTIONNAIRE UPON COMPLETION OF WEB SITE

Questionnaire Upon Completion of Web Site

Please answer the following questions to the best of your ability and place completed questionnaire in Ms. Soderquist's box. Information is confidential and there is no need for you to identify yourself.

1. What did you feel about the on-line learning experience?
2. Do you think this type of training will motivate you to continue learning about and implementing technology into your teaching?
3. Was the web site user friendly and school support appropriate?
4. What changes would you make in the web site design or delivery of instruction for future novice users?
5. Do you envision using and sharing the web quests created by other teachers at your site?
6. Do you feel that this type of technology training is cost effective and flexible for teachers with limited time to work at school?
7. Please add any additional comments that you feel would be helpful.

APPENDIX E

TEACHER QUESTIONNAIRE TWO RESULTS

Questionnaire Upon Completion of Web Site

Please answer the following questions to the best of your ability and place completed questionnaire in Ms. Soderquist's box. Information is confidential and there is no need for you to identify yourself.

1. What did you feel about the on-line learning experience?
   - √ Easy to read and follow/easy to navigate with links
   - √ Models of web quest were beneficial prior to web quest construction
   - √ Multiple resources
   - √ On-line learning experience was positive
   - √ Information was informative
   - √ Great alternative to worksheets and lab assignments that are typically used to teach students
   - √ User friendly/students could easily use web quest
   - √ Tons of information

2. Do you think this type of training will motivate you to continue learning about and implementing technology into your teaching?
   - √ Yes, most of the information was on one site
   - √ Links are great for students/doesn't allow them to wander around Internet aimlessly
   - √ This type of site made me not afraid to use this type of instruction
   - √ Already made web quests make it easy to implement into teaching/once web quest is done can be use again and again
   - √ Yes, can be done in a short time and is not too involved
   - √ Yes, this would make a good lab station
   - √ Yes, great web site

3. Was the web site user friendly and school support appropriate?
   - √ Very user friendly/all links worked/content and link content useful and appropriate
   - √ Yes, the directions were clear/we have school site people on campus to ask for help
   - √ I loved the pictures showing you what you should see after clicking on something (what the screen should look like)
   - √ Yes, it was very easy to move from one link to another or between pages of the same site
   - √ Everything was easy to use/school support was great
   - √ School support appropriate/user friendly for adults
   - √ Site was very well put together/not too advanced/not talking down to students
   - √ Easy to navigate/curriculum matched

4. What changes would you make in the web site design or delivery of instruction for future novice users?
   √ Opening page scrolls rather far/I do like the "top" option for fast return
   √ Incorporate more sites so students would be able to do science homework using this site
   √ No ideas, everything was explained step-by-step
   √ More pages to spread information across

5. Do you envision using and sharing the web quests created by other teachers at your site?
   √ Yes (100%)

6. Do you feel that this type of technology training is cost effective and flexible for teachers with limited time to work at school?
   √ Yes (100%)

7. Please add any additional comments that you feel would be helpful.
   √ What about rubrics?
   √ Great content and great interaction between users and administrator.

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