THE IMPACT OF TECHNICAL BARRIERS ON THE EFFECTIVENESS OF PROFESSIONAL DEVELOPMENT AS RELATED TO A DISTANCE EDUCATION SYSTEM-BASED COURSE: A CASE STUDY IN THE WEB WORLD WONDERS ENVIRONMENTAL SCIENCE LEARNING COMMUNITY

John L Dawson, Jr., B.S.Ed., M.Ed.

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APPROVED:

Mark Mortensen, Major Professor
Bill Camp, Minor Professor
Jeff Allen, Major Professor and Coordinator of Applied Technology, Training and Development
Jon I. Young, Chair of the Department of Technology and Cognition
M. Jean Keller, Dean of the College of Education
Sandra L. Terrell, Interim Dean of the Robert B. Toulouse School of Graduate Studies

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This study reports and discusses the impact of technical barriers on the effectiveness of professional development as related to a distance education system based course: a case study of the web world wonders environmental science learning community in Florida. The project involved 4th through 12th grade public school teachers learning how to use GPS readers, digital cameras, and Arc View software for the purpose of utilizing a Website that enabled remote Internet camera access in Florida State Parks. Under the supervision of Florida State University and the Florida Department of Education those teachers received professional development in techniques for developing lesson plans utilizing the equipment and software as stated above. Using the Concept Based Adoption Model, a description of the teacher's demographics, Levels of Use and Stages of Concern with relation to gender, age, teaching experience, and technological experience was examined. Technical barriers were identified and an explanation of how they were overcome in the process of receiving the professional development is reported.

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CHAPTER 1

INTRODUCTION

Distance education (DE) has been in use since the idea of drawing on a cave wall. A person could interpret what someone else had drawn and could then internalize that concept. Knowledge could then start building upon itself, and over time, that knowledge has grown into the world knowledge base. Those first scribbles were, in a way, the first technological advancements of modern communications technology, even if they were primitive by today's standards.

With those first scribbles came technical barriers such as what to draw, what to use to draw, and on what to draw. Those barriers had to be overcome in order for others to see and understand the drawings. One technological barrier to drawing on the wall or deciphering what was on the wall would have been seeing in the dark environment of the cave. To overcome that barrier, a burning torch may have given the light to see in the cave. As that torch happened to scrape a wall, it was determined that a dark mark was left on the cave wall. By exploring the cave with that torch for light and marking on the wall with another extinguished torch, the first drawings may have been made.

Moving through time from those earliest renderings on cave walls to the invention of the printing press gave rise to another shift. Using the printing press, books could be inexpensively printed, providing people access to knowledge that helped them learn to read and write. This one invention helped spread literacy to the masses. The modern educational setting that faces today's professional teachers and administrators is more than a quantum leap. There have been several such shifts on that timeline. These advances in technology have powered paradigmatic shifts in education (Frick, 1991). Such shifts can occur only after advances in technology have provided the necessary tools. The harnessing of electricity gave rise to the invention of radio, television, and more recently the modern computer. Technological advances have further promoted education.

Today, children are exposed to modern telecommunications from the time they are born. They grow up listening to music, watching television, and talking on the phone. Technology has always been there for these children. Exposure to the media gives people an unplanned education beyond the classroom. "The fusion of computers and telecommunications have created a new tool for teaching and learning, and now is the time to clearly enunciate and disseminate our goals in order to shape future uses of instructional technology" (Berge & Collins, 1995, p. 3).

The amount of information available on the Internet is astounding. Zemke (1998) and Knowles, Holton, and Swanson (1998) agreed that adults prefer self-directed learning to any other learning style. According to Abernathy (1999), Internet traffic is doubling every 100 days. Individuals can use the Web to seek out knowledge and acquire skills on their own. This ability to access information at any time from anywhere in the world is appealing to busy professionals who may need to incorporate their professional development into their schedule at nontraditional times. Technical barriers for those seeking knowledge by way of professional development distance education will have to be resolved.

Geographic and time zone barriers make distance education a viable alternative to traveling to a specific location for professional development. Travel time is saved, which in turn presents more time for learning. Curricula in K-12 environments can be enriched by linking students in different geographic locales and providing opportunities for students of various social, ethnic, cultural, and experiential backgrounds to converse in an interactive fashion (Schlosser & Anderson, 1994). However, the barrier that often deters the initial use of distance education is the technical barrier.

There has been much debate over whether learning in distance education settings actually works. Inquiries have been made into this subject, and evidence exists that it enhances knowledge just as well as, if not better than, regular instruction (Aveling, Smith, & Wilson, 1992). Even if less than 5% of published empirical, quantitative, and valid research supports the conclusion as to the effectiveness of technology in education learning outcomes, there is still a need to overcome the technical barriers associated with technology (Jones & Paolucci, 1997).

This study has focused on the technical barriers to professional development as related to a distance education system-based course and on how those barriers can be overcome, which will contribute to the larger body of knowledge in the field of education.

Purpose of the Study

The first purpose of this study was to identify technical barriers that impact the effectiveness of professional development as related to a distance education system-based course in a selected learning community within the United Star Distance Learning Consortium, more specifically known as Web World Wonders. This study utilized information gathered from a cadre of teachers who were participating in ongoing professional development in the Web World Wonders Environmental Science learning community in the state of Florida. Those 4th-through 12th-grade teachers participating were in the process of learning to use varied technologies while incorporating information derived from the Web site http://webworldwonders.firn.edu. The second purpose of this study was to provide help in overcoming technical barriers to professional development, as related to distance education in other learning communities, so as to provide teachers with the skills necessary for technologically advanced classrooms.

Significance

Studying the impact of technical barriers in the field of applied technology, training, and development is timely. The field lacks sufficient current studies that measure the impact of technical barriers associated with professional development as related to using distance education. Education professionals are currently experiencing an explosion of information with regard to professional development. For example, the knowledge base is doubling every 18 to 24 months, (Karlin, 2002). Distance education can be useful as an avenue for acquiring professional development to keep up with advancements in education. However, the distance education aspect of the professional development equation presents technical barriers that must be overcome in order for that education to be viable.

Much of the information that is needed for professional development can be successfully presented via the Internet when used in an effectively designed and implemented system. “The World Wide Web coupled with user friendly Web browsers now provides access to multimedia Web pages in universally accepted formats that can be accessed world wide easily via inexpensive desktop computers” (MacIntyre & Wolff, 1998, p. 257). This feature alone opens the world’s knowledge base to anyone with the proper tools and knowledge of their use. Another requisite to having successful distance education is that of being self-directed. According to Driscoll (1998), adult learners can have the special characteristic of being self-directed. With this self-direction, professional development distance education can be achieved.

The research in this study adds focus to the impetus of overcoming the technical aspect of technology. This case study identified technical barriers that impact the effectiveness of professional development as related to a distance education system-based course in a selected learning community within the United Star Distance Learning Consortium. Those technical barriers were measured by the Stages of Concern Questionnaire (SOC) and the Levels of Use (LOU) interview instrument, which comprise part of the Concerns-Based Adoption Model (CBAM) (Hall, Loucks, Rutherford, & Newlove, 1975).

Environmental Science Learning Community Background

The learning community chosen for this case study was part of the United Star Distance Learning Consortium (USDLC), more specifically known in the environmental science community or Web World Wonders. The premise of the community was to place interactive video cameras in environmentally sensitive areas and let students and teachers use those cameras for instructional purposes. The objectives of Web World Wonders were to accomplish the following:

1. Instruct trainers and teachers with the use of basic handheld global positioning system (GPS) units.
2. Instruct trainers and teachers with the use of digital cameras and field documentation imagery.
3. Instruct trainers and teachers with the use of graphical information system (GIS) concepts and software.
4. Publish virtual field trips created by teachers and students integrating the above technologies into classroom curriculum.
5. Publish community atlas projects created by teachers and students integrating the above technologies into community projects. (USDLC 1st Quarter Report Year 5 Extension, 2003, p. 23)

The University of Florida and the Florida Department of Education collaborated under the auspices of the USDLC with the intent of helping train teachers, through professional development, to use that technology which in turn will be used in classroom instruction.

Theoretical Framework

The theoretical framework for this case study is based on previous research by other experts in the field (e. g. Berge, 1998; Moore, 1994). Using theory as a guiding framework to build on the work of others allows research to be replicated and enhances its generalizability and meaningfulness (Merisotis & Phipps, 1999). According to Moore and Kearsley (1996), "Research is ineffective when . . . not set in a theoretical framework: Researchers are not able to build on the work of others, they are less likely to identify the really significant questions, and their results are of limited generalizability" (p. 77).

Moore (1994) placed no significant emphasis on the technical aspect impediment to distance education. He speculated:

> The barriers impeding the development of distance education are not technological, nor even pedagogical. We have plenty of technology, and we have a fair knowledge about how to use it. The major problems are associated with the organizational change, change of faculty roles, and change in administrative structures. Here we desperately need all the ideas and all the leadership than can be assembled. The starting point is to expose the problems. (p. 4)

This concept could be restated as follows: The barriers associated with organizational change, change in faculty roles, and administrative structures are more critical than barriers associated with technology or pedagogy.

In an interview conducted in February 2003, Moore (2003) asserted, "Administrators and policy makers . . . have put far too much faith in new communications technologies and missed the point that distance education needs changes in organizational structures and pedagogical methods" (para. 5).

Moore (2003) also noted,

> Distance education has the potential of delivering more educational opportunities to more people than ever before, to do so at lower average cost and, what is most important, higher quality than most people can get in other ways, but we aren't doing it, partly because people don't know what distance education really is. Most of what

is happening in the name of distance education is simply traditional pedagogy and traditional structures of higher education with the addition of new technology. And people are proposing new names for this old wine in new bottles, such as e-learning, asynchronous learning, distributed learning, flexible learning, open learning, and so on. All this is part of distance education, and none of it alone is distance education. Yet there is enough sound literature and theory in distance education for people to make sense of all this, if only more attention was given to training, to developing courses, and of course to publication. (para. 7)

Clark (1983) and other theorists, such as Collis and Rockman (as discussed in Barron & Orwig, 1997), concluded that learning is a result of adequate instructional design and development, not the results of the medium used to deliver instruction.

However, there is disagreement among researchers as to the importance of technical barriers in relation to distance education. Although technology is being applied in some classrooms, lack of on-site technical support in schools that are technologically advanced may discourage teachers' using technology to its fullest potential (CEO Forum, 1997). Research on barriers to distance education that would transfer to professional development distance education has been conducted, but the major emphasis has not been on the technical aspects of those barriers.

Limited research concerning recent technical barriers to professional development as related to distance education has been reported. This case study will add to the foundation of knowledge identifying technical barriers to professional development as related to distance education, which will need to be replicated and expanded with further research. There are at least seven areas of education that may include technical barriers. Threlkeld and Brzoska (1994) have laid a framework for establishing a distance education system.

Technology - hardware (e.g., videotape players, cameras) and software (e.g., computer programs).

Transmission - the on-going expense of leasing transmission access (e.g., T-1, DSL, Cable Modem, satellite, microwave).

Maintenance - repairing and updating equipment.

Infrastructure - the foundational network and telecommunications infrastructure located at the originating and receiving campuses.

Production - technological and personnel support required to develop and adapt teaching materials.

Support - miscellaneous expenses needed to ensure the system works successfully including administrative costs, registration, advising/counseling, local support costs, facilities, and overhead costs.

Personnel - to staff all functions previously described (p. 136).

It is from this framework that technical barriers emerged and have been analyzed in this study.

Statement of the Problem

As technology advances, teachers will need professional development to stay apprised of new developments. The incorporation of technology in education may be the most important and most underutilized tool for providing teachers access to the targeted professional development they need. Online courses, informal support groups, and other network-supported resources provide opportunities to professional development exceeding what any school or district might be able to offer. Teachers are professionals whose expertise must be constantly upgraded as the content in their field changes, as new technologies are introduced, and as new students enter their classrooms.

Rigorous professional development opportunities must be embedded in the foundation of public education. Just as learning communities should design schools around the principles of how children learn, professional development should be structured around how adults learn (National Commission on Teaching and America's Future, 2003).

Distance education had become more prevalent in professional development. A professional development course for the Web World Wonders Environmental Science learning community in the state of Florida uses advanced technology. That technology was being introduced to 4th through 12 grade teachers who were in the process of learning how to use varied technology while incorporating information derived from the Web site http://webworldwonders.firn.edu. Participants in Web World Wonders, both students and teachers, gather information about environmentally sensitive areas of Florida and then analyze that data to be shared with other teachers around the world. The instructors are given the task of transferring the techniques involved with incorporating distance education materials associated with the course and the technological equipment to students. As the technology is introduced and utilized, technical barriers will be encountered.

Questions

The following questions were raised to identify and provide possible solutions to the technological barriers associated with them.

1. What technical barriers are detriments to professional development as related to a distance education system-based course as identified in the Web World Wonders learning community?
2. How can significant time lost to teaching by inadequately trained teachers using innovative technology be reduced as identified in the Web World Wonders learning community?
3. What are the significant effects between age, gender, technology experience, years of teaching experience, and technical barriers to professional development as related to a distance education system-based course as identified in the Web World Wonders learning community?

Delimitations

1. This case study was limited to the public school teachers participating in the Web World Wonder Environmental Science professional development course in the state of Florida in association with the University of Florida and the Florida Department of Education.

2. The researcher requested the teachers to answer a 35-question Levels of Use of the Innovation survey, along with a demographic data sheet, and to complete an interview for the Stages of Concern of the Innovation. The "Innovation" was the Web World Wonders Environmental Science professional development course in the state of Florida.

3. This case study was limited to observations of the researcher who has monitored the Web World Wonders Environmental Science professional development course over the past 5 years.

Limitations

1. The learners, the subjects of this study, were assumed familiar with the use of a computer and the World Wide Web. They were assumed to have the basic knowledge and skills that would enable them to access sites by using URLs and to send and receive e-mails.

2. None of the subjects was assumed experienced in the use of the technology that would be presented to them during the course.

3. None of the subjects had answered the questionnaire or interview.

4. Although the target population of this study was the teachers participating in the Web World Wonder Environmental Science professional development course in the state of Florida, the sampling was limited to those teachers that volunteered to participate in the study.

Definition of Terms

For the purpose of this study, a brief description of the key terms is provided.

Asynchronous system: a type of communication systems that does not require the instructor and the learner to communicate at the same time. In fact, asynchronous systems are used more in the training environment than synchronous systems due to their availability and cost-effectiveness. Examples of asynchronous systems are videotape, audiotape, CD, and DVD.

Bandwidth: the transmission capacity of a telecommunications system. The greater the bandwidth, the greater the amount of digital information that can be transmitted per second.

Bulletin board: a computer-based meeting place (and its accompanying software) that allows people to discuss topics of interest, upload and download files, and make announcements.

Computer-based instruction (CBI): a method of instruction delivery that uses the computer to deliver instructional programs according to the pace and characteristics of the learner. The learner can access the training course at his/her convenience whenever it is needed (Piskurich, 1993). In the corporate world, this method of instruction is often referred to as computer-based training (CBT), in which training materials can also be disseminated.

Computer-mediated communication (CMC): the use of computer tools for communicating with other individuals who also use computers to receive or send messages.

Distance education: planned learning that normally occurs in a different place from teaching and as a result requires special techniques of course design, special instructional techniques, special methods of communication by electronic and other technology, as well as special organizational and administrative arrangements (Moore & Kearsley, 1996).

Plug-in: a software component required by an Internet browser to expand its abilities. For example, Live-Audio is a Netscape plug-in that enables it to play audio.

Staff development: "a planned experience designed to change behavior and result in professional and/or personal growth and improved organizational effectiveness" (Merkle & Artman, 1983, p. 55).

Synchronous system: a type of communication systems that requires both the instructor and the learner to have a live, interactive communication. A typical example of synchronous systems is a videoconference or telephone conference.

Web-based instruction (WBI): a method of delivery in which instruction can be delivered over the Internet or over a company's Intranet. Using a Web browser, such as Microsoft explorer or Netscape navigator, allows for training access. *Web-based instruction* is interactive and utilizes the available multimedia to enhance the level of delivery of instruction (Hall, 1997). *Web-based instruction* is referred to as *Web-based training* (WBT), *Web-based learning*, *interactive distance learning*, *Intranet-based learning*, or *Internet-based instruction* (IBI) (McMasters, 1999). However, they all share the same concept, which is delivering learning to audiences at dissimilar locations using the Internet Infrastructure (Barron, 1999).

CHAPTER 2

REVIEW OF THE RELATED LITERATURE

This chapter provides the empirical and theoretical basis for determining technical barriers to professional development distance education. The chapter seeks out and analyzes real-world experiences of the teachers involved in the learning community Web World Wonders Environmental Science, which is within the United Star Distance Learning Consortium and combines a professional development course with distance education. One of the major themes of this chapter is to derive outcomes from the responses that teachers involved with the professional development course provided upon during the administration of the instruments. Hence, this chapter is a discussion of the following main areas: professional development, distance education, and the barriers associated with both concepts. To understand the melding of these two concepts requires knowledge of both. Professional development and distance education each have varying definitions.

Professional Development

The No Child Left Behind Act (1999) has an in-depth definition of professional development as noted below.

THE TERM PROFESSIONAL DEVELOPMENT —

(A) includes activities that —

(i) improve and increase teachers' knowledge of the academic subjects the teachers teach, and enable teachers to become highly qualified;

(ii) are an integral part of broad school-wide and district-wide educational improvement plans;

(iii) give teachers, principals, and administrators the knowledge and skills to provide students with the opportunity to meet challenging State academic content standards and student academic achievement standards;

(iv) improve classroom management skills;

(I) are high quality, sustained, intensive, and classroom-focused in order to have a positive and lasting impact on classroom instruction and the teacher's performance in the classroom; and

(II) are not 1-day or short-term workshops or conferences;

(v) support the recruiting, hiring, and training of highly qualified teachers, including teachers who became highly qualified through State and local alternative routes to certification;

(vi) advance teacher understanding of effective instructional strategies that are —

(I) based on scientifically based research (except that this sub-clause shall not apply to activities carried out under part D of title II); and

(II) strategies for improving student academic achievement or substantially increasing the knowledge and teaching skills of teachers; and

(vii) are aligned with and directly related to —

(I) State academic content standards, student academic achievement standards, and assessments; and

(II) the curricula and programs tied to the standards described in sub-clause (I) except that this sub-clause shall not apply to activities described in clauses (ii) and (iii) of section 2123(3)(B);

(viii) are developed with extensive participation of teachers, principals, parents, and administrators of schools to be served under this Act;

(ix) are designed to give teachers of limited English proficient children, and other teachers and instructional staff, the knowledge and skills to provide instruction and appropriate language and academic support services to those children, including the appropriate use of curricula and assessments;

(x) to the extent appropriate, provide training for teachers and principals in the use of technology so that technology and technology applications are effectively used in the classroom to improve teaching and learning in the curricula and core academic subjects in which the teachers teach;

(xi) as a whole, are regularly evaluated for their impact on increased teacher effectiveness and improved student academic achievement, with the findings of the evaluations used to improve the quality of professional development;

(xii) provide instruction in methods of teaching children with special needs;

(xiii) include instruction in the use of data and assessments to inform and instruct classroom practice; and

(xiv) include instruction in ways that teachers, principals, pupil services personnel, and school administrators may work more effectively with parents; and

(B) may include activities that —

(i) involve the forming of partnerships with institutions of higher education to establish school-based teacher training programs that provide prospective teachers and beginning teachers with an opportunity to work under the guidance of experienced teachers and college faculty;

(ii) create programs to enable paraprofessionals (assisting teachers employed by a local educational agency receiving assistance under part A of title I) to obtain the education necessary for those paraprofessionals to become certified and licensed teachers; and

(iii) provide follow-up training to teachers who have participated in activities described in subparagraph (A) or another clause of this subparagraph that are designed to ensure that the knowledge and skills learned by the teachers are implemented in the classroom. (para.1)

According to the U.S. Department of Education, high-quality professional development for teachers does the following:

1. Focuses on teachers as central to student learning, yet includes all other members of the school community
2. Focuses on individual, collegial, and organizational improvement
3. Respects and nurtures the intellectual and leadership capacity of teachers, principals, and others in the school community
4. Reflects best available research and practice in teaching, learning, and leadership
5. Enables teachers to develop further experience in subject content, teaching strategies, uses of technologies, and other essential elements in teaching to high standards
6. Promotes continuous inquiry and improvement embedded in the daily life of schools
7. Is planned collaboratively by those who will participate in and facilitate that development
8. Requires substantial time and other resources

9. Is driven by a coherent long-term plan
10. Is evaluated ultimately on its impact on teacher effectiveness and student learning, and this assessment guides subsequent professional development efforts. (U.S. Department of Education, Office of Educational Research and Improvement [1997], as cited in Northwest Regional Educational Laboratory, 2003, p. 37)

Most definitions of professional development are more concise. Hassel (1999) defined professional development as the process of improving staff skill and competencies needed to produce outstanding educational results for students.

Distance Education

The other concept involved with this study, distance education, may be defined as the planned learning that normally occurs in a different place from teaching and as a result requires special techniques of course design, special instructional techniques, special methods of communication by electronic and other technology, as well as special organizational and administrative arrangements (Moore & Kearsley, 1996).

Another term, *distance learning*, is sometimes mistaken for distance education, but this is an inaccuracy. The United States Distance Learning Association (2000) has defined distance learning as the acquisition of knowledge and skills through mediated information and instruction, encompassing all technological and other forms of learning at a distance. Distance learning is the student aspect of distance education in that the student is responsible for learning, while the instructor is responsible for and controls the delivery of the materials. Distance learning has also been defined as a situation in which the learner and instructor use telecommunication devices that enable direct or indirect interaction between the instructor and the learners (Azarmsa, 1993). Distance learning was introduced in the late 1800s in the United States at the University of

Chicago, where the first major correspondence program was established in which the teacher and the learner were at different locations (McIsaac, 1998).

History

This review of literature includes several aspects of barriers to professional development as related to distance education. Before concentrating on the barriers, the history of professional development and distance education needs to be addressed. There have been three distinct generations of growth in the field of distance education. The first generation involved correspondence courses. The courses were conducted through written and printed material and then sent through the postal service to the students. This process was prolonged and drawn out (Bitter & Pierson, 1999).

The real materialization of distance education began in the early 1960s. This was called the second generation, in which television broadcasts of classes and audiocassettes were disseminated to students. Telephones were utilized for student-teacher conferences with these technologies. The main consequence of this generation was that distance education was limited to the delivery of information (Bitter & Pierson, 1999). Television is one of the major examples of using technology in conveying educational knowledge, and it has been used in the educational field since its introduction. Berge and Collins (1995) emphasized the role of distance education teachers by encouraging the students to interact with the learning environment, rather than restricting themselves to the content of the given subject matter.

The third generation in the evolution of distance education involves the integration of computers into the distance-learning model. This includes two-way interactive video and computer conferencing via chat rooms and e-mail. The key element with this generation is that it could be done either synchronously or asynchronously, depending on the requirements of the class and instructor. This integration would certainly result in the evolving of new forms of learning (Bitter & Pierson, 1999).

A review of literature indicates an historical approach by presenting the overall picture of technology from the earliest days to the present use of technology in the classroom (Merrill et al., 1992; Poole, 1997). This elemental chronological approach placed the inception of computing with the abacus at about 4000 BC, which was called the beginning of mechanical computing. A prior point in time was described as premechanical computing in that people counted on their fingers and made marks on cave walls and used animal bones to keep track of numbers. The mechanical computing era featured highlights that included the creation of the slide rule in 1621 and the invention of Boolean Logic in 1854. The creation of counting problem-solving machines in the first half of the 20th century led to the development of the first computers. Those first computers were developed in the late 1940s, but they were too large and expensive for use in schools. The introduction of computing in schools began in 1976 as a result of the creation of the personal computer system.

Technology continued to change and affect children. Throughout history, significant barriers were perceived to exist by persons who believed that the infusion of technology in the classroom could help teaching and learning. The following examples of barriers mentioned in the educational technology literature served as a starting point in developing a comprehensive list of such obstacles. Leggett and Persichitte (1998) examined the history of barriers and determined that teachers consistently cited the same basic five barriers: time, access, resources, expertise, and support.

A review of the literature supported the Leggett and Persichitte (1998) contention that those five factors, or barriers, were very important. Historically, the barriers occurred repeatedly.

Loughary (1966) mentioned limited resources and lack of support as potential barriers to the implementation of computers in the classroom. O'Shea and Self (1983) examined the factors that affected teachers as they tried to struggle with new technology. Those factors included poorly designed materials and a lack of technical support, teachers' anxiety and resentment concerning the new technology, and the lack of administrative support.

Schofield (1995) provided a detailed observation of the barriers to technology use. Important factors were the belief by teachers that (a) computer use would add little value to current practice and (b) existing educational software was not useful in the classroom. A major barrier that affected the teachers' sense of competence and authority in the classroom was anxiety based on the teachers' unfamiliarity with computers. The presence of disincentives and the lack of incentives played a role, as well as infrastructure problems such as repairs, trouble-shooting, and maintenance. Finally, the lack of adequate training, coordination, and timing between training and hardware purchase, the inability to match training to the teachers' level of knowledge and instructional concerns, and concentrated experiential training further exacerbated the situation.

Driscoll (1999) supported the use of a facilitator when teaching psychomotor skills via the Web. Psychomotor learning, in some situations, required coaching techniques, which meant that the facilitator perhaps needed to hold the learner's hand to teach him/her. This handholding help the inexperienced learner be more comfortable with experiencing a new technology and its implementation.

Merrill et al. (1992) broke the barriers into three basic categories: ethical issues, legal issues, and cultural issues. This approach was an exit from the earlier focus on the mechanical issues of poorly designed equipment, lack of support, and confusion. In the last decade of the 20th century, the literature reflected a deeper analysis of the types of barriers that existed for teachers, schools, and students. Collis et al. (1996) also directed attention to the possible negative side effects of computer use across cultures. The equity issue of the gender disparity of use between boys and girls in the classroom was mentioned. Collis noted that the lack of knowledge about the future negative impact of technology on students.

Starr (1996) provided an analogous assessment of barriers in the classroom. Barriers included inequality for minorities and low-income students, lack of high-end uses of technology for primary and secondary education, as compared to higher education and the need for inexpensive connectivity and low-cost access to content that are provided on many Web sites for a fee.

Fisher, Dwyer, and Yocam (1996) directed attention to the equity issue as a barrier to the blending of technology. Besides the barriers of lack of technical support, limited funds and resources, lack of time for preparation, implementation, and review, the authors also highlighted the issue of limited access by all students to computers and the Internet. Montgomery (1996) concurred on the issue of access and inequality for minorities and low-income students. The quality of the new media culture and the effect of a highly commercialized and unregulated media were also noted by the author.

Sandholtz, Ringstaff, and Dwyer (1997) reported somewhat comparable results. The main barriers were limited access, lack of equity, potential for envy or stinginess among teachers, and a large number of technical problems. Poole (1997) noted that the barriers of inequities, such as socioeconomic level, gender, race, and lack of equal access to information based on disparities in the funding and management of different school systems were of great concern to educators.

Turkle (1997) presented a different approach to the issue of barriers. She discussed the actual role of the computer in the classroom and its impact on learning instead of focusing on the logistics and obvious causes of difficulties. This alternative perspective provided three intrinsic concerns.

The initial concern was the seduction of simulation and the possibility that computer activities might reduce students' need to question and think through problems carefully. She also wondered whether the appeal of using simulations was based on the fact that it might be easier to buy software packages that allowed students to conduct virtual experiments than to hire and fund an additional science teacher. The second barrier was the resentment that teachers felt for computer applications that served as overblown video games. The third possible problem was that the computer might produce students that were fluent users of technology rather than fluent thinkers of technology. Turkle observed a student who could use a particular software package correctly; conversely, the student could not explain why a particular situation occurred, what the ramifications were, or pass judgment on what she was learning. Turkle described her as someone who could pronounce words in a book but did not understand what they meant.

Instructors who were highly regarded and who received positive evaluations from students in a traditional classroom often found difficulty in adapting their style to a distance learning format. The following were some of the more frequent mistakes of new distance instructors:

1. Using advanced technologies when straightforward procedures would meet the requirements. Some instructors put PowerPoint slides in Internet courses when text alone would result in the same goal. While PowerPoint worked satisfactorily on fast campus networks, it often took a longer time for students using home computers with modems to download presentations. Graphics, audio, or video without a definitive purpose also resulted in frustration and a lack of learning for students.
2. Not taking time to learn the technology was another common problem. Students were more likely to use technology effectively when instructors had the knowledge to answer most of their questions and understand their concerns. By being adept at the technologies,

instructors were able to transcend the basic features and optimize the effectiveness of their courses.

3. Instructors often failed to interact with students in a timely manner and follow up regularly to e-mail and voice mail. Students felt closer associated with instructors who participated regularly, even daily, in bulletin board discussions. (Clay, 1999, Five Common Mistakes of New Distance Instructor section).

Sulla (1998) discussed the sluggish rate of successful integration of computer technology in the classroom and contended that it takes up to 7 years for teachers to successfully infuse the technology. The three stages were defined as dynamic disequilibrium, contrived equilibrium, and reflective practitioner. The difficulty and length of time involved in the implementation of technology appears to have remained steady over the past thirty years. As computers become more prevalent in the classroom, the need for a long-term perspective is essential.

Through the use of a framework that Berge (1998) developed, the literature reviewed above, along with others (e.g., Abdal-Haqq, 1995; Evans-Andris, 1996; Oppenheimer, 1997; Rice, 1995), suggested that barriers to the use of technology in the primary and secondary classroom result in three categories: academic, cultural, and technical. Little or no reference was made in the literature to the use of technology in K-12 regarding student services, legal, governance, or geographic areas. There was another barrier, a lack of technical and administrative support for teachers involved with distance education (Betts, 1998). Gender, rank, and tenured/nontenured status were not found to have significant effects on faculty participation in distance education (Betts, 1998). Faculty played an essential role in the implementation of distance education and technological change. However, despite the recent expansion of distance education programs across the United States, research indicates that many faculty resist participation in distance education (Olcott & Wright, 1995).

Importantly, the success or failure of distance education rested on the enthusiasm with which these new technologies were embraced by the faculty (Willis, 1994). The integration of new technologies into higher education was inevitable (Gilbert, 1995).

Distance education learners have a more significant role than their roles in the traditional classroom, with a greater responsibility for manipulating and directing the content of the subject. From the instructor's viewpoint, Web Based Instruction (WBI) students are the center of the learning process; they could be described as active and critical thinkers. Within the framework of learner-centered theories, the instructor's roles also must change to be a catalyst, coach, and a program manager (Leonard, 1999). French, Hall, Johnson and Farr (1999) stated,

> For students to use Internet-based materials effectively and more away from regarding the teacher as "sage on the stage," they must learn to become self-directed and to not remain passive receptors of knowledge. The ultimate goal is to increase access to knowledge and facilitate learners becoming life-long learners. (p. 10)

Faculty members are more likely to participate in distance education if inhibiting factors are eliminated by the administration and if the intrinsic benefits involved in distance education are stressed by the administration. Distance education participants would continue and increase their participation in distance education if their needs are satisfied. Faculty participation would not increase significantly unless the administration eliminated inhibitors that deter faculty from participating in distance education (Betts, 1998).

Table1

Barriers to Using CMC in the Online K-12 Classroom

Policy area	Key issues	Number
Academic	Academic calendar; inadequate course integrity/design; transferability; transcripts; evaluation process; curriculum approval process; accreditation; inequality (e.g., disabilities; gender; race); questioning the value added by technology/software; ethical issues; lack of student time; large class size; lack of teacher support for student learning to use technology	30
Fiscal	Tuition rate; technology fee; FTE's; consortia contracts; state fiscal regulations; business model; marketing; lack of hardware/software/people; sustainability and reliance on business and community support; revenue sharing with departments; competition with other business entities	15
Geographic	Service area limitations; different time zones; local versus out-of-state tuition; consortia agreements; cross-cultural issues	9

(table continues)

Policy area	Key issues	Number
Governance	Single versus multiple board oversight; staffing; existing structure versus emerging structure (e.g., forming subsidiaries for distance education); administrative support/issues; strategic planning; school scheduling; admission standards	14
Labor-Management	Compensation and workload; promotion and tenure; development incentives; intellectual property rights/ownership; faculty training; congruence with existing union contracts; lack of teacher/faculty time	29
Legal	Fair use; copyright; faculty, student and institutional liability; computer crime, hackers, software piracy, computer viruses	4
Student Support	Advisement; counseling; library access; materials services delivery; student training; test proctoring	4
Technical	Lack of systems reliability; lack of connectivity/access; inadequate amount/type hardware/software; setup problems; inadequate infrastructure; inadequate technical support; inadequate maintenance of hardware/software	67

(table continues)

Policy area	Key issues	Number
Cultural	Faculty or student resistance to innovation/new methods; resistance to change; difficulty recruiting faculty or students; lack understanding of distance education and what works at a distance; lack of shared vision/mission; cross-cultural issues; slow pace of change; lack of teachers who can model effective use; information overload	89

Note. From "Barriers to Online Teaching in Post-secondary Institutions," by Berge, 1998, *Online Journal of Distance Learning Administration*, *1* (2), para 9.

Although technologically mediated learning held several advantages and potential for educators and learners, it was not suitable or available to all learners or in all learning situations. Economic, physical, social, or learning barriers existed in schools that lacked the resources to make computer/telecommunication systems available. Those barriers denied them the advantages that technology could offer (Berge, 1998).

While the technological infrastructure was improving and access to the Internet was increasing in elementary and secondary schools, there were still significant barriers to teaching and learning. The lack of computer access, increased workload, differential individual preferences, student and teacher resistance to change, lack of student and faculty support services, and the lack of adequate training and technical support were all common problems faced by both students and teachers (e.g., Furst-Bowe, 1996; Galusha, 1997; Morrison & Lauzon, 1992).

One of the world’s foremost distance education researchers, Michael G. Moore, speculated: “The barriers associated with organizational change, change in faculty roles, and administrative structures are more critical than barriers associated with technology or pedagogy” (Moore, 1994, p.

4). Put in terms of the factor analysis reported in Table 1 and surveys conducted by Berge, changes in faculty roles would be included in the organizational change cluster. So, Berge's test was to determine whether, as Moore said,

> "Barriers associated with 'organizational change' and 'administrative structure' were more critical than "social interaction and quality concerns", which represented pedagogical issues, "technical expertise", and possibly "threatened by technology" which represented technological issues. (p. 4)

In the years prior to and following his statement, substantial research has identified the barriers that Moore (1994) addressed. Several hundred articles have been published that identify and discuss barriers to distance education. Those articles are either research reports on the barriers to distance education, or they share anecdotal experiences, lessons-learned, problems and issues that educators face when teaching and learning at a distance. Alternatively, Keegan (1986) wrote of distance education as a teaching process "which is achieved by bridging the physical distance between student and teacher by means of at least one appropriate technical medium" (p.119).

Citing Tinto (1975), Keegan (1986) hypothesized that students who fail to receive adequate reintegration measures such as electronic or telephone communication, are less likely to experience complete academic and social integration into institutional life. Consequently, such students are more likely to drop out (Sweet, 1992).

Nineteen of 69 barriers (27.5%) mentioned by the respondents in a survey by Berge (1997) indicated inadequacies in the technical area, such as lack of systems reliability, lack of connectivity/access; inadequate hardware/software; setup problems; inadequate infrastructure; and inadequate technical support.

Historically, escalating access to quality education has been one of the main justifications for the use of distance education, so it is little wonder that it is essential to online teachers that access can be provided to the broadest range of students. One of the most powerful uses of the Internet in education has been to provide an efficient way to collaborate with others using chat-rooms, list-serves, instant messaging, and other modes of audiovideo communications, either synchronous or asynchronous. Experts and educators from all over the world can become collaborators with the teachers and students in a classroom. Distance and time are no longer barriers to educational collaborations. An online teacher from Berge's (1999) survey stated,

> I think the biggest barrier we've encountered boils down to access. In past courses, we had problems because the system we were using was so busy that students could not get on when they needed to. With the growth of the Internet and the variety of service providers now available, that problem has greatly diminished. But, it has not gone away. It is now virtually impossible to dial into the university any time between about 9 a.m. and midnight. The entire modem pool is always busy. And, for some of those students we most want to reach--those in remote areas of the state--there still are no service providers within the local calling area. If we start relying more on the Web, I'm concerned that we'll compound these issues. Web access via AOL at 2400 baud is like no Web access at all. (p. 4)

Several barriers to learning and teaching at a distance could be caused by lack of access to resources and people. Possibly, the most critical barriers reported in this survey appear to be related to persons' resistance to or fear of the many changes that must take place at the individual and organizational level. Added to these fears, the lack of support for the changing roles of students and teachers provides the ingredients that often lead to significant obstacles to success in online education (Berge, 1998).

Modern distance education has two forms: asynchronous and synchronous systems. Asynchronous systems do not require a live interaction between the learners and the instructor, who could communicate through e-mail or use of a bulletin board such as Web CT and Blackboard. The instructor and the learners could discuss issues and ask questions regarding the related course of study. Asynchronous distance education, which has been extensive, is restrictive in engaging the learners (Derringer, 1999). Synchronous systems, conversely, require two-way interaction between the instructor and the learners and among the learners themselves (Barron, 1999). For many educational organizations, synchronous, two-way interactivity is considered a mandatory component of online learning (Barron, 1999, p. 30). Consequently, many educators have been researching the effects of using synchronous systems on achieving learning objectives.

In another survey done by Berge and Mrozowski (1999), 17 of 67 teachers, 25%, reported that technical barriers were a problem. Those technical barriers were the following:

1. Lack of systems reliability;
2. Lack of connectivity/access;
3. Inadequate amount/type hardware/software;
4. Setup problems;
5. Inadequate infrastructure;
6. Inadequate technical support; and
7. Inadequate maintenance of hardware/software. (para. 27)

Those barriers could be mitigated through technological methods such as electronic mail (e-mail). Computer conferencing and electronic mail e-mail could be integrated into the delivery of the course to provide the missing interactivity. Because both are essentially asynchronous, they continue to leave the student in charge of setting his or her own work times, which is a critical success factor for the distance student. It is important that the student received prompt feedback in any institutional setting, particularly in distance learning where the learner is impaired by the lack of casual contact with the teacher and other students. Concerning the fundamentals of distance education, there are three major categories.

1. What is distance education?
2. What is the systems approach, and how does it apply to distance education?
3. Distance education entails fundamental change to schools and training (Moore & Kearsley, 1996).

Substantial research has been conducted concerning whether or not technology adds to or detracts from learning (Aveling et al., 1992). Schlosser and Anderson (1994) noted that distance education literature has been dominated by comparison studies in which comparisons were made between students learning at a distance and students learning in a traditional classroom. As Eiserman and Williams (1987) suggested, distance education programs have been effective in providing educational service to those who would otherwise be unserved.

There has also been substantial research concerning barriers to distance education. Research into the technical barriers of the use of technology exists, but is in need of updating and replication. Jones and Paolucci (1997) argued that the influence of technology has been substantial. They questioned the untested educational quality of technology by educators.

Prior to 1994, computer and communications technology had not expanded as rapidly as it has today. The World Wide Web was still in its infancy. Computers in schools that had them were mainly Macintosh computers with small memory and storage capacities. Digital cameras were not in the general classroom. Global Information Systems, or GIS units, were only for the military and were not readily available to the public. Digital graphics on computers were blocky and rudimentary compared to current standards. CD-Rom drives were not part of a standard computer. Display in a classroom consisted of blackboards, flip charts, poster board, and film and overhead projectors. Today, the modernly equipped classroom may contain digital still cameras, digital and analog video cameras, computers more sophisticated than NASA has used to put men on the moon, Global Positioning Satellite (GPS) reading units and other data acquiring technology, Personal Digital Assistants (PDAs) and other wireless communication devices.

Today, classroom computers may be found with CD-Read and Write drives, DVD-Read and Write drives, video cameras, microphones, multi-gigabyte hard drives, memory sticks, and compact flash card readers. They may operate with a speed in the 2.4 gigahertz range and can display steaming audio and video. The technological ramifications concerning all of these new educational tools can be intimidating to a new or experienced teacher. Teachers need to let students explore technology involved with learning new knowledge. Berge and Collins (1995) emphasized the role of the distance education teachers in encouraging learners to interact with the learning environment, not limiting themselves to the content of the given subject matter.

Students have access to a blend of old and new technology, but educators often lack the professional development and content resources necessary to fully leverage the appropriate technology in the classroom. The main barrier to technology integration in technologically advanced schools has been the lack of professional development and technical support (CEO Forum, 1997). There is some evidence that the success of distance education in schools depends largely on the effectiveness of the teacher, and that this has in turn depends on the teacher's knowledge, skills, enthusiasm, and commitment to innovation (Moore & Thompson, 1990).

Although technology has been leveraged in some classrooms, lack of on-site technical support in technology-ready schools might discourage teachers use of technology to its fullest potential.

The advanced technologic tasks involved in today's new learning environment have developed into the following tasks: (a) accessing the Internet; (b) utilizing browsers and search engines; (c) e-mailing; (d) tabulating student performance in a spreadsheet; (e) designing certificates in a publishing program; (f) writing parents using word processing; (g) recording attendance in a data base; (h) installing, and protecting software; (j) demonstrating concepts through the use of digital projectors; (k) communicating via an online site with digitized photos, voice, video, music, animation, and scanned documents; (l) burning a compact disc (CD) or digital video (DVD); (m) storing and re-accessing files, correlating activities with standards and inserting into a lesson plan template; (n) e-portfolios; and (o) considering ethical and legal implications.

These tasks could provide new skill and pedagogical challenges for today's educators. Experiences from the University of Pittsburgh's PT3 grant project showed that many of the following factors increased the likelihood of technology skill development in educators and classroom integration: on-site/on-call support, intrinsic/extrinsic rewards, collaboration in a sustained learning community, increased student interest, creativity, equipment, mini-grants, effort, attitude, timely repairs, stipends, Web resources, demonstrations, workshops, struggles, reflection, peer modeling, and successes. Some of the barriers found to impede technology growth were time; firewalls; lack of hardware, supplies, and manuals; breakdowns; ineffective professional development programs; failure to see technology potential; lack of confidence, training pupils, underutilization, and isolation. Even highly experienced technology-using teachers have become preoccupied with trouble-shooting hardware and software problems. This trouble-shooting siphons away valuable time and attention from the students. To support teachers and ensure consistent access to the technology already in their schools, technology-ready schools must invest in responsive, reliable technical support (CEO Forum, 1997).

Gender, Age, Teaching Experience, Technology Experience

Bates (1995) maintained that access is the most important criterion for deciding which technology fits a certain program. In relationship of the learner to that access, adequate contact and interaction with the instructor, tutors, and fellow students has been crucial. The Internet has provided opportunities for the necessary interaction and has been easily accessible. However, it was important to consider that the learner must possess a certain level of computer skills in order to take the course. Some courses can be more demanding than others, so certain skills that are pre-requisites, such as the ability to upload, download, and unstuff compressed files, among others. For these not familiar with those applications, the course could present quite a challenge. Depending on the individual and his/her level of skill and self-efficacy, it could affect the decision to take a particular course (McIntyre, 2000).

Gender disparity exists in educational environments despite conscientious attempts to equalize opportunities and outcomes. Sex differences persist in attainment of careers in the related fields of mathematics, science, and technology (AAUW, 1998; Beisser, 1999-2000; Benston, 1988; Meece & Eccles, 1993; Roblyer, 2000; Shashaani, 1993; Sutton, 1991; Turkle, 1988).

Learning on the Web, either formal or informal can be user-unfriendly because it requires a certain level of computer skills, so those not at the level required might experience difficulty. Technical problems can be extremely frustrating and can interfere with the learning process (McIntyre, 2000).

Elsie L. Brumback, the former director of instructional technology for the North Carolina Department of Public Instruction, found that she was always doing staff development because the teachers coming out of the universities were not adequately trained. “If they are not adequately trained, they will certainly face technical challenges or barriers when they begin teaching” (Brumback, 1999, p. 1). The professional development presented to them will have to involve many forms of technology. As technology makes advances, additional barriers need to be addressed and overcome.

Any reasonable vision of the near future must be bound by two distinct constraints. The first is technological. The second, more fundamental, is how can this technology be meaningfully used? To enable this technology to be meaningfully used involves professional development to help teachers stay aware of technological advancements. Distance education can help bridge this expanse.

In 1996 President Clinton expressed a clear concept for improving education then and through the next century through computer technology in American schools. The President called for broadening educational technology objectives to include not only hardware and connectivity, but also digital content and professional development. The following were the Four Pillars of his Technology Literacy Challenge:

1. Hardware: All teachers and students will have access to modern multimedia computers in their classrooms.
2. Connectivity: Every classroom will be linked to the information superhighway.
3. Content: Effective software and on-line learning resources can expand students' learning opportunities.
4. Professional Development: All our nation's teachers will have the training and support necessary to help students learn how to make use of computers and the Information Superhighway. (CEO Forum, 1997)

With regard to gender, studies indicated that women have a more significant negative perception about computer-based technology and stronger preferences for traditional methods than men do. However, gender could be irrelevant to these results; rather, women's experiences may have changed their perceptions of learning. Numerous research studies have found that both men and women have had successful experiences with computer use and feel confident in working with technology (Proost, Elen, & Lowyck, 1997). Female participation in information technology courses has been low (Moffatt, 1997). Depending on the individual's level of skill and self-efficacy, it could affect his/her decision to take a particular course (McIntyre, 2000). During the last few years, studies have shown that women have negative preferences about computers, whereas men seem to feel powerful in relation to the computer (Proost et al., 1997). Various factors have contributed to this positive male attitude. One is that males traditionally receive more encouragement from parents to pursue computing activities and careers than females. Another factor is that males are much more likely to have access to computers. According to Huang et al. (2003),

> Male teachers had better instructional technology ability than female (male mean=2.8269, female mean=2.3208). Therefore, it is suggested that we should encourage female teachers to use instructional technology to assist teaching, or take and participate in instructional technology study or training. (p. 1)

Evaluative surveys of the study patterns of female distance learners in direct relation to questions of time and space in the home have been pursued sporadically, revealing considerable barriers related to traditional domestic roles and responsibilities. Effeh (1991), in a study of the habits of female distance learners in Nigeria, concluded that maternal responsibilities, family and home chores, and the inadequacy of many homes as a major study base for the homebound woman were among the barriers that the female distance learner had to overcome. A qualitative research study among women's studies distance learners in the United States revealed that little change occurred in the domestic burden of women learners.

> The women had little control over study schedules within their own homes. Women who are mothers of young children usually study late at night while the other women fit study activities around both daytime and evening household tasks . . . they remained seemingly grateful that distance education permitted them to adapt their study schedules around family responsibilities. (May, 1994, p. 2)

A study by Scheffler and Logan (1999) identified computer competencies as important for teachers. A Delphi panel developed a survey instrument of 67 computer competencies. Fifteen of those competencies related to networks, the Internet, and e-mail. Survey responses came from 437 technology coordinators, teacher educators, and secondary teachers. The most important computer competencies dealt with the integration of computers into curricula and the use of computers in instruction. The use of networks and the Internet for research and the use of e-mail were rated important, but they ranked 22nd and 23rd in the list of 33 competencies that were rated *Important* or *Very Important* (Scheffler & Logan, 1999). This study investigated the interrelationship between gender, age, teaching experience, and technology experience in regard to technical barriers associated with professional development as related to a distance education system-based course. The technical proficiency and effective use of the technology by faculty members becomes a key enabling factor in maximizing the potential use of learning technologies. The number of staff adopting technologies in their teaching relates strongly to their technical experience and proficiency (Jacobsen, 1998; Lan, 2001).

Huang et al. (2003) observed,

> About the age factor, elder teachers had less instructional technology ability. Younger teachers were used to technology environment, but elder teachers weren’t. So, it is suggested that we should encourage elder teachers to use instructional technology to assist teaching, or take and participate in instructional technology study or training. (p.1)

Gender and age might be irrelevant to the results in that the experiences of those participating contribute to the perceptions of technical barriers. Research studies have found that both men and women have had successful experiences with computer use and feel confident in working with technology (Proost et al., 1997). Aldhafeeri (2000) related the differences in male and female learning to social experience, not gender type. Teaching experience might also be irrelevant, in this case, because technology advances at such a rapid pace. All participants could lack in hands-on experiences with the new technology, which would lead all of the participants to experience similar technical barriers.

Technological experience could possibly be more of a factor in overcoming technical barriers, depending on how much experience the participant has had with the associated technology and what extraneous factors have not been encountered. Berge and Muilenburg's (2003) research findings reported, "It was disappointing that more persons had not responded who had no experience, or interest perhaps, in distance education" (p. 14). If subjects had more interest in technology, they might have responded instead of being indifferent to Berge's (1998) survey.

Assumption

Today it is less an assumption, more of a presumption, that technology has become part of the everyday classroom, as well as ubiquitous in society. Computer application in education has continued to grow due to developments in software and hardware, and expanded research in applicability (Simon, 1993). Change has become so rapid in computer technology that much of today's software and hardware becomes obsolete within 9 months of its introduction to the public.

Statistics and Numbers

In February 2003, a total of 24 states required schools or districts to set aside time for professional development. Additionally, 44 states funded professional development, and 33 of those states provided professional development funds to all districts in the state (*Education Week*, 2003b). According to the U.S. Department of Education, National Center for Education Statistics, Early Estimates of Public Elementary and Secondary Education Statistics: School-Year 2001-02, April 2002, there were 90,640 public schools, with 47,576,000 students being taught by 2,988,000 teachers (*Education Week*, 2003a). In the year 2000, of public school teachers, 99% participated in at least one of the professional development activities. Utilizing the figures above for teachers and multiplying by the percentages from the National Center for Education Statistics (2003), that translates into 2,958,120 teachers who participated in professional development. Of the selected activities, teachers most commonly attended those addressing state or district curriculum and performance standards. In general, teachers typically reported spending 1 to 8 hours in a single area of development during 2000. During the same year 2,748,960, or 92%of teachers, participated in one of the collaborative activities, the most common of which was regularly scheduled collaboration with other teachers, which accounted for 69% or 2,689,200. Approximately 34%, or 1,015,920, of all public school teachers participated in this activity at least two to three times a month. The National Center for Education Statistics does not currently report or collect data relating to professional development as related to distance education.

Summary

The necessity for high-quality professional development programs for teachers has been steadily growing, especially for those teachers who live and work in rural, isolated areas. Teachers who live beyond the normal service areas of institutions of higher learning deserve an equitable opportunity to participate in professional development programs. With rising access to the Internet in all public schools and homes, online courses of professional development could help bring educational opportunities to teachers in all areas of the country. Insufficient research has been conducted to measure and analyze the technical barriers to professional development as related to distance education when applied to the population of teachers in the United States. Researchers have disputed cohort findings, which might relate to the date during which the studies were conducted. The later studies might have found more technical barriers because the whole technology structure has become more complicated. Most of the research failed to focus on technical barriers and focused rather on any barriers associated with professional development as related to distance education. When professional development was included in the equation, similar results could be expected. In general, the review of the literature provided differing points of view about the importance of technical barriers, and could imply that other factors were more important to the success of professional development as related to distance education.

CHAPTER 3

METHODS AND PROCEDURES

Distance education has become a prominent trend; thus, many educational institutions must become aware of its importance in enhancing professional development. According to French et al. (1999), self-directed adult learners may learn best through Web-based instruction. Professional development has also become an ongoing process for teachers because of the individual state requirements involved in keeping teaching certificates updated. The 24-hour-a-day, 7-days a-week professional development distance education course availability is enticing to many self-directed teachers.

This section describes the methods and procedures to be used in this study, beginning with the identification of the subjects who would participate in the study. This is followed by a description of the research design, which established the variables intrinsic to the study. Instruments used in the are then described. Finally, the procedures to collect data, statistical analysis, and the questions to be answered are explained.

Participants

The participants of the study were limited to those participating teachers in the Web World Wonder Environmental Science professional development course in the state of Florida. There were course workshops offered and presented by Professor Laurie Molina, of Florida State University, and Kim Bowman, Educational Program Director Instructional Television Section, Florida Department of Education. The purpose of the workshops was professional development in relationship to the Web World Wonders Environmental Science Web site in which distance education was incorporated. The total number of teachers participating in the workshops was 34.

This study requested the participants to answer a series of documents that were part of the Concerns Based Adoption Model developed in 1975 by the Research and Development Center for Teacher Education, The University of Texas at Austin. The documents were sent by e-mail to those participants who attended the above weeklong workshops at Marathon Island. The first document was an introductory letter explaining this study and asking for the participants' help in determining technical barriers for the Web World Wonders professional development course (see Appendix D). The second document was a consent form that they returned via email showing that they were willing to participate in this study (see Appendix A). The third document was a demographics data sheet (see Appendix E). A Stages of Concern Likert style 35-question instrument was the fourth document (see Appendix F). This questionnaire was not a Likert scale document in that there were eight possible selections. The zero selection was for responses that were nonapplicable, hence the eighth choice instead of the odd number of responses in a normal Likert scale. Because the document was sent via e-mail, the scale was completed by bolding the desired response instead of circling it. The last document, the Levels of Use interview questionnaire required the most time to complete on the participants requirement (see Appendix G). The *innovation*, which is replaced throughout this study with Web World Wonders, was the Web World Wonder Environmental Science professional development course in the state of Florida. The interview questions were arranged in a branching environment. If the first question answered was *yes*, then the next question was under the *yes* category of the document. If they answered *no* to the first question, they moved to the *no* category of questions until finished with that section.

A demographic information survey was completed by each of the participants in this study. Answers were graphed and compared to show the data. It was understood that the data collected might not be fully representative of all teachers in Florida because the data were from a small sample of participant volunteers in a select learning community in Florida. Thirty-four teachers participated in the Web World Wonders project. Approximately 20 teachers were enrolled in any one of four professional development workshops offered by Florida State University and the Florida Department of Education. Those teachers constituted the participants of the study. The information acquired was limited to those teachers who volunteered to participate in the study. It was more feasible and convenient to select a group of individuals in one workshop than to select all those who participated in all of the workshops. The individuals were selected based on their cooperation.

Ethical Standard

Participation in the study was voluntary, and no compensation was granted to the participants. The subjects in this study were not exposed to any unreasonable discomforts, risks, or violations of their human rights. However, an approval to conduct this study was requested and granted from the Institutional Review Board for the protection of Human Subjects in Research at the University of North Texas (see Appendixes A and B). A brief introduction concerning the study was provided to all subjects, and as required by the review board, all participants signed an Informed Consent form.

Research Design

This study utilized a case study design. Case study research was used to intensively study the background, status, and environmental interactions of Web World Wonders Environmental Science as a specific learning community in Florida. This study was an in-depth investigation of a selected segment of Web World Wonders, which resulted in a well-organized picture of that unit. Another characteristic of this study was to examine multiple variables and conditions that affected the Web World Wonders unit. The participants were teachers who took part in a professional development course taken from the Web World Wonders Environmental Science learning community, sponsored by the United Star Distance Learning Consortium and under the auspices of Florida State University and the Florida Department of Education.

Instrumentation

Instruments used in this study were part of the Concerns-Based Adoption Model (CBAM), which assumed that change is a highly personal and lengthy process, one that affects individuals differently. The model hypothesized two dimensions along which individuals grow as they become more familiar with and sophisticated in using innovation: Stages of Concern About the Innovation (SoC) and Levels of Use of the Innovation (LoU). The Stages of Concern Questionnaire (SoCQ) was validated over a 3-year period, preceded by 10 years of measurement development and research (Fuller, Parsons, & Watkins, 1973). The Stages of Concern Questionnaire consisted of 35 questions on a Likert-type scale scored from 0 through 7. Although there were eight choices on the scale, the 0 choice was for responses that were irrelevant to the participant. The SoCQ was developed to assess the seven hypothesized Stages of Concern About the Innovation, in this case, the Web World Wonder professional development course.

The second component of the CBAM was the Levels of Use (LoU) of the Innovation interview. The LoU described the behavior of individuals as they became more familiar with and more skilled in using the innovation, Web World Wonders professional development course. Each of the eight identified Levels of Use focused on behavior that was characteristic of the innovation user at a particular stage of development (Hall et al., 1975).

> During the two and one-half years of research related to measuring Stages of Concern about the Innovation, the 35-item Stages of Concern Questionnaire was developed. In a one-week test-retest study, stage score correlations ranged form .65 to .86 with four of the seven correlations being above.80. Estimates of internal consistency (alpha coefficients) rage from .64 to .83 with six of the seven coefficients being above .70. A

series of validity studies was conducted, all of which provided increased confidence that the SoC Questionnaire measures the hypothesized Stages of Concern. (Hall et al., 1975, p. 20)

Data Collection Procedures

All of the participants took the course on a voluntary basis to learn more about the Web World Wonders Environmental Science Web site. Each of the participants traveled to the workshop site and stayed for 5 nights in an area motel on Marathon Island in the Florida Keys. Each class day started at 8:00 a.m. and broke for an hour lunch, then continued until 5:00 p.m. Participants learned how to use a digital camera, GPS readers, and Arcview software for analysis of data. Participants were administered a set of documents via e-mail. The same instruments were used in all cases. The self-reported information contained in the demographic survey was reduced to tables and figures to determine whether a pattern would emerge when compared to the data collected from the Levels of Use and the Stages of Concern instruments.

Data Analysis

Several techniques were used to analyze the data. Information, or data collected from the participants, was plotted into bar and line graphs. After these distributions were determined, conclusions were made. Demographic data were converted to a spreadsheet, using Excel, with the participant numbers as the header and the categories as the first vertical column. A numerical one was placed in each column under the corresponding participant number, indicating that their response was in that category. A total column was the last column on the right of the spreadsheet. The numerical ones were summed in the total column to depict how many of the participants responded to that category.

For the Stages of Concern questionnaire, data were evaluated by the researcher using a response sheet categorized into seven stages. Five questions from the 35 questions comprised each stage. Each question was rated from a 0, or nonapplicable, or a 1 to 7, with 1 being a low stage of concern to a 7 being a high stage of concern. The raw score for each scale was simply the sum of the five statements on that scale. Once the seven raw scale scores had been obtained, it was necessary to convert these to percentile scores to interpret them. The total score, which was simply the sum of the seven raw scale scores, was also converted to a percentile scale. The percentile scores were then tabulated to show how they compared to four Stages of Concern: nonuser, inexperienced user, experienced user, and a renewed user. Figure 8 shows the typical user levels.

Once collected and processed, Stages of Concern Questionnaire data were interpreted at several different levels of detail and abstraction. The simplest form of interpretation was to identify the highest stage score. A more detailed interpretation was developed by examining both the high-stage score and the second highest stage score. Analyzing the completed profile developed the most sensitive interpretation. After examining the percentile scores for all seven stages and interpreting the meaning of the different highs and lows and their interrelationships, a rich clinical picture developed.

Levels of use are discrete states that represent observably different types of behavior and patterns of innovation (Hall et al., 1975). These levels characterize a user's development in acquiring new skills and varying uses of the innovation, in this case Web World Wonders. Levels encompassed a range of behaviors and were defined by seven categories: knowledge, acquiring information, sharing, assessing, planning, status reporting, and performing. Questions were designed to indicate a level of use in each category, and then an overall level of use value was given the participant based on the answers to the questions. Specific answers to the questions exposed technical barriers to the professional development as related to a distance education system-based course that was integral to the Web World Wonders Environmental Science Web site program.

Innovation Adoption

In order to determine the level of adoption and sophistication in the Web World Wonders (WWW) Environmental Science professional development program, the investigator utilized interviews and surveys completed by the participants. The Levels of Use of an Innovation (LoU) is a dimension of the Concerns-Based Adoption Model (CBAM) (Hall, Wallace, & Dossett, 1973), utilizing a focused interview that describes the behaviors of individuals as they become more familiar with and skilled in using an innovation. According to Hall et al. (1975), the premise of this research methodology is that innovation adoption is a process rather than a decision point and is experienced individually rather than collectively. Further, the LoU describes users as they progress from familiarization to increased sophistication with an innovation. A list of specific questions used to guide the interview and to ensure that sufficient responses had been gathered to adequately determine levels of functioning were used (see Appendix F). For this study, interviews were conducted via e-mail, which streamlined the analysis of data because the information was already in a document format so that data could be analyzed efficiently. Investigators, seeking to discover and document change over time in educational settings, have effectively used this type of research design.

The Level of Use of an Innovation identifies eight discrete levels of functioning, which focuses on behaviors that are characteristic of the innovation user at a particular stage of development. In addition, each level is further divided into seven subcomponents or categories, which describes key performance indicators while using an innovation. Interviews were rated, by the evaluator, using the CBAM rating instrument or framework (see Appendix G).

The Stages of Concerns questionnaire was conducted as an e-mail interview with 19 out of the 34 teachers in the cohort group using the innovation, the Web World Wonders Environmental Science project. The questions were taken directly from the CBAM interview so that the validity and reliability remained constant throughout the process. The interviews were coded using the CBAM guidelines and charted to determine the stages of concern.

Description of the Innovation

The innovation, the Web World Wonders Environmental Science project, provided a discourse in the environmental science community for classroom teachers in Grades 4 through 12, to become more proficient in the use of technology while furthering their knowledge of environmental science. This Engaged Learning Community had two distinct, yet intertwined, stages: Web World Wonders 1 and Web World Wonders 2.

Web World Wonders 1 was the stage of physical technological placement of live still cameras in environmentally sensitive areas of Florida, for the purpose of observing flora and fauna. Content development by 11 teachers from Monroe County School District and John M. Sexton Elementary School was to follow. This was an Engaged Learning Community that worked together for a year and a half, utilizing the discourse models, e-mail, discussion board, technology (digital cameras, handheld global satellite positioning reader units) and curriculum content on environmental science to provide content such as lesson plans and student work. Web World Wonders 2 took the materials and content, from Web World Wonders 1 and developed professional development as related to a distance education system-based course (http://webworldwonders.firn.edu).

CHAPTER 4

ANALYSIS OF DATA

Introduction

The first purpose of this case study, which paralleled the first question raised in chapter 1, was to identify technical barriers that impact the effectiveness of professional development as related to a distance education system-based course in a selected learning community within the United Star Distance Learning Consortium, more specifically known as Web World Wonders. Question 1 was What technical barriers are detriments to professional development as related to a distance education system-based course as identified in the Web World Wonders learning community? This case study utilized information gathered from a group of teachers who participated in ongoing professional development in the Web World Wonders Environmental Science learning community in the state of Florida. Those 4th-through 12th-grade teachers participated in the process of learning to use varied technologies for teaching, utilizing distance education while incorporating information derived from the Web site http://webworldwonders.firn.edu.

The second purpose of this case study was to provide solutions in overcoming technical barriers to professional development, as related to a distance education system-based course. This second purpose paralleled question 2 in chapter 1. Question 2 was How could significant time lost to teaching by inadequately trained teachers using innovative technology be reduced as identified in the Web World Wonders learning community? These solutions could help teachers in other learning communities that might also face technical barriers in technologically advanced classrooms. The findings have been reported by the first and second purposes of the study.

Additional findings have been reported for the participant demographics and the percentage of technical barriers reported to answer the third question raised in chapter 1. Question 3 was What are the significant effects between; age, gender, technology experience, years of teaching experience, and technical barriers to professional development as related to a distance education system-based course as identified in the Web World Wonders learning community?

Description of Participant Demographics

Participants were asked to self-report their demographic information on the CBAM form. The population ($N = 19$) consisted of both males and females and ranged in age groups from 20 years to 69 years old, with a 10-year span in each group. The median age group was 40-49 with that age group comprising 21.05 % and having 4 participants. The participants had teaching experience ranging from 1 year to 29 years. Their technical expertise ranged from a non-user of technology to an expert in technology usage.

The percentage of technical barriers reported by gender and the percentage of participants are indicated in Table 2. The percentage of gender was almost equal, with the 10 female participants comprising 53 % of the group. The 10 females represented 56 % of the reported technical barriers, compared with the 9 males (47 %) of the participants, who had 44 % of the responses.

Table 2

Percentages of Technical Barriers and Gender

Gender	Male	Female
Percentage Reporting Technical Barriers	0.44	0.56
Percentage of Participants	0.47	0.53

Eleven technical barriers, along with 3 nontechnical barriers, use of software, lack of support by administration, and permission to place the camera at a remote sight, are shown in Figure 1. Seven of the female participants related that the main technical barrier to using the site was that the server was out of commission or that the camera could not be accessed from the classroom. Three male participants related the same barrier. Six females and 3 males said that using the GPS reader was a technical barrier. Five females and 1 male related that digital camera use was a barrier.

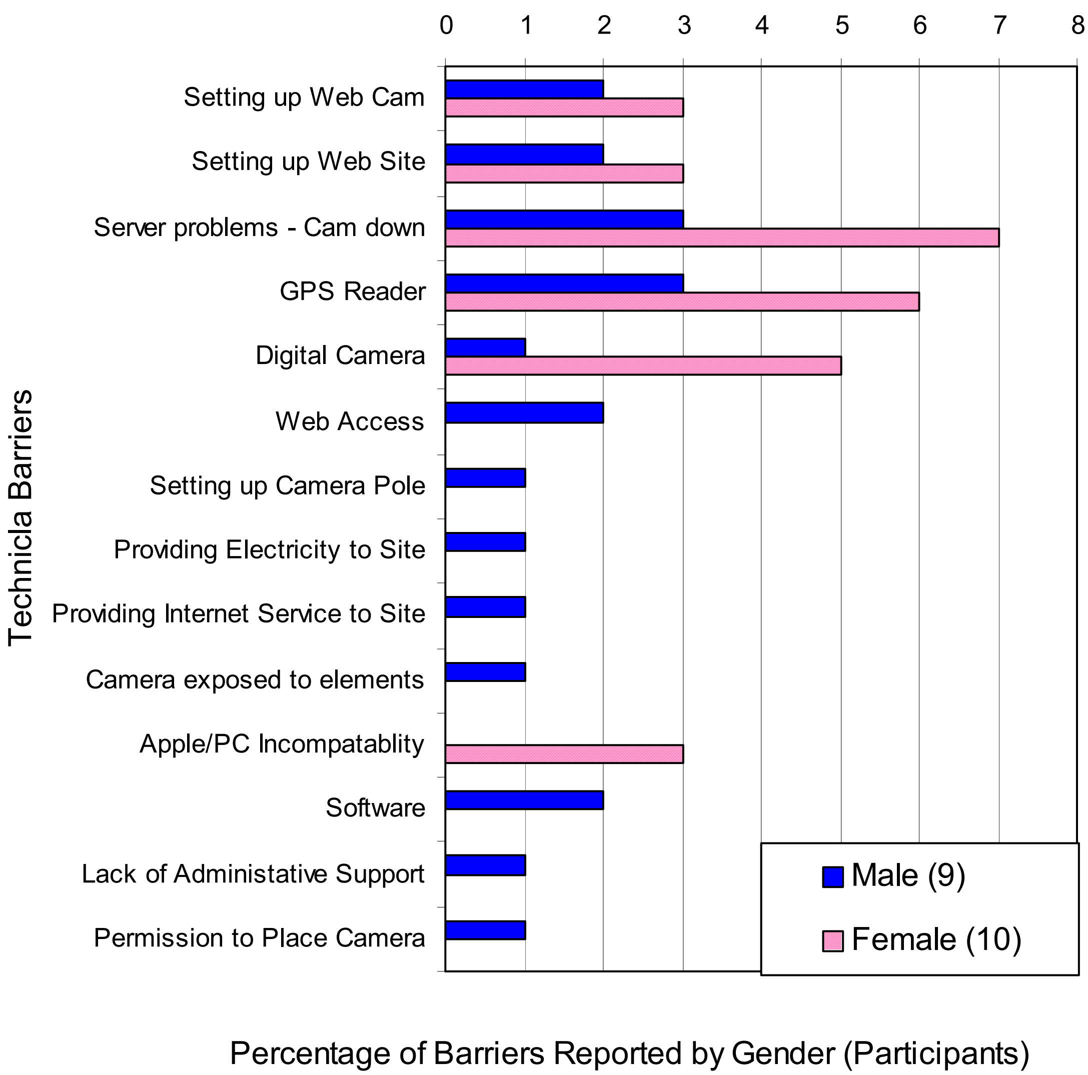

Figure 1.

Technical Barriers by Gender.

The percentage of technical barriers, reported by the participants and the percentage of participants according to age group, is shown in Table 3. The age group 60-69 had only 1 participant. Two groups that 5 participants each, 50-59 and 30-39, and two groups had 4 participants each, 40-49 and 20-29. The 50-59 age group made up 33 % of the participants.

Table 3

Percentages of Technical Barriers and Age Group

Age groups in years old	20-29	30-39	40-49	50-59	60-69
Percentage Reporting Technical Barriers	0.21	0.29	0.15	0.33	0.02
Percentage of Participants	0.21	0.26	0.21	0.26	0.05

There were 11 technical barriers, along with 3 nontechnical barriers, as indicated in Figure 2. The 3 lower barriers of the figure indicate nontechnical barriers. Ten participants stated that the server problem and the camera being unusable from the classroom were technical barriers. The second highest frequency of participants concerns was in using the GPS reader. The participant who related the most technical barriers was a male in the 50-59 year old group.

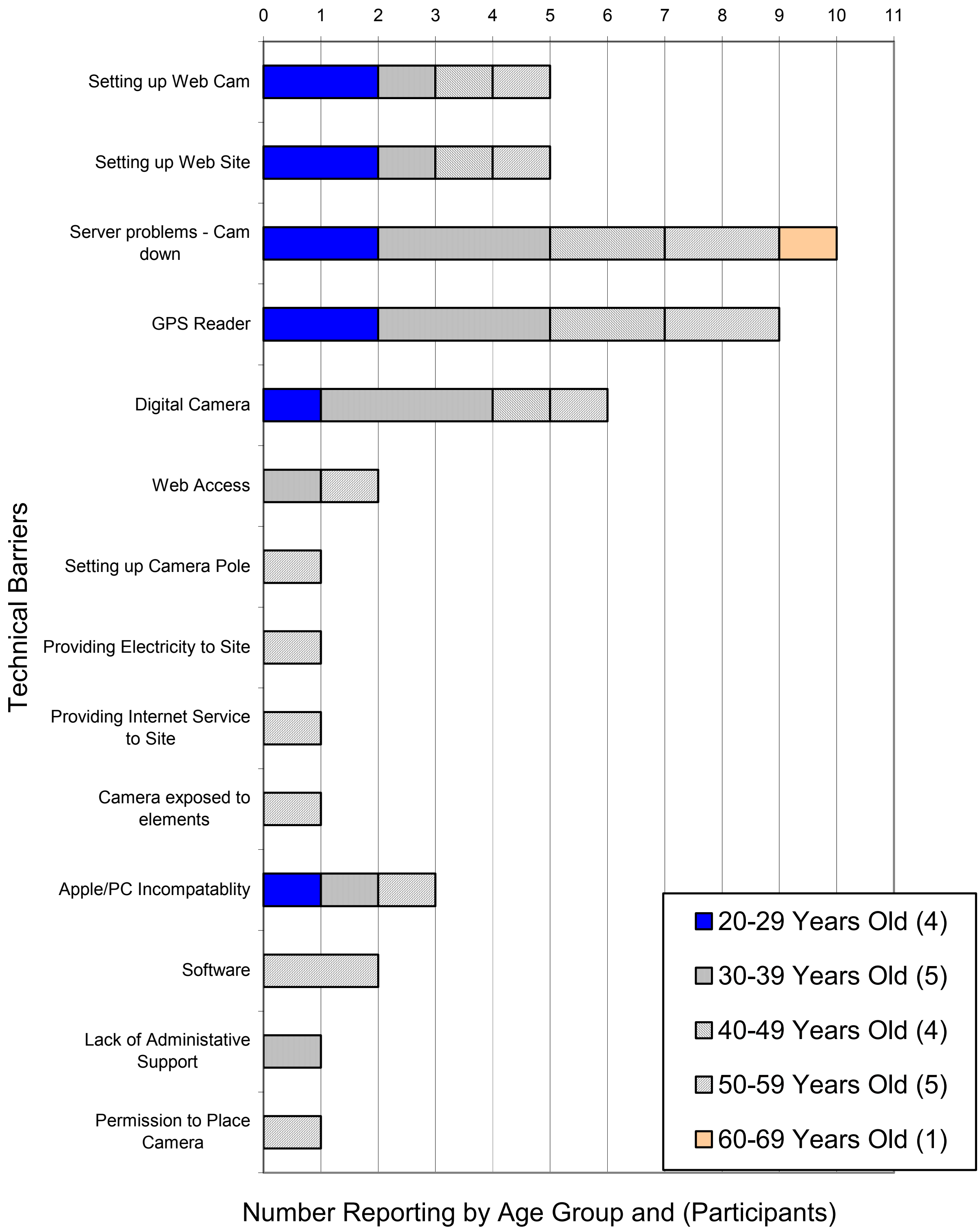

Figure 2.

Technical barriers reported by age group.

The percentage of technical barriers reported by teaching experience and the percentage of participant responses are reported in Table 4. The largest teaching experience group was the 1-10 years experience group, with 13 participants (68 %) who reported 65 % of the barriers.

Table 4

Percentages of Technical Barriers and Teaching Experience

Teaching experience	1-10	11-20	21-30
Percentage Reporting Technical Barriers	0.65	0.17	0.19
Percentage of Participants	0.68	0.21	0.11

There were 11 technical barriers, along with 3 nontechnical barriers as indicated in Figure 3. The 3 lower barriers shown in Figure 3 indicate nontechnical barriers. Ten participants related that the server problems and the camera being unusable from the classroom were technical barriers. The second most often reported technical barrier was using the GPS reader, followed by using the digital camera. All three groups related the server barrier, whereas only the two less experienced groups reported that using the GPS reader and using the digital camera were technical barriers.

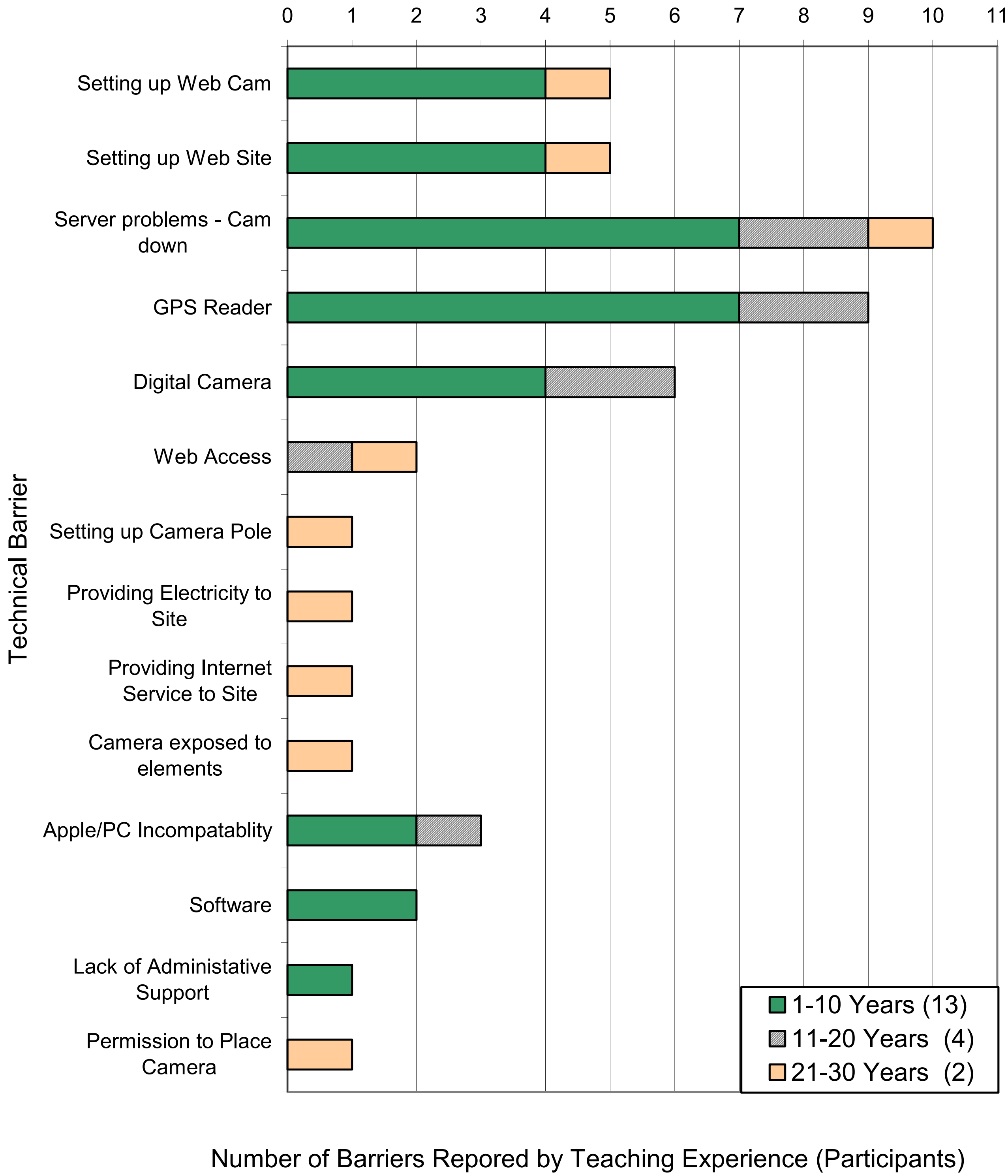

Figure 3.

Technical barriers by teaching experience.

The percentage of technical barriers reported by the participants and the percentage of participants according to technical experience are indicated in Table 5. Eight of the participants (42 %) were rated at the intermediate level in technical experience. The next largest group, 7 participants (37 %) were at the expert level.

Table 5

Percentages of Technical Barriers and Technology Experience

Technology experience	Non-user	Novice	Intermediate	Expert
Percentage Reporting Technical Barriers	0.00	0.19	0.29	0.52
Percentage of Participants	0.05	0.16	0.42	0.37

There were 11 technical barriers, along with 3 nontechnical barriers, as reported in Figure 4. The 3 lower barriers of Figure 4 indicated nontechnical barriers. As shown in Figures 1, 2, and 3, the technical barrier most often reported was the server problem and the camera being unusable from the classroom. The second most often reported technical barrier was using the GPS reader at nine responses, followed by using the digital camera, with six responses. Three of the four groups related the above barriers, but the Non-user group reported a barrier in the nontechnical category.

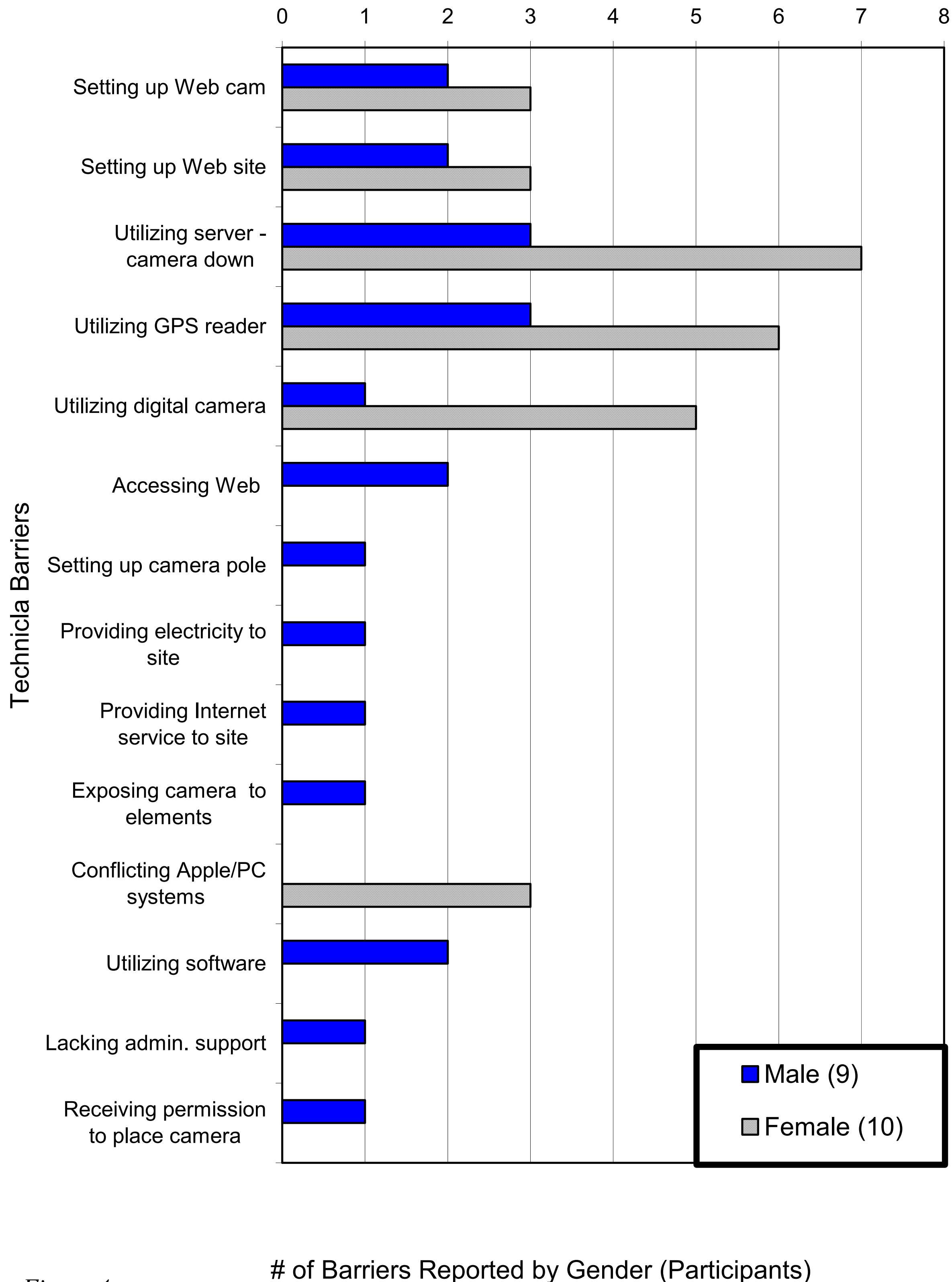

Figure 4.

Technical barriers by technical experience.

Findings

Eight discreet Levels of Use are distinct states that represented observably different types of behavior and patterns of innovation (Hall et al., 1975). These levels characterize a user's development in acquiring new skills and varying uses of the innovation. Levels of Use encompasse a range of behaviors and has been defined by seven categories: knowledge, acquiring information, sharing, assessing, planning, status reporting, and performing. The questions were designed to indicate a Level of Use in each category. An overall Level of Use value was given the participant based on the answers to the questions. Table 6 indicates the criteria for each level.

Table 6

Levels of Use of the Innovation Scale

Scale Points	Level of Use
0	*Non-Use*: The user has little or no knowledge of the innovation.
I	*Orientation*: The user has acquired or is acquiring information about the innovation.
II	*Preparation:* The user is preparing for first use of the innovation.
III	*Mechanical Use:* The user is engaged in a stepwise attempt to master the tasks required to use the innovation.
IVA	*Routine:* The user has stabilized the use of the innovation, but gives little thought to improving the innovation use.
IVB	*Refinement:* The user varies the use of the innovation to increase the impact on clients within immediate sphere of influence.
V	*Integration:* The user is combining own efforts to use the innovation with related activities of colleagues to achieve a collective impact on clients within their common sphere of influence.
VI	*Renewal:* The user reevaluates the quality of use of the innovation seeking major modifications and examining new developments in the field.

Note. From " Measuring Levels of Use of the innovation: A manual for trainers, interviewers, and raters," by Hall, G., Loucks, S., Rutherford, W, & Newlove, B., 1975, p. 8

The Levels of Use of Web World Wonders is reported in Table 7 for the 19 participants. The range of the participants across the levels was consistent with the length of time they had been involved with Web World Wonders. Two participants were at the Non-use level, and those 2 had just arrived at the workshop. Six participants each rated level II Preparation and level V Integration. The 6 at level II had been involved with Web World Wonders for a weeklong workshop before this session. Those at the Integration level had been involved for more than 2 years.

Table 7

Levels of Use Synthesized Data From all 19 Participants

	Levels of use for participants								
Participants	0	I	II	III	IVA	IVB	V	VI	
2	2								Non-Use
1		1							Orientation
6			6						Preparation
3				3					Mechanical Use
1						1			Refinement
6							6		Integration
19									Total Participants

Four Stages of Concern, as indicated in Figure 5 are shown for comparison in relation to the 19 participants. None of the user lines matched the participants. The lines for the participants were skewed upward for the Collaboration stage of concern in that 68 % of them ranked at or above the 80th percentile and 21% were above the expert user stage for Consequence. Fifty-eight percent of the participants were above the expert user Personal stage. At the Awareness stage, 89 % of the participants were above the expert or renew user stage.

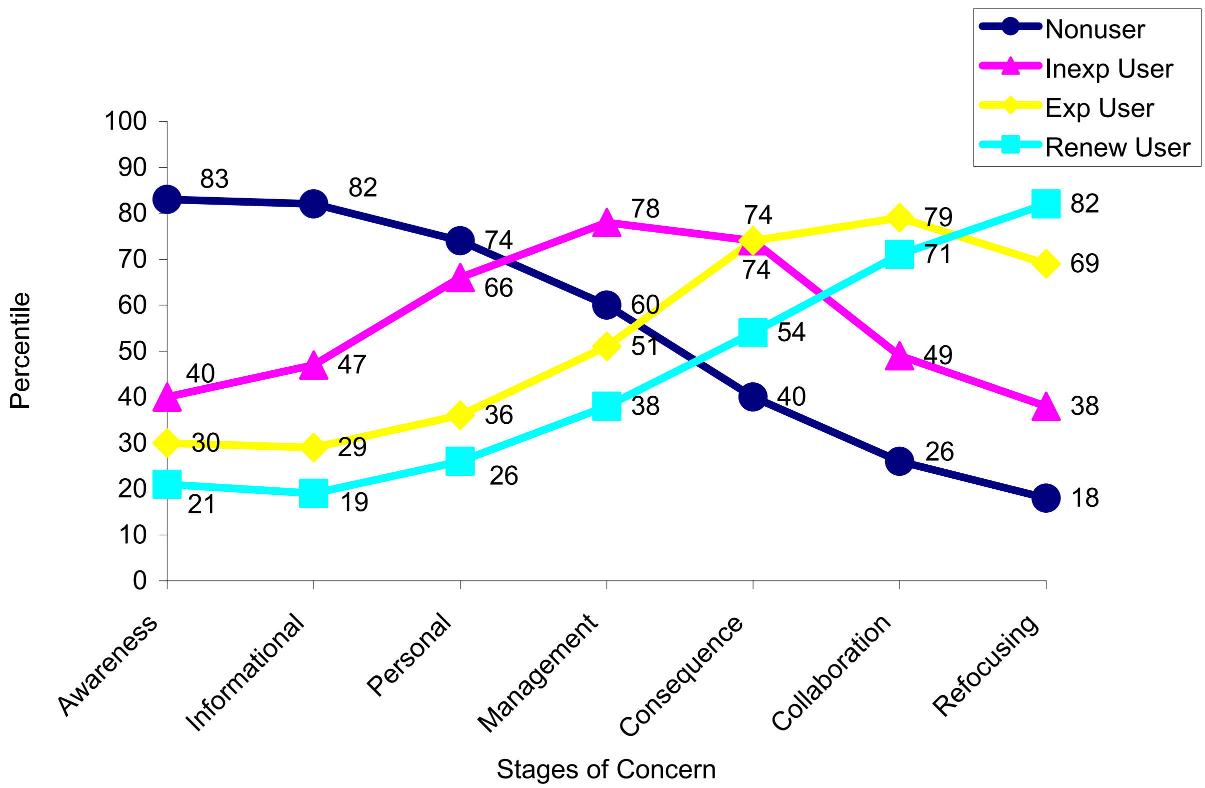

Figure 5.

Stages of concern showing standard patterns for four stages of concern.

Stages of Concern for participants are shown in Table 8. Ten participants were at the Collaboration level, but the next highest frequency of participants was 5 at the Awareness level.

These figures also relate to the length of time each participant had been in the Web World Wonders program. The shorter the time involved, the lower the Stage of Concern would be expected to be. In contrast, the participants involved with the program the longest had higher Stages of Concerns. It might be noted that since this project was highly collaborative, 10, or over half of the participants, were at the collaborative Stage of Concern. These 10 participants at that stage scored higher than would be expected at the highest stage, Refocusing, which compared with the renew user. The distribution could be accounted for by the fact that there were two major divisions in the participants' experiences with Web World Wonders. These two groups consisted of those who had been involved with Web World Wonders for 2 or more years and those who were newly recruited to the program.

Table 8

Stages of Concern Percentile Scores

Subject	Awareness	Informational	Personal	Management	Consequence	Collaboration	Refocusing
Nonuser	83	82	74	60	40	26	18
Inexperienced User	40	47	66	78	74	49	38
Experienced User	30	29	36	51	74	79	69
Renew User	21	19	26	38	54	71	82
Means	63	56	44	36	52	79	45
Peak Individuals	5	2	1	0	1	10	0
2nd Peak	5	2	0	1	6	5	0

Group Profile *N*=19

Stages of Concern Percentile Scores

Purpose 1 was to identify technical barriers in the population as they participated in a professional development course to teach students via the use of distance education. Distance education has become more of an accepted practice than a specific subject to be taught, with regard to the current practice of teaching subject matter from the Internet. The technical barriers reported by the participants in the administered documents were reported as the following: (a) setting up a Web camera; (b) setting up a Web site; (c) Accessing server, where the server was inoperable or the camera unusable; (d) using the Global Satellite System reader; (e) using the digital camera; (f) having Web access and having it on a reliable basis; (g) setting up a pole to position the remote-controlled camera; (h) providing electricity to the remote camera and server; (i) providing Internet service to the remote sight; (j) preventing corrosion of camera, connections, and wires at the remote sight; (k) incompatibility of Apple computer versus a Windows-based computer with regard to software and connections; (l) learning to use new complicated software like Arcview; (m) lacking administrative support and ; (n) receiving permission to place the remote camera.

The second purpose of this case study was to provide possible solutions to the barriers, identified in purpose 1. These solutions are discussed in chapter 5. The third question for which data were collected related to gender, age, teaching experience, and technological experience. Figures 1, 2, 3, and 4 depict the information gathered concerning these four categories.

Summary

This chapter reported the findings from e-mail response for the demographics, Stages of Concern and Levels of Use, which were received from the participants. All of the participants responded to the e-mail with encouragement from the Florida Department of Education and Florida State University. The participants self-reported their demographic information, filled out a Likert-style questionnaire for the Stages of Concern, and filled out responses to questions in an interview form for the Levels of Use. Tables and figures indicated technical and nontechnical barriers, Levels of Use, Stages of Concern, gender, age group, teaching experience, and technical experience. Chapter 5 is a discussion of the summary of findings, results, and recommendations concerning the technical barriers reported in this chapter.

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

The first purpose and the first question raised by this case study was to identify technical barriers that are detriments to and impact the effectiveness of professional development as related to a distance education system-based course in a selected learning community within the United Star Distance Learning Consortium (USDLC), more specifically known as Web World Wonders. Technical barriers were the focus of this study as reported and revealed by a group of teachers taking a professional development course through the joint collaboration of the United Star Distance Learning Consortium and both Florida State University and the Florida Department of Education. The participants in the study were 4th-through 12fth-grade public school teachers in the state of Florida, and their responses helped reveal those technical barriers. The second question raised by this study was to determine how significant time lost to teaching by inadequately trained teachers using innovative technology can be reduced, as identified in the Web World Wonders learning community. The third question of interest in this study was, involved the significant effects between age, gender, technology experience, years of teaching experience, and technical barriers to professional development as related to a distance education system-based course as identified in the Web World Wonders learning community. The variables of interest were gender, age group, teaching experience, and technical experience.

Participants surveyed in this study were part of a group of teachers who received training at a series of workshops in Florida. For their workshop, they traveled to Marathon Island, located in the Florida Keys. The course consisted of several ongoing workshops developed by both Florida State

University and the Florida Department of Education. The workshops were developed into a full professional development course to be offered to other Florida teachers. The 19 teachers in this study comprised more than half of the 34 teachers participating in the course.

Once all the documents had been completed by the participant, they e-mailed them back to be evaluated. There was a 100% return on all the questionnaires, which was exceptional. The 100 % response was attributed to Professor Laurie Molina, of Florida State University, and Kim Bowman, of the Florida Department of Education, who encouraged the participants to respond to the request, but left the decision to them. The analysis of the information focused on determining what technical barriers the participants were confronted with as they completed the system-based course of Web World Wonders. Each of the participants was also involved with relating the program to their respective schools faculty.

The strengths of the case study were to show important variables, processes, and interactions that deserved more extensive attention. Another strength was to show examples that illustrated more generalized statistical findings. The weakness of this study method was that it examined a small number of participants who were not generalized to any other specific group until after appropriate follow-up research could be accomplished that focused on specific hypotheses and used proper sampling methods. Subjective biases were another weakness in this method. The analysis of data may have been influenced by the subjective nature of the responses (Isaac & Michael, 1995).

Summary of Major Findings

To answer the questions raised in chapter 1, the major findings of this study are as follows:

1. In their interview responses, participants reported 11 technical barriers, along with 3 nontechnical barriers. All four groups gender, age, teaching experience, and technical experience

reported that the server being off-line and the resulting camera outage were the most frustrating of all the technical barriers reported. All of the teachers used the remote camera as a focal point of their teaching environmental science using the Web World Wonders Internet site. They reported that the periodic outages of the camera caused at least 4 of the participants to contemplate not using the site. However, after a change in leadership at Florida State University in 2000, the focus of the project reorganized into developing a group of teachers with an interest in the project rather than simply providing a Web site that could be used by teachers. This cohesive group of teachers and leaders focused the direction of the project into a more interactive course involving the teachers and students. A more stable server was also established that gave the participants reliable access to the remote cameras via the Web World Wonders Web site.

Actual equipment, such as the Global Positioning Satellite (GPS) reader, digital camera, and the Arc View data analysis software, was received by those participating in the project and utilized to build actual databases of information about environmentally sensitive areas of Florida. The sites were used by the participants and students who wanted to know more about the area in which they lived, which led them to investigate water quality, flora and fauna. Pictures taken at remote sights were documented with the GPS reader to pinpoint the location of what the digital photograph was about and its precise location. Once these data were converted to databases, the Arc View software allowed students and teachers to see patterns that were then translated into information that was placed on the Web World Wonders Web site. This information could then be analyzed by other students and teachers from anywhere Internet access was available.

The technical barriers reported in this study most often concerned the server being inoperable and the remote camera not functioning properly, the use of the GPS reader, and the use of the digital camera. Both of the mechanical devices were used by all of the participants and required technical knowledge. The knowledge to utilize the three above items was provided by the workshops attended by the participants. A support staff provided by Florida State University was utilized by those participants who needed additional help in using the equipment and software. E-mail was the preferred method of communication. A question, could then be responded to by the support staff at any time. This reduced the missed phone calls and long delays that sometimes happened when two or more people were communicating back and fourth.

2. Reporting the technical barriers by gender (Table 2 and Figure 1) produced findings that were almost evenly distributed between the two groups. Numerous research studies have found that both men and women have had successful experiences with computer use and felt confident in working with technology (Proost et al., 1997). It would appear that findings of this study are similar to that study.

3. In the age group category (Table 3 and Figure 2), technical barriers were distributed evenly across the barriers reported, with the exception of the physical establishment of the remote camera site. As reported in the interview, 1 male from the participants was more involved with that aspect of the project than the other teachers and had greater involvement with the setting up of the server and camera in a remote site. That fact could possibly account for the fact that the most barriers reported, were from the 50-59 age group.

4. In the teaching experience category (Table 4 and Figure 3), years of teaching experience group barriers were distributed by number of participants. Since 13 of the 19 participants were in the 1-10 years teaching experience category, more barriers were reported by that group than by any other group. When there were more participants, more barriers were reported.

5. The technical experience group had a proportional reporting of technical barriers compared to the number of participants in that experience group, with the exception of the expert

group. Although the expert group had only 37 % of the participants, they reported 52 % of the barriers. This discrepancy could be attributed to the fact that the expert group was more involved with the placing of cameras, servers, poles, wires, and electrical/Internet access. The participants at that level were more involved with the physical selection and placing of the remote cameras. The participants who used the cameras only from remote sights reported more access barriers.

Discussion of Findings

Technical barriers were a detriment to the professional development undertaken in the Web World Wonders Environmental Science learning environment course. The barriers were overcome through the diligent efforts of both Florida State University and the Florida Department of Education personnel. Extra training sessions were developed into what had become a full professional development course. As barriers became evident, solutions were applied to counteract the barrier. The barriers could be categorized into four areas: location, training, access, and support

The first area of barriers was the location related technical barriers. These barriers were related from the interviews with participants who had direct responsibilities in the physical placement of the remote cameras, and included (a) acquiring permission to place the camera; (b) setting up a Web camera at a remote location, which entailed; setting up a pole to house and position the remote controlled camera, providing electricity to the remote camera and server, providing Internet service to the remote sight, corrosion of the camera, connections, and wires at the remote sight; (c) accessing the server, such as when the server locked up, and the camera became temporarily unusable; and (d) setting up of a Web site for the camera and park sight.

The information pertaining to the technical barriers associated with the remote sites was obtained from the interview with the participants with those responsibilities. The above barriers involved the placing of the physical equipment at the remote location. Since these camera sites were in environmentally sensitive areas, collaboration with the Florida Park Service was necessary. With the installation of the first camera at Pigeon Key, corrosion took place quickly because of the salt air. The camera was located under an eave of a park ranger station. The cables were exposed to the environment, along with the connections to the camera. The camera was eventually placed in a clear Plexiglas housing. This housing was not airtight, which allowed spiders to enter. Cobwebs had to be removed periodically.

From the interviews, it was ascertained that the island of Pigeon Key was about 75 miles from either end of the Florida Keys. The technicians who would be sent to reset the server if it became inoperable came from either Sugarloaf Key or Key Largo. That effort took up to 2 hours just to reach the camera and server location. Sometimes the server would go offline after a short time, and the process would have to be repeated. Eventually, the camera was relocated to Sugarloaf Key in the rear area of the Sugarloaf Middle School property. If the server or camera became inoperable, a short walk was all that was necessary to reach the location. This saved at least 4 hours of travel time to and from the camera site. There were three upgrades to the cameras used. This resulted in airtight housings that greatly reduced corrosion and improved camera dependability and resolution.

After permission was granted to place the camera, the logistics concerning how to run electricity and Internet connectivity to the site were a major barrier. The distance that the server could be from the camera was a limiting factor. A location had to be ascertained that met that criterion. Both the Internet and the electrical cables had to be protected in conduit and then buried without excessively disturbing the surrounding area. This fact greatly reduced the corrosion to the cable connections. Much of this work was done by manual labor, using hand equipment. In some instances, the camera was placed on a pole that was set in concrete. All materials had to be taken to the location by manual transportation.

The second group of technical barriers reported from the interviews was the access to the servers barrier, which meant having Web access and having it on a reliable basis. After the site for the server was decided and the camera was placed, the next step was setting up the Internet site from which the camera and information about the site could be accessed. Florida State University was the physical entity location for the Internet provider service. Working collaboratively with the university, the teachers were responsible for developing the information that could be accessed from the URL site. At times the Florida State University server was out of commission. This resulted in the individual camera sites being unavailable. This server access barrier should not be confused with the server at the individual camera location. Through the combination of periodic outages by both servers, access was not reliable on a regular basis during the first 2 years of the project. Participants related that this technical barrier made it difficult to conduct lessons relating to the use of the remote cameras. The server at the university has since been upgraded to handle more access, which has reduced the outages reported by the participants.

It was also reported from the interviews, that a third group of technical barriers was training related. These involved barriers that arose during the training portion of the professional development course. The training barriers were (a) Apple versus PC usage; (b) Global Satellite System reader usage; (c) digital camera usage; (d) Web site setup; and (e) complicated new software, like Arc View, usage.

One of those training barriers was the result of the Apple Computer format versus the personal computer, (PC), based on the DOS system. Three of the participants in one of the first training workshops received professional development training on the PC format computers. They learned how to use the digital camera, the GPS reader, and the ArcView spatial relationship software and they were given all of the class notes, suggestions, and instructions on a CD-ROM. When they returned to their classrooms, they were surprised to find that the software was unreadable and that the wired connections from the camera and GPS reader were incompatible with the receptacles on their Apple based computers. These barriers led to delays in the implementation of the program at that school. It was ascertained that it would have been better to have received the training on the same computer systems as were available to the participants at their school location.

Using the GPS reader and the digital camera were technical barriers reported by participants other than those reporting the Apple versus PC barrier. The participant would go to one of the remote camera sites and use the GPS reader to take global satellite positioning information, from up to twelve geosynchronous satellites. That information, or reading, would then be calculated into a specific latitude, longitude and elevation location. Pictures that were taken with the digital cameras where then linked to a specific location and then a series of pictures with locations could be assembled into a virtual field trip. Some of the pictures were combined into a panorama using the Arc Vue software. Two sets of pictures would then be saved to a computer file for each set taken. A high resolution and low-resolution picture would then be able to be accessed, depending on bandwidth service by the person accessing the picture on the Internet. Those with a low bandwidth service would choose the low- resolution picture, to reduce the time it took to download the picture. Those that had a high-speed connection could download the higher resolution pictures. Depending upon the location for the picture, the panorama could consist of from 12 to 20 pictures. This total process was technologically challenging for some of the participants in the professional development course.

The Arc View software was used as a spatial data analysis tool. Readings such as water depth, water and air temperature, water PH, along with flora and fauna populations could be entered into the computer and then be spatially analyzed by the software. This process was detailed and systematically specific. The software had a high learning curve and some participants related that it was a barrier. Through the efforts of the Florida Department of Education and Florida State University, extra support was provided to help overcome that barrier.

The fourth barrier was a support barrier. One participant reported that it was felt that there was a lack of school administrative support in relation to allowing release time to conduct the training. Although this was not a technical barrier, it was a barrier reported by the participant who felt it was important to relate.

Conclusions

Based on the findings of this study, the following is concluded:

1. Technical barriers reported by participants in the Web World Wonders professional development course fell into four categories; location, access, training, and support, which paralleled the five categories that Leggett and Persichitte (1998) reported as time, access, resources, expertise and support.

2. Reporting the barriers by gender showed that neither males nor females were more likely to report technical barriers at a higher level than the other gender.

3. Reporting the barriers by age group indicated that the number of participants and the number of technical barriers reported was closely aligned.

4. Reporting the barriers by teaching experience indicated that the number of participants and the number of technical barriers reported was closely aligned.

5. Reporting the barriers by technology experience indicated that the number of participants and the number of technical barriers reported was closely aligned.

6. Concerning the Levels of Use, there were participants at six of the seven levels. It would appear that the longer the participant was involved with Web World Wonders, the higher the Level of Use.

7. Concerning the Stages of Concern, participants were at all stages except the Management and Refocusing stages, and 10, or over half of the participants, were at the Collaboration stage. It would appear that the longer the participant was involved with Web World Wonders, the higher the Stages of Concern.

Discussion of Conclusions

The technical barriers reported by the participants in this case study compare with the technical barriers that Threlkeld and Brzoska (1994) reported in establishing a distance education system. Their barriers are listed below followed by a comparison from this study in brackets.

1. Technology- hardware and software [which compared with the digital camera, GPS reader, and the remote cameras and with the Arc View software used by the participants in Web World Wonders]
2. Transmission- the on-going expense of leasing transmission access [which compared to the Internet access barriers related by the participants]
3. Maintenance- repairing and updating equipment [which compared to the moving of the camera site at Pigeon Key to Sugarloaf Middle School]
4. Infrastructure- the foundational network and telecommunications infrastructure located at the originating and receiving campuses [which compared to the server problems at Florida State University server and the campus access to the camera servers]

5. Production- technological and personnel support required to develop and adapt teaching materials [which compared to the participants who served as the personnel to reset the servers when they locked up and those who developed materials to place on the remote camera site URLs]
6. Support- miscellaneous expenses needed to ensure the system works successfully, including administrative costs, registration, advising/counseling, local support costs, facilities, and overhead costs [which compared to Florida State University and the Florida Department of Education supporting the participants with the equipment and training]
7. Personnel- to staff all functions previously described [which compared with the above organizations support of the participants].

To answer the questions raised in this study the following were inferred.

1. In reference to the Web World Wonders professional development course, the technical barriers related by the participants were overcome by the diligent efforts of Florida State University and the Florida Department of Education personnel directly involved with that project, by providing the necessary training modifications as the barriers were encountered.

2. Training on the same computer systems as the ones the participants used at their school locations reduced barriers encountered.

3. The effect of age, gender, years of teaching experience, and technology experience with regard for the technical barriers reported by the participants was indeterminate due to the small number of participants spread over a large number of categories.

This case study was limited to the public school teachers participating in the Web World Wonder Environmental Science professional development course in the state of Florida in association with the University of Florida and the Florida Department of Education. The study requested the teachers to answer a 35-question Levels of Use of the Innovation survey, along with a demographic data sheet, and to complete an interview for the Stages of Concern of the Innovation. The “Innovation” was the Web World Wonders Environmental Science professional development course in the state of Florida. This case study was limited to observations of the researcher who had been monitoring the Web World Wonders Environmental Science professional development course over the past 5 years. The strengths of the case study highlighted important variables, processes, and interactions that deserved attention, which gave a more extensive impression of the project. Another strength was to show examples, which illustrated more generalized statistical findings. The weakness of this study method was that it examined a small number of participants who were not generalized to any other specific group until after appropriate follow-up research could be accomplished, focusing on specific hypotheses and using proper sampling methods. Subjective biases were another weakness of this method. The analysis of data may have been influenced by the subjective nature of the responses (Isaac & Michael, 1995).

Recommendations and Implications

Based on the review of literature in chapter 2, Berge and Mrozowski (1999) related that technical barriers could be a detriment to distance education. Although this case involved the exploration of the technical barriers encountered by a professional development group of teachers, the barriers closely paralleled those barriers found by Berge and Mrozowski: "lack of systems reliability; lack of connectivity/access; inadequate amount/type hardware/software; setup problems; inadequate infrastructure; inadequate technical support; inadequate maintenance of hardware/software" (p. 4). The lack of systems reliability related to the server being inoperable. The lack of connectivity/access related to the limitations of Internet access. Inadequate amount/type hardware related to not having enough computers for everyone in the class to use at the same time and not enough of the Global Positioning Satellite readers and digital cameras to be used in different classrooms at the same time. Setup problems related to setting up a Web site. Inadequate infrastructure related to not having electricity and Internet connectivity to the remote camera sites. Inadequate technical support was not related in that Florida State University and the Florida Department of Education provided adequate technical support to the participants in the professional development course at Web World Wonders. Inadequate maintenance of hardware/software related to the server for the cameras being off-line during the 1st year and a half of the project. After the leadership was conveyed to Professor Molina and Kim Bowman, these problems were mostly alleviated.

It could be surmised that the Web World Wonders professional development course had progressed through stages and levels compared to the Stages of Concerns and Levels of Use through which the participants had progressed. The longer Web World Wonders was in existence, the more teachers and students it impacted, not only in Florida, but also around the world. Internet users were able to access the Web World Wonders site from anywhere the Internet was available. The technical barriers that arose were overcome through the diligent efforts of the leadership team involved with the teaching of the professional development course.

Many technical barriers were related during the course of this study, and although they seriously affected the teams of teachers who took the Web World Wonders professional development course, these barriers were not insurmountable. The expectation was that new technical barriers to that professional development course would have been revealed. Instead, technical barriers that affect many technologically advanced endeavors were encountered. Although this professional development course was unique to others in the field, it had comparable parameters that might be encountered by other professional development courses that employ varied technologically advanced hardware and software. Supportive leadership is one prerequisite that could be inferred to other areas that want to excel in this type of endeavor, in that these people responsible for the project showed dedication by having overcome all of the barriers encountered.

Statistical analysis or the evaluation of the effects of gender, age, teaching experience, and technological experience were inappropriate as applied to this study, due to the small number of participants. The demographic, Stages of Concern, and Levels of Use data collected was of little or no value when related to the technical barriers that were reported. It might also be wise to separate the participants into skill categories so that barriers encountered would be relative to that skill level. A higher skill level participant might not report the same technical barriers that a lower skilled participant might report.

Solutions to the technical barriers encountered were accomplished though the modifications to the professional development that was delivered to the participants. As barriers appeared, adaptations were made to counter the obstructions. When the participants voiced concerns about their situations, the professional development team responded with additional information that was presented at the next workshop. Communications to the participants was also made to inform them of ways to overcome the barrier encountered. Professional development for the Web World Wonders environmental science learning community was molded around the needs of the participants to better serve the students that would be impacted by the teachers participation in the project.

As technology advances at an increasing pace, professional development training updates are required with those achievements. By being flexible and adjusting to the needs of the participants, effective professional development training for teachers involved with advanced technology is possible. That training enables teachers to incorporate the technology seamlessly into their lessons. Technology then becomes a tool to teaching rather than as a separate subject to be taught.

Appendix A

Consent Form

Consent Form

Title of Study
The impact of technical barriers on the effectiveness of professional development as related to a distance education system-based course: a case study in the web world wonders environmental science learning community.

Principal Investigator:
John Dawson - The University of North Texas
PO Box 311337
Denton, Texas
940-565-2837

Faculty Sponsor:
Dr. Mark Mortensen - The University of North Texas
PO Box 311335
Denton, Texas
940-565-4130

Before agreeing to participate in this research study, it is important that you read and understand the following explanation of the proposed procedures. It describes the procedures, benefits, risks, and discomforts of the study. It also describes the alternative treatments that are available to you and your right to withdraw from the study at any time. It is important for you to understand that no guarantees or assurances can be made as to the results of the study.

Start Date of Study	**End Date of Study**
08/30/2003	09/19/2003

Purpose of the Study
The first purpose of this case study will be to identify technical barriers that impact the effectiveness of professional development as related to a distance education system-based course in a selected learning community within the United Star Distance Learning Consortium, more specifically known as Web World Wonders. This case study will utilize information gathered from a cadre of teachers that are participating in ongoing professional development in the Web World Wonders Environmental Science learning community in the state of Florida.

The second purpose of this case study will be to provide help in overcoming technical barriers to professional development, as related to distance education, in other learning communities, so as to provide teachers with the skills necessary for technologically advanced classrooms.

Description of the Study
The objectives for this study are to identify and provide possible solutions to the technological barriers associated with:

1. Technical barriers that are detriments to professional development as related to a distance education system-base course as identified in the Web World Wonders learning community.

2. Significant time that is lost to teaching by inadequately trained teachers using innovative technology be reduced as identified in the Web World Wonders learning community.

3. A determination of whether there are there significant effects between; age, gender, technology experience, years of teaching experience, and technical barriers to professional development as related to a distance education system-base course as identified in the Web World Wonders learning community.

Procedures to be used

Each participant will complete an interview, demographic form and questionnaire.

Description of the foreseeable risks
The proposed research involves minimal risks to participants.

Benefits to the subjects or others
The subjects will help determine technical barriers to professional development as they relate to distance education.

Procedures for Maintaining Confidentiality of Research Records

Participant's names will not be associated with the finished study. Subjects will be asked to voluntarily participate in the study. Only those volunteers will be interviewed and surveyed. Subjects will receive a number that will be associated with their responses.

Review for the Protection of Participants
This research study has been reviewed and approved by the UNT Committee for the protection of Human Subjects (940-565-3940).

Research Subject's Rights
I have read or have had read to me all of the above. John L Dawson, Jr. has explained the study and answered all of my questions. I have been told the risks and/or discomforts as well as the possible benefits of the study. I have been told of other choices of treatment available to me.

I understand that I do not have to take part in this study and my refusal to participate or to withdraw will involve no penalty, loss of rights, loss of benefits, or legal recourse to which I am entitled. The study personnel may choose to stop my participation at any time.

In case problems or questions arise, I have been told I can contact John Dawson at telephone number 940-321-3599.

I understand my rights as research subject and I voluntarily consent to participate in this study. I understand what the study is about, how the study is conducted, and why it is being performed. I have been told I will receive a signed copy of this consent form.

___________________________________ ______________

Signature of Subject Date

For the Investigator or Designee:
I certify that I have reviewed the contents of this form with the subject signing above. I have explained the known benefits and risks of the research. It is my opinion that the subject understood the explanation.

___________________________________ ______________

John L Dawson, Jr. Date
Principal Investigator

Appendix B

IRB Approval

UNIVERSITY of NORTH TEXAS

Office of Research Services

August 26, 2003

John L. Dawson, Jr.
Texas Center for Educational Technology
University of North Texas

Re: Human Subjects Application No. 03-275

Dear Mr. Dawson,

As permitted by federal law and regulations governing the use of human subjects in research projects (45 CFR 46), the UNT Institutional Review Board has reviewed your proposed project titled "The Impact of Technical Barriers on the Effectiveness of Professional Development as Related to Distance Education: A Case Study in the Web World Wonders Environmental Science Learning Community." The risks inherent in this research are minimal, and the potential benefits to the subject outweigh those risks. The submitted protocol and informed consent form is hereby approved for the use of human subjects.

Enclosed is the information document with stamped IRB approval. Please copy and **use this form only** for your study subjects.

U.S. Department of Health and Human Services regulations require that you submit annual and terminal progress reports to the UNT Institutional Review Board. The Board must review this project annually and/or prior to any modifications made in the approved project. **Federal policy 45 CFR 46.109(e) stipulates that IRB approval is for one year only**.

Please contact me if you wish to make changes or need additional information.

Sincerely,

Marcia J. Staff

Marcia J. Staff,
Chair
Institutional Review Board

MS:sb

P.O. Box 305250 ◆ Denton, Texas 76203-5250 ◆ (940) 565-3940
Fax (940) 565-4277 ◆ TTY (800) RELAY TX ◆ www.unt.edu

Appendix C

IRB Completion Certificate

Human Participant Protections Education for Research Teams

Completion Certificate

This is to certify that

John L (initial only) Dawson, Jr.

has completed the **Human Participants Protection Education for Research Teams** online course, sponsored by the National Institutes of Health (NIH), on 01/02/2003.

This course included the following:

- key historical events and current issues that impact guidelines and legislation on human participant protection in research.
- ethical principles and guidelines that should assist in resolving the ethical issues inherent in the conduct of research with human participants.
- the use of key ethical principles and federal regulations to protect human participants at various stages in the research process.
- a description of guidelines for the protection of special populations in research.
- a definition of informed consent and components necessary for a valid consent.
- a description of the role of the IRB in the research process.
- the roles, responsibilities, and interactions of federal agencies, institutions, and researchers in conducting research with human participants.

National Institutes of Health
http://www.nih.gov/

Appendix D

Concerns Based Adoption Model

Introductory Letter

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Southwest Educational Development Laboratory
211 East Seventh Street, Austin Texas 78701

INTRODUCTORY PAGE

WWW
S0CQ 20

Web World Wonders

Concerns Questionnaire

Subject # T__.

The purpose of this questionnaire is to determine what people who are using or thinking about using various programs are concerned about at various times during the innovation adoption process. The items were developed from typical responses of school and college teachers who ranged from no knowledge at all about various programs to many years experience in using them. Therefore, a good part of the items on this questionnaire may appear to be of little relevance or irrelevant to you at this time. For the completely irrelevant items, please **bold** the "0" on the scale. Other items will represent those concerns you do have, in varying degrees of intensity, and should be marked higher on the scale.

For example:

This statement is very true of me at this time.	0 1 2 3 4 5 6 **7**
This statement is somewhat true of me now.	0 1 2 3 **4** 5 6 7
This statement is not at all true of me at this time.	0 **1** 2 3 4 5 6 7
This statement seems irrelevant to me.	**0** 1 2 3 4 5 6 7

Please respond to the items in terms of your present concerns or how you feel about your involvement or potential involvement with Web World Wonders We do not hold to any one definition of this innovation, so please think of it in terms of your own perception of what it involves. Since this questionnaire is used for a variety of innovations, the name Web World Wonders never appears. However, phrases such as "the innovation," "this approach," and "the new system" all refer to Web World Wonders Remember to respond to each item in terms of your present concerns about your involvement or potential involvement with Web World Wonders.

Thank you for taking time to complete this task.
John L Dawson, Jr.

Appendix E

Demographic Data

DEMOGRAPHIC PAGE

Web World Wonders

PLEASE COMPLETE THE FOLLOWING:

1. What percent of your job is:
   teaching ____%administration ____% other (specify) ____________________

2. Do you work: full time ____ part time ____

3. Female ____ Male ____

4. Age: 20-29 ____ 30-39 ____ 40-49 ____ 50-59 ____ 60-69____

5. Highest degree earned:

   Associate ____ Bachelor ____ Masters ____ Doctorate ____

6. Year degree earned: _________

7. Total years teaching: _________

8. Number of years at present school:________________

9. In how many schools have you held full time appointments?

   one _____ two _____ three _____ four _____ five or more _____

10. How long have you been involved in Web World Wonders, not counting this year?
    never _____ 1 year_____ 2 years_____ 3 years_____ 4 years_____ 5 years or more_____

11. In your use of Web World Wonders, do you consider yourself to be a:

    non-user _____ novice_____ intermediate _____ old hand _____ past user _____

12. Have you received formal training in Web World Wonders (workshops, courses)?
    yes _____ no _____

13. Are you currently in the first or second year of use of some major innovation or program other than Web World Wonders?
    yes _____ no _____
    If yes, please describe briefly.

14. Please check to see that you have written the last four digits of your Social Security number on the front page of this questionnaire.
    Thank you for your help.

Appendix F

Concerns Based Adoption Model

Stages of Concern Questionnaire

QUESTIONNAIRE ITEMS

0	1	2	3	4	5	6	7
Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	

1. I am concerned about students' attitudes toward this innovation.	0 1 2 3 4 5 6 7
2. I now know of some other approaches that might work better.	0 1 2 3 4 5 6 7
3. I don't even know what the innovation is.	0 1 2 3 4 5 6 7
4. I am concerned about not having enough time to organize myself each day.	0 1 2 3 4 5 6 7
5. I would like to help other faculty in their use of the innovation.	0 1 2 3 4 5 6 7
6. I have a very limited knowledge about the innovation.	0 1 2 3 4 5 6 7
7. I would like to know the effect of reorganization on my professional status.	0 1 2 3 4 5 6 7
8. I am concerned about conflict between my interests and my responsibilities.	0 1 2 3 4 5 6 7
9. I am concerned about revising my use of the innovation.	0 1 2 3 4 5 6 7
10. I would like to develop working relationships with both our faculty and outside faculty using this innovation.	0 1 2 3 4 5 6 7
11. I am concerned about how the innovation affects students.	0 1 2 3 4 5 6 7
12. I am not concerned about this innovation.	0 1 2 3 4 5 6 7
13. I would like to know who will make the decisions in the new system.	0 1 2 3 4 5 6 7
14. I would like to discuss the possibility of using the innovation.	0 1 2 3 4 5 6 7
15. I would like to know what resources are available if we decide to adopt this innovation.	0 1 2 3 4 5 6 7
16. I am concerned about my inability to manage all the innovation requires.	0 1 2 3 4 5 6 7
17. I would like to know how my teaching or administration is supposed to change.	0 1 2 3 4 5 6 7
18. I would like to familiarize other departments or persons with the progress of this new approach.	0 1 2 3 4 5 6 7

0	1	2	3	4	5	6	7
Irrelevant	**Not true of me now**		**Somewhat true of me now**			**Very true of me now**	

19. I am concerned about evaluating my impact on students. 0 1 2 3 4 5 6 7

20. I would like to revise the innovation's instructional approach. 0 1 2 3 4 5 6 7

21. I am completely occupied with other things. 0 1 2 3 4 5 6 7

22. I would like to modify our use of the innovation based on the experiences of our students. 0 1 2 3 4 5 6 7
23. Although I don't know about this innovation, I am concerned about things in the area. 0 1 2 3 4 5 6 7
24. I would like to excite my students about their part in this approach. 0 1 2 3 4 5 6 7
25. I am concerned about time spent working with nonacademic problems related to this innovation. 0 1 2 3 4 5 6 7
26. I would like to know what the use of the innovation will require in the immediate future. 0 1 2 3 4 5 6 7
27. I would like to coordinate my effort with others to maximize the innovation's effects. 0 1 2 3 4 5 6 7
28. I would like to have more information on time and energy commitments required by this innovation. 0 1 2 3 4 5 6 7
29. I would like to know what other faculty are doing in this area. 0 1 2 3 4 5 6 7
30. At this time, I am not interested in learning about this innovation. 0 1 2 3 4 5 6 7
31. I would like to determine how to supplement, enhance, or replace the innovation. 0 1 2 3 4 5 6 7
32. I would like to use feedback from students to change the program. 0 1 2 3 4 5 6 7
33. I would like to know how my role will change when I am using the innovation. 0 1 2 3 4 5 6 7
34. Coordination of tasks and people is taking too much of my time. 0 1 2 3 4 5 6 7

35. I would like to know how this innovation is better than what we have now. 0 1 2 3 4 5 6 7

Appendix G

Concerns Based Adoption Model

Levels of Use Interview Questions

Levels of Use Interview Survey

Subject # T__.

Date July, 2003

1. Q: Are you using **Web World Wonders**?
If NO please go to question **17.**
If YES please go to question **2.**

If **YES**

2. Q. Can you describe Web World Wonders for me as you see it?
   A.

3. Q. What do you see as the strengths and weaknesses of Web World Wonders in your situation? Have you made any attempt to do anything about the weaknesses?
   A.
   B.
   C.

4. Q. Are you currently looking for any information about Web World Wonders? What kind? For what purpose?
   A.
   B.
   C.

5. Q. Do you ever talk with others about Web World Wonders? What do you tell them?
   A.
   B.

6. Q. What do you see as being the effects of Web World Wonders? In what way have you determined this? Are you doing any evaluating, either formally or informally, of your use of Web World Wonders? Have you received any feedback from students? What you have done with the information you get?
   A.
   B.
   C.
   D.
   E.

7. Q. Have you made any changes recently in how you use Web World Wonders at? Why? How recently? Are you considering making any changes?
   A.
   B.

8. Q. As you look ahead to later this year, what plans do you have in relation to your use of Web World Wonders?
   A.

9. Q. Are you working with others (outside of anyone you may have worked with from the beginning) in your use of Web World Wonders? Have you made any changes in your use of Web World Wonders based on this coordination?
   A.

10. Q. Are you considering or planning to make major modifications or to replace Web World Wonders at this time?
    A.

Level V Probes

11. Q. How do you work together? How frequently?
    A.

12. Q. What do you see as the strengths and the weaknesses of this collaboration?
    A.

13. Q. Are you looking for any particular kind of information in relation to this collaboration?
    A.

14. Q. When you talk to others about your collaboration, what do you share with them?
    A.

15. Q. Have you done any formal or informal evaluation of how your collaboration is working.
    A.

16. Q. What plans do you have for this collaborative effort in the future?
    A.

If **NO**

17. Q. Have you made a decision to use Web World Wonders in the future? If so, when?
    A.

18. Q. Can you describe Web World Wonders for me as you see it?
    A.

19. Q. Are you currently looking for any information about Web World Wonders? What kinds7 For what purposes?
    A.

20. Q. What do you see as the strengths and weaknesses of Web World Wonders for your situation?
    A.

21. Q. At this point in time, what kinds of questions are you asking about Web World Wonders? Give examples if possible.
    A.

22. Q. Do you ever talk with others and share information about Web World Wonders? What do you share?
    A.

23. Q. What are you planning with respect to Web World Wonders? Can you tell me about any preparation or plans you have been making for the use of Web World Wonders?
    A.

24. Q. Can you summarize for me where you see yourself right now in relation to the use of Web World Wonders? (Optional Question)
    A.

Appendix H

Levels of Use Rating Sheet

LEVEL OF USE RATING SHEET (CBAM, 1975)

Tape #: 1 Site: Florida Interviewer: Dawson
Date: 9/15/03 I.D. #: Rater: Dawson

Level	Knowledge	Acquiring Information	Sharing	Assessing	Planning	Status Reporting	Performing	Overall LoU
Non-Use D.P. A	0	0	0	0	0	0	0	0
Orientation D.P. B	I	I	I	I	I	I	I	I
Preparation D.P. C	II	II	II	II	II	II	II	II
Mechanical Use D.P. D-1	III	III	III	III	III	III	III	III
Routine D.P. D-2	IVA	IVA	IVA	IVA	IVA	IVA	IVA	IVA
Refinement D.P. E	IVB	IVB	IVB	IVB	IVB	IVB	IVB	IVB
Integration D.P. F	V	V	V	V	V	V	V	V
Renewal	VI	VI	VI	VI	VI	VI	VI	VI
User is not doing:	ND	ND	ND	ND	ND	ND	ND	
No information in interview:	NI	NI	NI	NI	NI	NI	NI	

Is the individual a past user? Yes No

How much difficulty did you have in assigning this person to a specific LoU? None 1 2 3 4 5 6 7 Very much

Comments about interviewer:

General Comments:

REFERENCES

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