INSTRUCTIONAL TECHNOLOGY RECOMMENDATIONS
FOR THE
CENTRAL WISCONSIN ENVIRONMENTAL STATION
EDUCATION PROGRAM

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CHAPTER 1
PROBLEM, OBJECTIVES, AND SIGNIFICANCE OF STUDY

GOAL STATEMENT

The goal of this research is to examine current instructional technology uses in non-
formal environmental education across the United States and to develop
recommendations for how the Central Wisconsin Environmental Station (CWES) can use
instructional technology to 1) enhance the educational experience offered at the
environmental station, and 2) bridge the classroom experience of Wisconsin K-12
students with their field experience at CWES.

RESEARCH OBJECTIVES

1. To determine the purpose and goals of instructional technology use at CWES.
2. To examine current instructional technology uses and related trends within K-
   12 schools in Wisconsin.
3. To survey instructional technology use at environmental education centers and
   related organizations to a) link the onsite and classroom experience provided
to visiting school groups, b) enhance onsite educational experiences, and/or c)
otherwise enhance educational experiences.
4. To examine and case study those uses that are most applicable and important
to CWES, including characteristics of the program such as site, staffing, etc.
5. To explore the benefits, drawbacks, and controversy surrounding the use of
   instructional technology within education and, more specifically,
environmental education.
6. To prepare recommendations for the future use of instructional technology in CWES programming.

SIGNIFICANCE OF RESEARCH

The Central Wisconsin Environmental Station (CWES) is an environmental education facility operated by the University of Wisconsin – Stevens Point College of Natural Resources (UWSP-CNR). It is located 17 miles east of Stevens Point, near Amherst Junction, Wisconsin. The Station is a year-round facility, offering education programs for school groups as well as summer camp programs. At present, over thirty school districts in Wisconsin bring groups to the center for educational programming each year.

The Central Wisconsin Environmental Station mission (2002) is

“To foster in adults and youth the appreciation, understanding, skill development, and motivation needed to help them build a sustainable balance between environment, economy, and community.”

The Station has five methods for achieving this mission (See Appendix A for complete mission and goals). This research will support the following four methods:

1) “Training and mentoring University of Wisconsin-Stevens Point undergraduate and graduate students in environmental education in an effort to develop the most skilled and sensitive professionals possible;

2) Providing innovative environmental education experiences based on ecological principles, integrated natural resource management philosophies, balanced perspectives, and inquiry-based methodologies;

4) Demonstrating sustainable designs and practices based on current research and technology;
5) Promoting this leadership model, in cooperation with the UW-Stevens Point College of Natural Resources, to others across the state, nation, and world.”

The following is a description of how this research can support each of these sections of the mission.

1) **Training and mentoring University of Wisconsin-Stevens Point undergraduate and graduate students in environmental education in an effort to develop the most skilled and sensitive professionals possible.**

Students within the Natural Resources: Environmental Education/Interpretation discipline at the University of Wisconsin – Stevens Point (UWSP) are required to spend one semester teaching at CWES. Through teaching experiences using a variety of modern technology within CWES programming, these university students will gain the skills necessary to enter the professional world and be successful representatives of the University of Wisconsin – Stevens Point College of Natural Resources (CNR).

As a field station of the CNR, CWES is responsible for helping to uphold the UWSP Vision Statement, in which Chancellor Thomas George (2002) writes

“Student-centered excellence, technology-enhanced learning, and partnerships are inextricably intertwined at UWSP. Our internal and external partnerships allow us to center our work on students through teaching, learning, and research at our home campus as well as at our distance-education sites and field stations. Our incorporation of leading-edge technology in our curriculum supports our educational mission by providing our students and faculty with state-of-the-art equipment, software, and support for enhanced learning opportunities.”

This research will support the UWSP vision by focusing on how instructional technology could be used to connect CWES to K-12 schools in Wisconsin and elsewhere.
State-of-the-art equipment and opportunities will provide both UWSP students and K-12 students with the most leading edge experience possible.

2) Providing innovative environmental education experiences based on ecological principles, integrated natural resource management philosophies, balanced perspectives, and inquiry based methodologies.

Bridging the education received at CWES with experiences in the classroom will help ensure the sustainability of CWES field trips as a part of school curriculum. Field trips are in jeopardy in many locations. Many schools are feeling the economy tighten on them, resulting in less money for field trips and other out-of-school experiences.

Research conducted by Orion and Hofstein (1994) showed that student learning gained from field trips is affected by three main factors: integration of the field trip within the curriculum, the extent of student familiarity with the setting, and the field trip structure (i.e. learning materials, program structure, and teaching strategies). Researchers suggest the use of pre and post visit activities to further reinforce the concepts learned while on field trips (Cox-Petersen & Melber 2001; Farmer & Wott 1995), particularly when these activities are led by field trip staff rather than the classroom teacher (Farmer & Wott 1995). These activities help students to become familiar with the key concepts, a factor identified as significant to student learning ability (Orion & Hofstein 1994), in addition to reinforcing the topics afterwards. By investigating tools to directly link CWES experiences with school activities, CWES can strengthen the value of the field experience for students, helping to support the need for and value of field trips to the Station.

Many teachers also feel pressure from the current educational emphasis on academic standards. This research will enable teachers to integrate CWES experiences into their curriculum, treating the visit as more than simply a one-time field trip. By
doing so, CWES will have increased ability to help teachers achieve curriculum goals and meet academic standards. There are teachers, however, who are unable to bring classes to the Station for a number of reasons, such as funding, time or distance. This research will help those teachers to provide their students with solid environmental education through technology-enhanced learning.

4) **Demonstrating sustainable designs and practices based on current research and technology.**

This project will bring CWES into the age of technology while enhancing the current hands-on education offered. The compilation of case studies and technology practices will serve not only as a stepping stone for future CWES programming, but as a model and information source for organizations, centers, and programs throughout the world.

5) **Promoting this leadership model, in cooperation with the UW-Stevens Point College of Natural Resources, to others across the state, nation, and world.**

One of the goals of the University of Wisconsin-Stevens Point is to “provide quality undergraduate and graduate instruction through innovative methods using print and non-print library resources, computing, communication technology, and direct student assistance” (UWSP 2002a). As previously mentioned, integrating instructional technology into CWES education programs will provide undergraduate and graduate practicum students with hands-on training that will prepare them to enter the field of environmental education with the experience necessary to excel.

The goal and long range plan of UWSP (2002) includes three sections: student-centered excellence, technology-enhanced learning, and partnerships. This research can help support all three.
Within student-centered excellence, UWSP strives to “pursue resources that will allow for upgrading, modernization, and current technology throughout the campus facilities to aid program delivery to the clientele served,” and to “provide service-oriented operations that will garner the respect and appreciation of the students attending and the faculty and staff who deliver the programs” (UWSP 2002). By enhancing CWES programming to continue being hands-on and authentic, while incorporating top-of-the-line technology, CWES, as a representative of UWSP, will be aiding in the education and experience provided to practicum students, as well as to the K-12 students they are educating.

In terms of technology-enhanced learning, the university strives to promote and support learning resulting from “the use of telecommunication links to field stations” (UWSP 2002). The final product of this research will incorporate concepts intended to help link CWES, a field station of UWSP, with groups not only locally but nationwide, providing practicum students with hands-on experience using the technology.

A third goal of the university that this research will help support is partnership. “We will continue to foster partnerships with the local pre-K through 12 schools in an effort to share information, strategies and expertise that will benefit students and families” (UWSP 2002). As a field station serving K-12 school groups throughout 30 school districts in Wisconsin, CWES can play a significant role in UWSP interaction with these groups.

Through this research, CWES will become a link for the Global Environmental Management (GEM) program currently being implemented at UWSP. “GEM helps people make local and global connections together via education to build a sustainable
and secure future. GEM will provide a technology and communication infrastructure for intercontinental learning bridges for people to share ideas and learn from each other” (Dean Victor Phillips, personal communication February 13, 2002). Many instructional technology methods discovered in this research would provide a means for CWES to link to audiences across Wisconsin and across the globe, helping to support the GEM vision of “responding to accelerating global change and critical issues through leading edge natural resources education; inspiring and developing creative solutions for making a world of difference in the 21st Century...the Environmental Century; creating a sustainable future for local communities in Wisconsin and abroad” (GEM 2002). Dr. Mike Dombeck, director of the UWSP GEM Initiative, feels that “through research such as this, CWES can help GEM and the CNR can take a forward step in reaching out towards audiences on both a local and global level, strengthening partnerships, and delivering the natural resources and state-of-the-art programming that makes both GEM and the CNR so powerful” (Dombeck, personal communication March 6, 2002). GEM and UWSP strive not only for a global connection, however, but also to connect local entities through programming.

“With its development of internal and external partnerships, UWSP is able to serve a larger and more diverse body of students than ever before. Partnerships that cut across disciplines, colleges, and divisions on campus, as well as external—including international—partnerships with other educational institutions, municipalities, and businesses allow UWSP to enhance its student-centered programming so as to achieve its goal of leadership” (George 2002).

By exploring ways in which technology can enhance the CWES Education Program, the Station will be exploring ways to uphold the UWSP Vision of serving large, diverse
audiences, creating partnerships with organizations across the globe, and focusing on the education provided to students.

CWES plays an important role in not only the College of Natural Resources, but at the university as a whole. This research will help CWES continue to serve as a role model for other organizations, while providing a top-level training experience for UWSP students and an excellent environmental education for K-12 Wisconsin students.

ASSUMPTIONS
This research is based on the assumption that the use of technology would improve the education CWES offers to schools and would be welcomed by potential audiences. It is also assumed that technology will continue to increase in popularity, thus necessitating training UWSP students in technology use. This training would be assumed to prepare students for the modern world of technology. In addition, it is assumed that technology use could be feasibly integrated into programs, and that those methods used at researched sites and programs throughout the country would be applicable to CWES and valid within future planning.
CHAPTER 2
REVIEW OF RELATED LITERATURE

This chapter will focus on previously published information about the nature and relationship of technology and education. The first section will explore the differences between scientific and instructional technology. The use of instructional technology within K-12 schools will next be explored through a discussion of the transition society has made from transmission models to constructivist models of education, as well as how these relate to the field of environmental education, in both formal and non-formal settings. Trends in technology use within K-12 schools, both in the state of Wisconsin and across the country, will be investigated next, followed by several key characteristics that research has shown to be important in implementing successful instructional technology programs. This chapter will conclude with a brief discussion about the controversy surrounding the use of instructional technology within environmental education.

INTRODUCTION

Technology comes in many forms. For the purpose of this research, technology is separated into two categories. These are scientific technology and instructional (or educational) technology. Scientific technology is defined as a means of creating new methods of satisfying human needs and accomplishing human goals (Baez 1987). There is much literature focusing on the effects of scientific technology on the environment. Some authors feel that an increase in this type of technology, while increasing the productivity and quality of products, is leading to degradation of the environment and an
increase in the amount of waste created (Rohwedder 1990a). Others view it as a cycle; as problems are discovered, scientists try to find new ways of solving them, often by creating a new technological solution that may lead to new problems (Barbour 1980).

Instructional or educational technology, herein referred to as instructional technology, is used to make information available to students and visitors. The Wisconsin Department of Public Instruction defines it as “Devices and systems used to deliver education; generally communication technology equipment and the associated processes. The method by which education (subject matter) is delivered.” (Fortier et. al. 1998f).

Begun as a means of increasing the efficiency of schools following World War II, instructional technology originally focused on the role of audio-visual media within education, specifically drill-and-practice activities rather than more communicative and collaborative uses (Networking the Classroom 1995). It has since grown to include a wide range of procedures based in academic fields ranging from social and cognitive psychology to management and psychometrics (Ely 1997). Through electronic mail, discussion groups, web sites and chat rooms, and web search capabilities, people are able to access and use more information than ever before (Beck & Cable 1999).

Scientific processes and methods can be integrated within instructional technology, with students learning how to use equipment and software that enhance their education and learning experience (Young 1993). Many Internet-supported programs not only encourage students to use scientific equipment and methods, but use these methods to help students model good environmental behaviors (Moore & Huber 2001). Instructional technology is considered to be an extremely effective and powerful method
of increasing environmental awareness and action, two major goals of environmental education (Rohwedder 1990a).

Some members of the educational community feel there is a need for science and environmentally based instructional technology to educate the public and to lead to a reversal of the environmental degradation currently underway (Baez 1987). Use of the Internet and related computer technology can help students to understand their role within the world through collaboration with other schools and scientists, giving students a sense of ownership, of community, and of motivation (Moore & Huber 2001).

A CHANGE IN DOMINANT LEARNING THEORY

Much of the argument for integrating instructional technology into education stems from current educational reform and a change in dominant learning theories. Education reform seeks a departure from transmission model classrooms - traditional teacher-centered classrooms in which the teacher is thought to transmit knowledge to passive students (Carlson & Maxa 1997). Reform efforts focus instead on the constructivist model, placing emphasis on providing students with opportunities to acquire skills that will help them investigate and solve complex, authentic, "real-world" tasks (Lord 1999; Bransford, Goldman, & Hasselbring 1996; Means & Olson 1994). This section will discuss some of the differences between the two models, as well as how they apply to the use of instructional technology within education and environmental education.

The traditional transmission model was the dominant learning theory in the United States from the early 1900's through the late 1960's. Inherent in the model are several assumptions and beliefs. These include 1) learning consists of acquiring a set of
skills or facts; 2) teachers are experts responsible for transmitting information to students; and 3) assessing is simply a process of determining whether students have acquired the desired set of facts and skills (Resnick 1987). This model presents an image of education that is similar to assembly lines, with each student passing through the same experiences and gaining the same set of facts. Traditionalist classrooms provide limited opportunity for individualized learning (Resnick 1987). Instructional technology within transmission model classrooms typically takes the form of computer-aided instruction (CAI), in which computers are used for “drill and practice” exercises. In these exercises, the computer guides the students through an activity or lesson until they master a particular skill or concept, then moves them on to the next (Means & Olson 1994).

These activities were the main form of computer application used within schools during the 1980’s and 1990’s (Networking the Classroom 1995). Typically used as a supplement to classroom learning, they provided review for concepts previously taught by the classroom teacher (Fortier et. al. 1998b). This supported the emphasis that transmission model classrooms placed on student verbal knowledge of specific isolated facts and skills (Thomas 2000; Center for Applied Special Technology 1996), rather than the deeper conceptual meanings that are the focus of constructivism (Glasson & Lalik 1993).

Constructivism has been increasing in popularity over the past 20 years, as a result of a recognized need for lifelong learners within the rapidly changing world (Resnick 1987). This model centers on the belief that “students actively construct knowledge through their interaction with physical and social environments” (Bransford, Goldman, & Hasselbring 1996). Teachers are viewed as facilitators and fellow learners,
helping students focus on the discovery of information through case and problem based techniques (Herr 2000; Carlson & Maxa 1997; Bransford, Goldman, & Hasselbring 1996). Constructivists stress that schools need to encourage students to “learn to collaborate with others and work in teams, sift through proliferating volumes of often conflicting information, engage in both critical and creative thinking” (Marx 2001). They encourage the use of multidisciplinary projects, flexible scheduling, and authentic tasks to achieve educational goals.

As education has shifted towards this model, instructional technology has also adapted. The use of this technology has transitioned from drill-and-practice activities to an “instrument with which [teachers] teach a traditional curriculum... in an effective, even more interesting way” (Tell 1999), to more interactive, interdisciplinary methods (Cradler & Bridgforth 1997). Advocates argue that the interactive nature of these instruments serve as “mind-tools that help students grasp concepts, use all of their sense, and practice what they have learned creating self-directed learning communities” (Cuban 1994).

Currently, instructional technology is viewed less as an educational subject in and of itself, and instead is used as a tool to enhance education in other subjects. Student-controlled technology use can improve communication skills, give students access to networks of data and resources, as well as connections to other learners (Kleiman 2000; Cradler & Bridgforth 1997; Bransford, Goldman, & Hasselbring 1996). Modern reform views technology as a tool to communicate with others, gather information from various sources, and express ideas (Thomas 2000; Center for Applied Special Technology 1996; Means & Olson 1994). These uses are extremely appropriate as collaboration, communication, and group learning are all stressed within the constructivist model.
A simple diagram can be used to demonstrate the differences between each model in terms of communication for a class of 30 students (Mitchell Nathan, personal communication December 11, 2001). Transmission models involve interaction solely between the teacher and each student, resulting in 30 connections or communication paths. The constructivist model, on the other hand, results in 465 lines of communication, stemming from interaction between the teacher and each student, as well as among students (Figure 1). This supports claims by Vygotsky and others that social interaction is a key feature in students' abilities to form new ideas and understandings. These researchers emphasize discussion and negotiation within student work, creating multiple connections (Lord 1999; Glasson & Lalik 1993; Roth & Roychoudhury 1993).

Research has shown that traditional transmission methods of teaching are not effective in providing students with in-depth understandings of materials that they can apply to new situations. In addition, the mental time students devote to learning is lower in teacher-centered classrooms than in student-focused classes (Lord 1999). In terms of
instructional technology use, however, researchers have discovered that the computer-aided technique favored by this model is indeed as, if not more, effective than traditional methods, and that the combination of CAI with traditional methods is also more effective than traditional methods alone (Bransford, Goldman, & Hasselbring 1996). Studies showed, however, that the addition of computers did not increase student ability to apply their knowledge to real life situations (Resnick 1987), one of the major drawbacks of the transmission model.

Students taught in constructivist classrooms have been shown to gain deeper, more comprehensive understandings of material, as well as a sense of enjoyment (Lord 1999; Cradler & Bridgforth 1997) and a motivation to continue to learn (Bransford, Goldman, & Hasselbring 1996). The Center for Applied Special Technology (1996), in a study of 28 schools in 7 of the United States’ largest cities, determined that Internet use within an existing curriculum did, in fact, significantly increase student learning. Students demonstrated “greater insight into the topic being studied, and were more effective in synthesizing the material and presenting different viewpoints” (Center for Applied Special Technology 1996). These students also gained a better sense of their role in, and connection to, the outside world, as well as the relevance of their chosen topic to their lives (Cradler & Bridgforth 1997; Center for Applied Special Technology 1996).

Instructional technology can have significant benefits within constructivism. These are: 1) to help teachers to see complex assignments as feasible; 2) to provide an entry point to content areas and inquiries that might otherwise be inaccessible until much later in an academic career; 3) to extend and enhance what students are able to produce, whether the task at hand is writing a report or graphing data; 4) to lend authenticity to
school tasks [because] students take great pride in using the same tools as practicing professionals; and 5) to give teachers the opportunity to become learners (Cradler & Bridgforth 1997; Means & Olson 1994). In addition, technology can help to “transform learning into the more flexible, personalized, and accountable endeavor required by today’s knowledge based economy” (SIAA 2001). Finally, many argue that, to effectively prepare students for the modern information-driven workplace, schools must expose students to modern computers and technologies (Kleiman 2000; Carlson & Maxa 1997; Cuban 1994).

It is important, however, that educators give thought to several possible reasons for the introduction of computers into classrooms: to ensure that students become computer literate, to provide students opportunities to access information and acquire higher-order thinking skills through analysis and problem solving, and to make a classroom more student-centered (Kleiman 2000; Kirkpatrick & Cuban 1998). While each of these can be a valid reason for using instructional technology, the distinction needs to be made in order to accurately assess the effectiveness of the method (Kirkpatrick & Cuban 1998).

The United States Department of Education (Thomas 2000) recognizes several key benefits to the use of instructional technology within education reform efforts. One such benefit is the change in student and teacher roles promoted by the changing uses of instructional technology. Classrooms are shifting from the more traditional expert/empty vessel roles to more facilitator/active learner roles. In a study published in 2000, they found that students using instructional technology became active participants in their education, while teachers functioned more as facilitators than experts. In addition, the
immediate feedback provided by the computer gave students a sense of accomplishment, a feeling of empowerment, and a greater feeling of competence and self-worth. Students also realized the importance and value of technology within our society through their own use of it (Thomas 2000; Cradler & Bridgforth 1997).

Based on research efforts focusing on changes in the dominant learning theory, Means and Olson (1994) presented five key features for classrooms striving to break away from the transmission model. These were 1) students should focus on complex, "real-world" tasks; 2) students should practice advanced skills; 3) the class should be broken into heterogeneous, collaborative groups; 4) the teacher should act as a facilitator, rather than transmitter of knowledge; and 5) work should occur over long periods of time.

An additional suggestion is to keep the student to teacher ratio low (President’s Council of Advisors on Science and Technology 1997), and to keep the student to computer ratio at or below 1:5 (Lohr 1997). Smaller groups result in more time for the teacher to interact with each student and to help the students to process information and practice skills. Longer class periods may also be beneficial to student learning, as longer times give students more opportunity to process and develop thoughts (Bransford, Goldman, & Hasselbring 1996; Means & Olson 1994). Figure 2 depicts these key factors that interact to support effective uses of technology within the constructivist model (Cradler & Bridgforth 1997).
Many of the skills addressed by the constructivist model of education are also compatible with the goals of environmental education. Environmental education encourages "inquiry and investigation and enables the learner to develop critical thinking, problem solving, and effective decision making skills" (EPA 1999). Constructivism reflects this, seeking opportunities for "hands-on, learner centered and cooperative learning approaches" and focusing on the need to develop "critical thinking, problem solving, and decision-making skills" (EPA 1999). In short, both strive for "students who are knowledgeable and skilled thinkers... able to put their knowledge, skills, and creativity to work solving problems... practiced at working collaboratively and independently... prepared to take their role as responsible citizens" (Archie, Heimlich & Daudi 1999).
INSTRUCTIONAL TECHNOLOGY AND THE ENVIRONMENT

The Tbilisi Declaration, created at the Intergovernmental Conference on Environmental Education in October 1977, sought to examine the role of environmental education on a worldwide level. Considered to be “one of the more important... documents in environmental education”, the declaration described a set of goals and objectives for which environmental education should strive. The overlying goal was that “environmental education should prepare the individual for life through an understanding of the major problems of the contemporary world, and the provision of skills and attributes needed to play a productive role towards improving life and protecting the environment with due regard given ethical values.” (Hungerford et. al. 1998). The definition of environmental education has been revised since, but the five objectives laid out by Tbilisi have remained. Hungerford et. al. (1998) describes these as:

1. **Awareness**: to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems.

2. **Knowledge**: to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems.

3. **Attitudes**: to help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.

4. **Skills**: to help social groups and individuals acquire the skills for identifying and solving environmental problems.
5. **Participation**: to provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems.

No specific disciplines or techniques were named within the declaration; presumably to allow educators to use whatever means possible to achieve the goals. Instructional technology is one such method.

Baldwin and Down (in Heimlich & Daudi 2000a) described instructional technology (IT) as having two main features. The first is that IT is essentially the organization of materials so that students and visitors have access to it. The second part is using the media and equipment available to aid the student or visitor in acquiring the desired information (in Heimlich & Daudi 2000a). The Association for Educational Communications and Technology published a similar definition: “the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning” (in Ely 1997). Both definitions focus on the availability and use of materials to help students learn.

In August of 1985, the Committee on the Teaching of Science of the International Council of Scientific Unions held a conference in Bangalore, India (Baez, Knamiller, & Smyth 1987). One of the goals of the conference was to promote education leading to responsible and rational use of the earth’s resources. Instructional technology was encouraged as one means of promoting such. According to Baez (1987), the goal of using instructional technology was to create new methods of teaching environmental concepts, while integrating them into education as a whole, rather than as a separate subject.
Many researchers report positive impacts of using instructional technology resources within environmental education. Having access to Internet resources makes it easy to obtain information about programs in other schools and centers, as well as allowing educators to interact with one another through e-mail and discussion groups (Rohwedder 1990; Leland 1990; Wals, Monroe & Stapp 1990). Instructional technology also makes a vast amount of information available, in terms of both teacher resources and environmental issues and concerns (Heimlich & Daudi 1996). Simulations and modeling activities may also help humans realize how their actions may affect the environment, before taking those actions (Rohwedder 1990a).

Research done by Mistler-Jackson and Songer (2000) demonstrated that interaction with scientists and peers worldwide results in an increase in student interest in a topic, as well as an increase in accountability for their actions. Sussman (1994) added another benefit to this interaction; by interacting with scientists, students gain a deeper content understanding and are more able to relate research directly to their lives.

Moore and Huber (2001) published a study demonstrating that use of the Internet can help achieve the National Science Education Standards while supporting the goals of environmental education. Environmental education emphasizes problem solving and decision-making within programs, and many Internet based programs focus on this, using small group discussions and collaboration between schools in a variety of countries. The standards, similarly, support the use of small cooperative groups to explore and process a wide range of issues. This increased interaction with others may also lead to improved presentations and final products, as students become more aware of what their audience desired and needed (Thomas 2000). This use of the Internet and related programs may
help teachers to achieve the goals of environmental education, as well, by offering opportunities to participate in experiential and authentic research, helping students deepen their learning and understanding of the environment (Moore & Huber 2001).

Instructional technology can improve the quality of material and types of opportunities provided by a lesson, provided it meets certain needs. As previously mentioned, the addition of computers themselves does not enhance learning. Rather, it is “the nature of the activities, tasks they accomplish, and intellectual and social activity involved in” that makes the difference (Solomon & Perkins 1996). Without proper planning, students may get caught up in stylistic features of the technology, rather than focusing on content (Thomas 2000). Some additional factors to consider when trying to integrate educational technology into a program are the characteristics and skills of the students, the grade levels and ages involved, the design of the system, anticipated outcomes, and the nature and cost of the design (De Miranda & Folkestad 1999; Truxel 1990; Boulton 1987). In addition, planners should consider how the teacher or educator is expected to participate and guide the activity, the nature of the activity being taught, the type of information being taught, and how the activity or information will relate to the outside world (Rohwedder 1990a; Wals et al 1990).

INSTRUCTIONAL TECHNOLOGY IN FORMAL SCHOOLS

There is a growing belief that technology, and technology-based education, needs to be further researched and put into practice in all school systems. Instructional technology can increase the opportunities and information available to students, while giving them experience and participation in the ever-growing technological world. An important part
of modern education reform is the integration of technology. The knowledge, skills, and education that students gain is being reshaped as new communication and information technologies are being developed and implemented in classrooms (Zohrer 2000).

The Internet is a large part of IT, with increasingly large numbers of individuals and classrooms becoming connected. Simply providing Internet access, however, may not be sufficient for promoting student learning (Kleiman 2000). McLaughlin (1997) found that 81% of classroom Internet use is solely for web surfing. In order to promote student motivation and performance, programs need to be designed to include four key features. (Mistler-Jackson & Songer 2000)

1) Lessons should include communication and collaboration with peers and professionals worldwide. These interactions have been shown to increase student interest and engagement (Mistler-Jackson & Songer 2000; Kleiman 2000), and to provide students with friendships and broadened perspectives of the topic (Means & Olson 1994).

2) Programs should provide a sense of authenticity and the opportunity for students to participate in authentic research and use professional tools.

3) The third feature is access to real time information, rather than older materials. By providing access to current information and phenomena, students feel more equal, more empowered, and more involved.

4) Finally, programs should involve first hand resources, rather than second hand information or observations.
When combined together, these four program features (communication and collaboration, authenticity, real time information, and first hand resources) can be effective in helping students to become more motivated, leading to a higher level of performance (Mistler-Jackson & Songer 2000).

The Kids as Global Scientists program (KGS) is an excellent example of a program found to use these four features to involve and motivate students. An evaluation of the program by Mistler-Jackson and Songer (2000) found that students “consistently show improvement in several areas, including content understanding, control of their own learning, and time on task.” KGS also demonstrated three additional features determined to enhance student learning.

1) The first of these is the use of tele-collaboration. Mistler-Jackson and Songer (2000) found that students were excited and intrigued to talk with students in different areas. They caution that facilitators need to ensure that these collaborations remain appropriate and subject-specific, however.

2) The second feature is the use of authentic questions. To properly research a topic, students need to be able to ask real, research-based, current questions and receive valid answers.

3) The final feature is the timing of a project. Students need to have enough time available for an in-depth investigation of the topic. (Mistler-Jackson & Songer 2000).

With the features described above, as demonstrated by KGS, students can become motivated to learn and empowered to perform well.
Many problems that have surfaced regarding technology use within the classroom are due to a lack of teacher preparation (Cox-Petersen & Melber 2001; Rohwedder 1990a). This may be related to the lack of instructional technology preparation by pre-service teacher education programs and/or a lack of available funding to provide in-service training (Cox-Petersen & Melber 2001; Kleiman 2000; President’s Council of Advisors on Science and Technology 1997). Other issues include limited teacher knowledge about how to use technology equipment and how to integrate technology into lessons. In addition, many trainings focus on how to use the technology itself, rather than how to use technology as a teaching tool (Herr 2000; Kleiman 2000; Rohwedder 1990a). Often, teachers are faced with limited time in which to plan, conduct, and process programs with their students (President’s Council of Advisors on Science and Technology 1997; Cuban 1995). Overcoming each of these challenges is important to the successful use of technology. To add to the problems, technology is constantly changing, making it hard to keep up with current uses. As such, De Miranda & Folkestad (1999) reported that technology education is often currently reserved for classes in which the teacher is creative enough to include technology. They feel this will remain the case until there are enough time and resources set aside to formally train teachers in using instructional technology to teach. Other organizations and individuals have also acknowledged the need for teacher preparation and training.

One organization taking a pro-active approach to this training is the International Society for Technology in Education (ISTE). ISTE is an organization dedicated to “promoting appropriate uses of information technology to support and improve learning, teaching, and administration in K–12 education and teacher education“ (ISTE 2000). In
1993, they created a set of standards for teachers using technology in their classrooms. This guide, entitled “National Educational Technology Standards for Teachers” (NETS•T) focused on pre-service teacher education, recognizing that many teachers need to be taught the main concepts, knowledge, skills, and attitudes needed to adequately bring technology into the classroom setting. The standards were revised twice, and in 2000 were coordinated with the student technology standards. Twenty-three indicators for satisfactory teacher training were identified, grouped into six categories: 1) technology operation and concepts; 2) planning and designing learning environment and experience; 3) teaching, learning and curriculum; 4) assessment and evaluation; 5) productivity and professional practice; and 6) social, ethical, legal, and human issues (ISTE 2000a). These were designed as guidelines for pre-service training institutions and school districts to use when developing and evaluating teacher-training programs. ISTE it is the responsibility of the training institution and school district to provide the opportunities for pre-service educators to gain the skills and knowledge necessary to successfully integrate instructional technology within their classroom. (ISTE 2000a)

The United States Department of Education has also acknowledged the need to improve teacher training in technology use. As such, in October 2000, two grants were approved to enhance the training available to teachers using technology. The first was to be used by the Public Broadcasting Service (PBS) to create an online teacher resource, linking classrooms in sixteen states with PBS, individual state departments of education, five colleges of education, ISTE (International Society for Technology in Education), and the Corporation for Public Broadcasting. Some of the resources that will be available are on-line mentoring, discussion groups and lists, and digital videos of classrooms in order
to help teachers improve their teaching techniques in the areas of math and technology.

The second grant was awarded to the Concord Consortium to conduct a study of the success of using technology as a teacher-training tool. Videos will be used as a comparison of methods and techniques, to determine whether technology has a significant effect on the teachers (Thomas 2000).

EduPort is yet another tool designed to help teachers supplement their classes. This tool was developed to “allow teachers to fetch on demand a wide range of educational materials not typically available at schools” (Chauhan 1995). Teachers using the system could navigate through materials, searching for video, text, images, and audio to supplement their classroom discussion. This material could be accessed when desired, allowing teachers to fully make use of teachable moments. Because the information was instantly available, teachers did not need to search a library and postpone discussions until later. Miriam Masullo, the researcher in charge of the project, described EduPort as a step for the future, saying “by the end of this century, large-scale digital libraries... will be accessed in real time, on-demand” (Chauhan 1995). The major obstacle to be overcome with EduPort was determined to be funding. To use the system, classrooms needed a multimedia computer system, in addition to large display screens and a server to house the information. During the pilot test, this was overcome by a partnership between Lincoln High School, I.B.M., the University of Nebraska, and Lincoln Telephone and Telegraph. Schools unable to create these partnerships may be financially incapable of initiating programs of this nature (Chauhan 1995).

Each school has its own specific needs, but many successful programs can be established by following the recommended standards and taking into account the...
considerations listed above. Non-formal settings, such as nature centers, are more variable and therefore need programs designed specifically for each center.

INSTRUCTIONAL TECHNOLOGY IN NON-FORMAL SETTINGS

Non-formal settings, including nature centers, museums, and environmental education programs, often serve a wide variety of audiences and it is therefore important that programs be developed in a manner that allow them to cater to the general public.

Wayburn (1987) listed five features that should be built into on-site technology-enhanced environmental education programs in such non-formal settings. These ensure that a program can be used for any visiting group, easily and logically.

1) Programs should be adaptable, multipurpose, and flexible.
2) Programs should involve a common and accepted medium.
3) Programs should use economical, durable, simple, and easily maintained materials.
4) Programs should use relevant local themes to illustrate broad issues.
5) Programs should use both practical experience and scientific knowledge as the basis for proposing alternatives to environmentally threatening actions (Wayburn 1987).

Many museums and other organizations have chosen to partner with schools, rather than leaving student discovery of their information to chance. Shields (2001) described several benefits to this partnership. Through partnerships, schools can access a wealth of learning materials and opportunities that can then be used to stimulate student
learning beyond textbook abilities. This is especially beneficial to teachers whose areas of specialty may span several disciplines. Museums benefit because the students are exposed to their collections and information, giving the museum the chance to “cultivate lifetime museum patrons” (Shields 2001). Technology based in the museum setting is used to enhance exhibits, provide information on a website, or use distance learning to reach audiences not able to visit the museum. The key aspect of using technology by museums is that it provides an opportunity for people to see the “treasures” museums house (Shields 2001).

Nature centers have also found a variety of methods for using technology onsite to help students learn. These have been divided into three main categories: simulation games and exhibits, information kiosks, and live interactive field trips.

**Simulation games:** Simulation games are beneficial to student learning because they promote active participation in the activity and provide an entertaining and fun way to learn decision making and problem solving skills. In many cases, these games take the form of computer applications that mimic or model an actual situation or environmental issue, in a manner that is easy to understand (Blum 1987). Whether an individual is observing a simulation or participating in a role-play, there are several goals to keep in mind (Meadows & Fiddaman 1990).

Games should have a friendly and cooperative attitude, while providing an opportunity for students to understand the causes and effects of their actions on the environment. There should be alternative actions made aware to students, and communication and problem solving skills should be used to obtain these. The final
consideration is that simulation games provide a metaphor of the issue examined by the game that allows students to compare this issue to real life phenomena (Meadows & Fiddaman 1990).

One such simulation, Mapping the Environment, is offered by the Missouri Botanical Garden. Participants in the program learn to use ArcView® GIS to explore volcanic activity and seismic patterns, tornado and hurricane paths, and climate patterns across the United States. They can then compare these activities to their community, exploring natural flora and fauna, typical conditions of the community, and how their local region compares to others. The recommended land use activity for CWES would use similar methods, though all students would focus on the landscape at CWES, rather than local landscapes.

Many of these games do have their downfalls though, mainly due to the inherent characteristics of the game. For instance, game playing tends to oversimplify environmental issues, as well as portray a certain value, inhibiting learners from forming their own values and understanding the full reality of a situation (Blum 1987). Designers should take care to avoid treating the simulation as a video game and to keep it educational (Lynch 1990).

**Information kiosks:** Kiosks differ from simulation games in the type of information they present. Rather than providing an opportunity to work through an issue or environmental concept, kiosks present simple factual information (Samples & Silcox 1996), ideally in a manner that is interesting, entertaining, and informative to the visitor (Honkonen & Hoogeboom 1996). The Walden Pond State Reservation in Concord, Massachusetts uses
a kiosk display to convey reservation and town information, a detailed history of Walden Pond and Henry David Thoreau, and information about other forests and parks in the state. The kiosk uses a combination of audio-visual techniques, ranging from video and audio clips to maps and text publications (Honkonen & Hoogeboom 1996).

In museums, exhibits, rather than people, are the teachers. As time passes, a variety of techniques have been developed to use technology to increase visitor participation in the museum setting (Boyd 1993). The American Museum of Moving Images is one example. Currently, the museum is developing portable devices for visitors to carry through the museum with them. These devices will allow visitors to selectively obtain information, images, and text files associated with exhibits in the museum. The selections they make from the device’s menu will then be placed on a personalized webpage that the visitors can link to when they arrive back at home. (Vargas 2001).

Webpages are a common tool used by museums and nature centers alike to get information to the general public. When designing the webpage for the Smithsonian Institutions National Museum for American History, Julia Forbes, senior educator at the museum, says that “we always include something interactive to highlight the theme and to help visitors approach it in a fresh way” (Shields 2001).

**Virtual field trips**: Live interactive technological field trips are another way environmental centers are reaching out to the community. These electronic trips make it possible for schools unable to visit a center to participate in a similar experience as those able to attend. These trips also allow access to sites that would not be physically possible for schools to visit due to accessibility, cost, distance, etc.
A large number of art museums have chosen to create virtual collections for visitors to peruse. Many of these are well-known and respected museums such as the Louvre, British Museum, National Portrait Gallery, National Gallery of Art, Art Institute of Chicago and Amon Carter Art Museum. Websites of each museum include an array of information and images from their museum, ranging from images of the collections housed in the museum to in-depth discussions of art history, searchable databases, and more. Several of these sites also include games, hands-on art creation, and personalized entries that are posted on the website for others to view. (Allen 2001)

The use of virtual field trips in the museum field is not limited to art. Science museums have also created an array of engaging virtual field trips. These incorporate online time tours (exploring dinosaurs and other ancient creatures), an interactive Periodic Table of the Elements, a database of satellite gathered NOAA data, information on the inner workings of atoms, the history of mathematics, the opportunity to take a virtual swim with sharks, explore the life of a vampire bacterium, search for a specific legislative bill or disease, and volunteer to assist scientists with water sampling. (Fackelmann 1997).

The Central Wisconsin Environmental Station has begun exploring the use of virtual field trips, through a Wisconsin Forestree Outreach project completed in the fall of 2001. The Wisconsin Forestree curriculum is a 10-lesson classroom unit combined with a 2-3 day field experience at CWES. The program seeks to help students explore the environment and economy behind Wisconsin forests. During the on-site experience, students in grades 6-8 learn about forest ecology, diversity, and value, as well as how to determine the suitability of a habitat for gray squirrels. Wisconsin Forestree Outreach
built off of these lessons, creating virtual field trips for each of the on-site lessons, in addition to online resources and related sites to help students further explore Forestree topics. Visitors to the site can learn how to use professional tools, read about current issues facing Wisconsin’s forests, learn to identify common Wisconsin trees, tour a sawmill, and go on a virtual field trip in which they learn the same techniques and participate in the same activities as students who visit the station.

(http://www.uwsp.edu/cnr/cwes/Forestree/ 2001)

The aforementioned methods all involved using technology to provide information at a center that both students and schools could access, either through live field trips or on-site opportunities and displays. Centers should also consider methods of outreach that do not involve actively seeking out schools (Palmer & DiSilvestro 1990). Many schools may not have access to site visits or may lack adequate time to use a live interactive field trip (Palmer & DiSilvestro 1990). In such cases, creating an Internet resource would allow schools or individuals to access information at their leisure and convenience.

The research demonstrates many benefits and potential uses of instructional technology within education, both in formal and non-formal settings. As time has passed, and dominant learning theory has changed its perception of students from one of empty vessels to active constructors of knowledge, the use of technology has also changed, transitioning from drill-and-practice to lesson supplements. The question is whether classroom use has changed as these transitions have occurred.
TECHNOLOGY TRENDS WITHIN EDUCATION

It is ineffective to discuss the theoretical side of technology use within education without examining the practical side as well. With the wide variety of technological applications available, what is actually being used? How has actual technology use changed over time as new technologies have been developed? There have been several studies of these trends.

The use of technology in schools has been steadily increasing in the United States as evidenced by the fact that expenditures have risen significantly, more than doubling between 1991 and 1998 (Rockman et. al. 1998). Many types of instructional technology have also increased in usage. For example, educational use of CD-ROMS increased 136% in 1995, and almost 250% since 1988 (Rockman et. al. 1998).

Computers, in particular, have been a significant source of technology within schools. There were almost twice as many computers per student in 1995 (12:1) as in 1988 (22:1) (Plotnick 1996). Student use of computers also increased, from 27.3% of students in 1984 to 68.8% of students in 1997 (National Center for Education Statistics 1999). This increase was present in both public and private schools, with public schools (27.4% in 1984, 70.2% in 1997) having slightly higher percentages of student use than private (26.5% and 60.7% respectively). The National Center for Education Statistics (1999) reported that total computer usage in schools increased from 59% of schools in 1993 to 69% of schools in 1997.

Internet access has also increased, as shown in Figure 3. Between 1994 and 2000, the percentage of public schools with access to the Internet rose from 35% to 98%. (Cattagni, Farris, & Westat 2001).
This held true within the classroom, as well. Figure 4 shows the percentage of schools and instructional rooms (classrooms, computer labs, and library or media centers) with Internet access between the fall of 1994 and the fall of 2000 (Cattagni, Farris, & Westat 2001).
The ratio of students to computers within these classrooms has dropped as well. In 1999, the national average was 6 students for every one computer. By the fall of 2000, that ratio had dropped to 5:1 (Cattagni, Farris & Westat 2001), a ratio “many experts consider… a reasonable level for the effective use of computers within the schools” (President’s Council of Advisors on Science and Technology 1997). (Figure 5)

![Figure 5: Ratio of Students to Instructional Computers with Internet Access](Castagni, Farris, & Westat 2001)

**CONTROVERSY SURROUNDING THE USE OF I.T. WITHIN E.E.**

There is some opposition to the use of educational technology in teaching environmental education. Many fear that technology is attempting to replace the outdoor experience of environmental education. Julyan (1990) writes that using computers during environmental lessons may isolate children from the environment, encouraging them to participate in mindless activities. Educators may also feel that allowing computers to be integrated into lessons may create a “strong potential for control, manipulation, and dehumanisation of people and centralisation of authority” (McClaren 1990).
David Sobel’s book, *Beyond Ecophobia* (1996), focuses on the need to reclaim the original focus of environmental education—exposure and experience in the environment. He fears that the increasing use of technology and electronic media is having the opposite effect of that intended. “Children are disconnected from the world outside their doors and connected with endangered animals and ecosystems around the globe through electronic media” (Sobel 1996). He advocates sending children into the outdoors to give them the education they need.

Moore and Huber (2001) stress two common misconceptions of opponents to IT within environmental education. The first misconception is that promoters of technology are suggesting replacing authentic outdoor learning experiences. Moore and Huber (2001) stress that the goal should be to use the Internet to support these types of experiences, rather than to replace them.

The second misconception is that Internet-supported programs focus on surfing the Internet for information. The truth is that, in many cases, access to the Internet can actually be restricted to those sites applicable to the study, preventing students from accessing information not related to the classroom activity (Moore & Huber 2001).

There are times when researchers agree that it may be inappropriate to use instructional technology within a lesson. An example of these is experiences that rely on hands-on contact with the environment. If the personal experience were replaced by technology, the ideal student experience would not be possible. To minimize these situations, planners should evaluate the information and experiences they are trying to pass on, assess the pros and cons of including technology in a given lesson, and try to accurately match the goals of the lesson with the methods available (Rohwedder 1990a).
CHAPTER 3
METHODOLOGY

The following pages discuss the methods used to reach each research objective.

OBJECTIVE 1: To determine the purpose and goals of instructional technology use at CWES.

A meeting was held on January 23, 2001 to discuss parameters for the research. There were three objectives for this meeting (Appendix B). The first objective was to define technology for the purposes of this project. Prior to the meeting, the researcher identified eight categories of technology used to guide planning meeting discussion. These categories were:

- Staff preparation, research, and training (i.e. lesson preparation)
- Non-active supplement to programming (i.e. exhibits in main building)
- Link from school to program (i.e. accessible data log of information)
- On-site technical experience (i.e. data collection and analysis)
- On-site supplement to programming (i.e. equipment to aid lessons)
- Special events or programs
- Distance learning (i.e. workshops, conferences, and lessons)
- Publicity and outreach (i.e. advertisement and information transfer)

The second objective was to determine which of these types of technology was of highest priority to CWES, in terms of programming and strategic planning.

The final objective of the meeting was to determine locations from which to gather information about how technology is currently being used in environmental education.

Results from the planning meeting were used to develop research objectives and the methods that follow.
OBJECTIVE 2: To examine current instructional technology use and related trends within K-12 schools in Wisconsin.

In order to understand how environmental centers can best use technology to bridge the school classroom experience with the field experience, it is necessary to understand current trends in technology within the school systems. Statistics and studies have been compiled at both a federal and state level illustrating how districts have been using technology within school systems. Research and data about technology trends within Wisconsin was accessed and compared to data representing the country as a whole, in order to determine where Wisconsin fit on a national level.

This information was then used to help the researcher, and CWES team, to determine the best use of technology to bridge classroom experiences with on-site CWES programming.

OBJECTIVE 3: To survey instructional technology use at environmental education centers and related organizations to a) link the onsite and classroom experience provided to visiting school groups, b) enhance onsite educational experiences, and/or c) otherwise enhance educational experiences.

Environmental centers with members in the Association of Nature Center Administrators (ANCA) were designated as the survey audience because of ANCA reputation and mission. The organization is a “national network of nature center leaders designed to enhance professionalism and provide the support system critical to innovative and progressive management” (Articles of Incorporation 1993).

An initial inquiry letter (Appendix C) was sent via electronic mail to each center or organization on the ANCA list (Membership Directory 2001), explaining the goal of the research and defining the technology being examined. Centers were asked if they had
any programs that met the description and if they would be willing to participate in the research.

Upon receipt of replies, organizations were e-mailed one of two follow-up letters (Appendix C). The first letter was sent to those centers agreeing to participate in the survey. It thanked them for their assistance and notified them of a time period in which to expect the survey. The second letter was sent to those centers that replied, but reported not having programs of the desired type. This thanked them for their assistance and notified them that results would be sent to them via e-mail during the spring of 2002.

The Technology Use Survey was created with which to gather information via electronic mail from these organizations (Appendix C). An online survey had two perceived benefits: 1) ease of access and reply, and 2) lower costs than postal mail to both researcher and audience. The electronic format of the survey made it difficult to include a cover letter with the actual survey. One was developed, however, to send to centers via email before completion of the survey. This letter reviewed the topic of the research, thanked them for their participation, and informed them of the Internet address at which they could locate the survey. (Appendix C).

The goal of the survey was to examine the technology being used within programming, in terms of both on-site education and bridging the school to the site experience. Questions were developed by the researcher and revised by the graduate committee. Partially closed questions were used to give the most options possible, but allow them to provide their own input in the case that a use was not included in the choices (Dillman 1978).
I. What types of instructional technology do you use at your facility? (check all that apply)
The research goal focused on ways that instructional technology was being used at EE centers. Therefore, the first question asked was what they use, to begin the survey with the most important topic.

II. Why did your organization choose to use instructional technology? (check all that apply)
This question allowed centers to explain the reasons that they chose to incorporate instructional technology into their programs. It also helped to explain the types of programs that they selected, whether they are highly technical or simpler and “kid-friendly”.

III. Please describe the technology-enhanced program/application of which you are most proud.
This is important for similar reasons as the first question. The open-ended question allowed centers to provide descriptions of the programs that they were most proud of, helping to showcase some of the variety of different technology programs that various centers have.

IV. How do you assess the effectiveness of your technology-enhanced programs? (check all that apply)
Answers to this question helped to explain how centers determine that their programs are successful.

V. Which of the following barriers, limitations, or challenges affect your use of instructional technology in educational programs? (check all that apply)
Each answer choice is a possible reason why technology use may be limited, or a challenge in keeping a program operating. Examining the perceived challenges to using instructional technology will be helpful when listing considerations for each recommendation for CWES.

VI. Please indicate which program(s) you offer (check all that apply.)
VII. Please indicate the audience(s) that you serve (check all that apply.)
These two demographic questions were helpful to compare the organization to CWES.

The survey was pilot tested by directors of three nature centers in Wisconsin:

Kathe Conn (Aldo Leopold Nature Center), Rick Flood (Riveredge Nature Center), and Libby Dorn (Fallen Timbers Environmental Center). These individuals were contacted
via email in early May 2001, and asked to review the survey for clarity and perceived appropriateness to the audience.

Surveys were mailed out on May 22, 2001 to individuals at the 36 organizations who had responded with their willingness to share their programming ideas with the researcher (Appendix D). All correspondence, with the exception of the response letters, was sent through the Central Wisconsin Environmental Station e-mail address, in order to maintain professionalism and accessible contact throughout the summer of 2001.

**OBJECTIVE 4:** To examine and case study those uses that are most applicable and important to CWES, including characteristics of the program such as site, staffing, etc.

Case studies of each center were compiled during the summer of 2001 using information gathered from survey responses and follow-up interviews. These write-ups summarized the results of the organization's survey response, as well as information gathered from the organization's website and subsequent e-mail responses to researcher questions. In addition, a spreadsheet of data was compiled to illustrate the abundance of instructional technology methods within the surveyed centers.

The case studies were then presented on September 13, 2001 to the CWES planning team (Appendix I) and September 20, 2001 to the graduate committee in order to obtain further input on the priorities of CWES and how results could be used to attain these.
OBJECTIVE 5: To explore the benefits, drawbacks, and controversy surrounding the use of instructional technology within education and, more specifically, environmental education.

Instructional technology is relatively new to the field of environmental education. As such, it was important to gather information about not only what is being done within the field, but also the opinions of professionals using IT within the field, both positive and negative. This was begun through an extensive literature search.

A poster was displayed at the Wisconsin Association for Environmental Education Winter Workshop on February 1-3, 2002. Roughly 90 teachers and environmental education professionals from the state of Wisconsin attended this workshop. Attendees were invited to share their opinions by writing them on the poster, which was hung in a prominent location and read

“What do you think about technology in EE? (instructional technology – i.e. computer-aided learning, virtual experiences, distance learning, etc.) Please feel free to write your thoughts. Beth Lesure, UWSP/CWES, Grad Student.”

Opinions were also sought from each nature and environmental center administrator who responded to the initial inquiry letter in Objective 3 (Appendix D). Each person was contacted by telephone between March 20th and March 29th, at which time the purpose of the study and this specific objective was explained to him or her. They were then asked if they would be willing to submit an opinion based on a brief survey that would be emailed to them. Fifty-four people were called. Eight phone numbers were incorrect. Messages were left for 16 individuals, and another 5 had left their organization since the first survey. Five people requested surveys and did not complete them. One message was undeliverable. This left 19 individuals to respond to the
survey. Those individuals were emailed between March 20\textsuperscript{th} and March 29\textsuperscript{th}, 2002. (See Appendix F for Telephone Contact Script and Survey Instrument)

**OBJECTIVE 6: To prepare recommendations for the future use of instructional technology in CWES programming.**

During the meetings held on January 23, September 9, and September 20, 2001, recommendations and suggestions were given delineating how CWES could use technology to enhance programming. The researcher and the CWES Director reviewed these recommendations and further developed the recommendations seen in Chapter 5.

The following factors were taken into consideration when reviewing recommendations.

- Overall objective for each activity.
- Components and audience activities necessary to attain the anticipated outcome.
- K-12 grade range that the activity could address.
- Integration into current programming, as well as any modifications or additions needed.
- Equipment requirements, detailing the current equipment to be utilized as well as any new equipment needed. If applicable, the location to store or implement the concept was also examined.
- Required staffing, including program related set-up (i.e. activity guide design) as well as ongoing staffing necessary (i.e. facilitate online bulletin board).
- Finances required to implement the recommendation (i.e. new equipment, staff time and training, etc.)
- Wisconsin Model Academic Standards (Environmental Education, English Language Arts, Social Studies, Science, Mathematics, Technology Education and Information and Technology Literacy), which each activity could address, within the appropriate age range.
- A justification for the option, including how the proposed option would address the CWES mission and how the audience(s) will benefit from implementation, in addition to benefits to the UWSP-CNR and practicum students.
CHAPTER 4
RESULTS

OBJECTIVE 1: To determine the purpose and goals of instructional technology use at CWES.

A planning meeting was held on January 23, 2001 to discuss parameters for the research (Appendix B). Present at the meeting were the researcher, CWES director, CWES assistant director, CWES program manager, CWES outreach specialist, and CWES program assistant/facility repair worker.

The first objective was to define technology for the purposes of this project. The following categories of technology were examined to provide a basis for discussion of the most desirable types to research.

- Staff preparation, research, and training (i.e. lesson preparation)
- Non-active supplement to programming (i.e. exhibits in main building)
- Link from school to program (i.e. accessible data log of information)
- On-site technical experience (i.e. data collection and analysis)
- On-site supplement to programming (i.e. equipment to aid lessons)
- Special events or programs
- Distance learning (i.e. workshops, conferences, and lessons)
- Publicity and outreach (i.e. advertisement and information transfer)

It was determined that some of the categories were already in place, and therefore could be left out of the discussion. These included staff preparation, special events, and publicity and outreach. This left the group with the remaining five categories to discuss during the second step of the meeting.

Discussion then focused on which categories the staff felt were most relevant to this research. It was determined that the focus of this research should be on examining methods of linking on-site, hands-on technical experiences and lessons with off-site investigation of results and further activities to increase student knowledge and exposure.
to the topic at hand. This was determined to be an effective way to increase the learning
time provided by CWES to longer than the one-day spent at the station and to maintain a
connection between school groups and CWES. In addition, the team felt that this
research would be an effective way of supporting sections of the CWES mission focusing
on the training and mentoring of university students and the providing of innovative
environmental education experiences to school groups.

The final objective of the planning meeting was to brainstorm possible locations
of desired data and information. The first population identified was environmental centers
and similar organizations throughout the United States. The team decided that a
qualitative survey would be the best way to obtain information from these organizations.
This survey would gather information about how these organizations use technology in
both on-site programming and as a means of linking on-site programming with classroom
activities. The reasoning behind this was that survey results could give CWES valuable
information about how technology is currently being used, which could then be used to
draw conclusions about which types are most effective and would be most applicable and
useful at CWES.

The second location for information was determined to be Wisconsin K-12
schools. Desired information from this audience included 1) the types of technology
currently being used within the schools; 2) how technology uses have changed over time;
and 3) projected changes in technology during coming years. This information could
lead to conclusions about the types of technology most common and therefore which
types would be most utilized when combined with CWES experience.
OBJECTIVE 2: To examine current instructional technology uses and related trends within K-12 schools in Wisconsin.

As discussed in Chapter 2, technology use within schools has been steadily increasing in the United States. This is true within Wisconsin as well. The Milken Family Foundation report, “Survey of Technology in the Schools: Preliminary Tables” (1999) surveyed district technology coordinators to compare technology use in schools in 26 states, including Wisconsin. Total expenditures per student were found to be higher in Wisconsin than the average nationwide expenditure per student. In addition, the percent of expenditure used to implement technology was higher in Wisconsin than the nationwide average (Survey of Technology in the Schools 1999).

The report also distinguished between the presence of computers, described above, and the type and duration of computer use (Figure 6). Wisconsin students were found to use technology less to improve their basic skills using drill and practice programs than the average state (22.7% vs. 28.4%). In addition, students in Wisconsin were found to focus on learning to use the actual technology only slightly more than nationwide averages (11.8% vs. 10.5%). Students in Wisconsin use technology to develop online research expertise more often than the average (63.5% vs. 55.8%).
Students in Wisconsin spent a slightly larger percentage of their classroom time using technology (16.4% vs. 16.2%). There are fewer Wisconsin students per Internet accessible computer than the national average and a greater percentage of Wisconsin schools have the majority of classrooms connected to the Internet compared to the national average (*Survey of Technology in the Schools* 1999).

Wisconsin teachers are also making use of technology more often than the nationwide average. The use of technology to turn in assignments, to meet individual student needs, and to use cooperative group learning processes were all areas in which teachers in Wisconsin integrated technology. 58% of teachers in Wisconsin believe that technology is a powerful tool for helping improve the learning in their classrooms. The percentage of these teachers is lower than the average (61.7%), and lower than 20 of the other 26 states researched (*Survey of Technology in the Schools* 1999).

Figure 7 illustrates typical teacher skills, as reported by district technology coordinators. These skills were reported on a Likert scale, with 1 being “Beginner” and 5
being "advanced." Percentages reported indicate the percentage of reported 4's and 5's on the scale. Results show that the typical teacher in Wisconsin is less skilled at several technology-related tasks than the average teacher, including the use of multimedia peripherals, online projects, using distance learning, and integrating technology into instruction. The typical Wisconsin teacher, however, is more skilled at general computer and software use, as well as the use of the Internet and email (Survey of Technology in the Schools 1999).

Figure 7: Skill Level of Typical Teacher in Wisconsin vs. Average
(Milken Family Foundation 1999)

The survey also gathered information about reported student outcomes. Figure 8 shows results from this survey for both Wisconsin and the overall average. Results indicate that in Wisconsin, students interact and communicate more widely as a result of technology use within their classroom. In addition, compared to the overall average,
Wisconsin students were reported to become more independent learners (63.4% vs. 56.9%) and more engaged in the learning (66.2% vs. 64.6%) due to technology. These percentages are only slightly higher than the overall average, however, illustrating that students nationwide are benefiting from the use of technology within their classroom. Many technology coordinators also feel that students are increasing their understanding of academic subjects, though these numbers are not as striking as several other student outcomes. This is especially true in Wisconsin, where only 30.3% reported this deeper understanding, as compared to 42.9% for the overall average.

Computer use and Internet access are increasing, in addition to other types of instructional technology. These are being used throughout schools, in both classrooms and libraries, for a wide variety of purposes. Research has shown that the Internet, when

![Graph showing reported student outcomes as a result of technology use in classroom](image-url)
used appropriately within school programming, can assist teachers in achieving National Science Education Standards (Moore & Huber 2001). As such, this research will include potential standards that could be addressed as a result of the recommendations.

As the Milken Family Foundation survey illustrated, Wisconsin is one of the top states in terms of technology access and use. Compared to the nationwide average, a greater percentage of teachers in Wisconsin believe that students interactions are different and that students communicate more widely with the presence of technology and that, as a result, students are becoming more independent learners (Survey of Technology in the Schools 1999).

OBJECTIVE 3: To survey instructional technology use at environmental education centers and related organizations to a) link the onsite and classroom experience provided to visiting school groups, b) enhance onsite educational experiences, and/or c) otherwise enhance educational experiences.

The Association of Nature Center Administrators (ANCA) membership directory yielded a list of 365 names, including organizations, environmental centers, and individuals. These were examined for repeat addresses, and then further narrowed based on available email addresses. The result was 261 organizations (Appendix D). Inquiry letters were sent to the contact person at each of these addresses in March 2000. To encourage cooperation, it was decided that each center or organization that replied to the initial inquiry would gain access to the final results of the study. Seven messages were non-deliverable, resulting in 254 possible responses. 55 organizations replied. 36 requested surveys and 19 requested results, though they had no programs applicable to this research study (Figure 9). One organization was rejected, as the organization was a formal school, therefore did not fulfill the parameters described in the survey criteria.
Questions inquired about the specific types of technology in use, the frequency of student technology use, the purpose of said technology use, the perceived effectiveness of technology in programming, and challenges to technology use. Relevant characteristics of the organization were also collected (i.e. target audience, setting, and length of programs offered).

The survey was completed in early May. The website that the survey was located on was accessible only by typing the address into a web browser, ensuring that the only people with access to it were those who had been specifically given the address. The online survey was created to be simple yet informative, and to require only 5-10 minutes of the individuals’ time.

Pilot tests were conducted, using three Wisconsin environmental center directors. The survey address was sent to them in early May and the directors were asked to evaluate the survey based on content, namely whether they would want any additional
information were they undertaking the research for their organization. The three
directors asked to pilot test were 1) Kathe Crowley Conn, director of the Aldo Leopold
Nature Center in Monona, Wisconsin; 2) Rick Flood, Executive Director of Riveredge
Nature Center in Newburg, WI; and 3) Libby Dorn, director of Fallen Timbers
Environmental Center in Seymour, WI. Responses were received from Kathe Conn and
Rick Flood (Appendix G), Libby Dorn was unable to access the website. Some
suggestions for edits to the survey included questioning organizations whether their
technology use has replaced human-human and human-nature contact, what the operating
costs of the program were, the impact the technology has had on their programming, and
the type of organization they are affiliated with. Many of these were topics previously
determined to be reserved for follow-up, so they were not included in the survey.

The survey website address was emailed to each organization on May 22, 2001.
Completed surveys were sent via electronic mail to the Central Wisconsin Environmental
Station, where they were printed out. Responses were received from 22 centers
(Appendix H).

The following summary is constructed by question, including the percentage of
respondents replying positively to each choice, as well as additional comments and uses
reported in “other”. This summary was sent via email on May 3, 2002.

Summary of Results (Appendix H)

Type of Instructional Technology In Use

The types of instructional technology in use at responding centers are shown in
Figure 10. Fifty-nine percent (13) of the replies described using computer software
programs or simulations within their education program. Forty-one percent (9) report student/visitor use of the internet. Forty six percent (10) of the surveys reported using technology to analyze data. Internet virtual field trips exist at only 9% (2) of responding organizations. Distance learning (providing education off-site via telecommunications) is present in 18% (4) of participating sites. Thirty six percent (8) of replying organizations use Global Information Systems (GIS) within program.

![Figure 10: Types of Instructional Technology in Use](image)

Several additional uses were reported. These ranged from handheld computer devices to collect and analyze data, to computer controlled theater presentations to welcome visitors to the site, to databases to sort and maintain habitat data, to webcams, CD-ROMS, and weather learning centers. In addition, several organizations participate in broader programs such as GLOBE and Classroom Feederwatch.

**Reasons for Using Instructional Technology**

Figure 11 depicts reasons respondents selected for using instructional technology within their programming. Thirty two percent (7) of the responding organizations
reported audience demand as a reason for using IT within their education programs. Eighteen percent (4) use IT to meet state education requirements. Thirty six percent (8) use technology to reach otherwise inaccessible audiences. Sixty-eight percent (15) reported that IT is used because kids relate well to technology.

![Figure 11: Reasons for Using Instructional Technology](image)

Additional reasons for using instructional technology within education programs were also reported. These included reporting data to larger agencies, enhancing the level of inquiry possible, connecting students with schools in other regions, supplementing and expanding on onsite education programs, and encouraging teachers to use computers in an educational yet fun manner.

**Assessment of Technology-Enhanced Programs**

Figure 12 shows the assessment methods used by respondents. Forty six percent (10) of those surveyed rely on evaluations from those using the programs (i.e. school groups.) Thirty two percent (7) use evaluations by the staff. Thirty six percent (8) of the organizations have no form of assessment to evaluate their technology-enhanced program.
One organization reported initially using focus groups to assess their program.

Another organization hired a consultant to complete a formal evaluation, though it was uncertain whether this was to evaluate the technology-enhanced program or the education program as a whole.

**Barriers, Limitations, or Challenges**

Figure 13 depicts the barriers, limitations, and challenges respondents perceived in using instructional technology at their site. Forty six percent (10) of respondents find lack of knowledge to be a challenge in using IT. The cost of implementing and using IT is a challenge for 64% (14) of organizations responding. Forty six percent (10) report maintenance and upkeep of technology as a challenge. Fifty five percent (12) of responding organizations report staffing to be a challenge. Forty one percent (9) find comfort to be a challenge in technology-enhanced programs.
Additional challenges described include the rapid changing nature of technology and the lack of availability in an area. Lack of space for storing equipment and lack of money for maintenance are also perceived as challenges. Challenges integrating the program into the curriculum and a lack of demand by the audience can also hinder the integration of technology into education programs.

**Demographics**

The types of programs offered by respondents are shown in Figure 14. All 22 respondents offer day programs at their facility. Thirty two percent (7) offer 1-2 night residential programs while just under a third (27%, 6) offer programs lasting 3+ nights. Eighty two percent (18) of the organizations that responded offer school programming. Eighty two percent (18) also offer programming during the summer.
Additional programming described included evening and weekend programs, travel and off-site programs, workshops, community outreach, teacher education sessions, public programs, and research opportunities.

**Audience**

The main audiences at each responding center are depicted in Figure 15. Twenty three percent (5) of those surveyed serve a single district of K-12 schools. All but one (21) serves multiple districts of K-12 schools. Sixty percent (13) of the respondents list a key audience as university or college groups. Youth organizations are served by 91% (20) of respondents. Eighty-six percent (19) serve teachers at their facility. Adults are an audience at 91% (20) of responding organizations and families are served by 86% (19) of respondents.
In addition to the aforementioned audiences, respondents also serve walk in visitors, landowners, and tourists or provide a location for city, state, or federal agency meetings.

**OBJECTIVE 4: To examine and case study those uses that are most applicable and important to CWES, including characteristics of the program such as site, staffing, etc.**

Based on survey results, six organizations were chosen to case study. These organizations were Bernheim Forest (KY), Delaware Nature Society – Ashland (DE), Kerrywood Nature Center (AB, Canada), Missouri Botanical Garden (MO), Puget Sound Environmental Learning Center (WA), and Tampeel (OH). These six organizations each conducted programs that were deemed innovative by the researcher. The case studies contained information gathered from the survey, as well as from the organization’s website.
Each case study included

1) Background information about the organization, when possible including the mission or focus of the organization, and the location of the facility and the area served;
2) The types of instructional technology used at the center, based on responses to questions one and three of the survey and additional information gathered from the organization website;
3) Reasons for using instructional technology, based on question two of the survey;
4) Assessment of technology enhanced programs, based on responses to question four of the survey;
5) Perceived barriers, limitations, and/or challenges to using instructional technology in programming, based on question five of the survey;
6) Programs offered by the organization, based on question six of the survey;
7) The audiences served by the organization, based on responses to question seven of the survey.

Additional comments made by the organization were included in the applicable section of the case study. These case studies are located in Appendix I.

Case studies were presented to the CWES Planning Team on September 13, 2001. Present at the meeting were the CWES Director, CWES Assistant Director, Program Manager, Program Coordinator, Student Teacher, and a student member of the CWES Advisory Board. Upon review of the results, the team determined that the results were unsatisfying. A discussion ensued about why the survey did not locate the type of information desired, and how to go about locating that information. A consensus was reached that further study would need to be completed to successfully explore the topic of how technology could be used at CWES for the objectives set out in January. In addition, the team felt that the ANCA audience, while most similar to CWES, omitted both the school and environmental education focus that many other organizations may rely on (Appendix E).
Suggestions from the meeting were then taken to the graduate committee for review. The committee agreed with the CWES Planning Team. For the purposes of this research, it was determined that further research should be limited to a) non-site based environmental education organizations using instructional technology within programming, and b) museums and related non-formal settings and how instructional technology is used within education programming.

There are a wide variety of educational technologies used in these settings, ranging from computer-based activities, such as Internet searches or data analysis, to technology on field trips and other learning experiences. There are many non-school educational programs that integrate technology and have been designed to be used within school programs. These are teaching tools that enhance the school experience students are provided with.

The following pages contain short descriptions of additional programs that use technology within education. This section begins with a matrix comparing each of the programs using a number of categories. These categories are as follows.

- **When and by whom established**: In what year and by who was the program founded? If the current managing organization is different from the founder, that information is noted as well.
- **Available in Wisconsin**: Can schools in Wisconsin participate in the program?
- **Target audience**: What age range is the program designed for?
- **Focus of program**: Many of these programs have a specific focus (i.e. water resources or bird migration.) This will summarize the key focus of the program.
- **Communication and collaboration with peers and professionals**: Are students involved in communicating with people (either other students or professionals in the field) in other locations?
- **Authentic research/First hand resources**: Do students gather data and conduct authentic research rather than using data collected by an
uninvolved party? Are they exposed to first hand resources rather than simply being told about them?

- **Teacher prep and training**: Does the program provide lesson plans, teacher training workshops, teacher networking or other forms of support to participating teachers?
- **Technology format used**: What type(s) of instructional technology does the program primarily use (i.e. distance learning, Internet, computer software, etc.)?
- **Level of program**: Is the program run on a local, regional, state, or federal level? Is it available to all schools (public) or only to those who pay to join (private)?

There are a wide variety of these types of programs available. Each is designed to provide students with valuable environmental knowledge and the ability to interact and communicate with scientists, informative web sites, and students from other schools.

There are two main types of programs described. The first are not site specific (i.e. do not have nature center or school setting) and are capable of being used by schools across a wide geographic range. The second type is museums and similar organizations using technology within education. Each was chosen because it represents the type of program sought by this research – non-school organizations using technology to link their program to school classrooms.
<table>
<thead>
<tr>
<th>Program</th>
<th>When and by who was it established</th>
<th>Available in Wisconsin</th>
<th>Target Audience</th>
<th>Focus of Program</th>
<th>Communication and collaboration with peers and professionals</th>
<th>Authentic Research/first Hand Resources</th>
<th>Teacher prep and training</th>
<th>Technology Format Used</th>
<th>Level of program (i.e. state, federal, private)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLOBE</td>
<td>1994 Former Vice President Al Gore – Managed through federal partnerships</td>
<td>Yes</td>
<td>K-12</td>
<td>Environmental observations</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Research and Internet</td>
<td>International</td>
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<td>Harcourt Science</td>
<td>Harcourt Science Publishers</td>
<td>Yes</td>
<td>K-6</td>
<td>Support science textbook</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>CD-ROM, software, video and Internet</td>
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<td>Jason Project</td>
<td>Dr. Robert Ballard</td>
<td>Yes</td>
<td>4-9</td>
<td>Explore the world from inside the classroom</td>
<td>Some</td>
<td>Yes</td>
<td>Yes</td>
<td>Internet and satellite broadcast</td>
<td>Nationwide</td>
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<tr>
<td>Project Feederwatch</td>
<td>Cornell Lab of Ornithology</td>
<td>Yes</td>
<td>All</td>
<td>Winter bird migration</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>Observations and Internet</td>
<td>Nationwide</td>
</tr>
<tr>
<td>Classroom Feederwatch</td>
<td>Cornell Lab of Ornithology</td>
<td>Yes</td>
<td>3-12</td>
<td>Winter bird migration</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Observations and Internet</td>
<td>Nationwide</td>
</tr>
<tr>
<td>Highway to the Tropics</td>
<td>1995 Raptor Center, University of MN</td>
<td>Yes</td>
<td>4-8</td>
<td>Expose students to current osprey research</td>
<td>Yes</td>
<td>Yes</td>
<td>Lesson plans</td>
<td>Internet</td>
<td>Nationwide</td>
</tr>
<tr>
<td>Program</td>
<td>When and by who it was established</td>
<td>Available in Wisconsin</td>
<td>Target Audience</td>
<td>Focus of Program</td>
<td>Communication and collaboration with peers and professionals</td>
<td>Authentic Research/first Hand Resources</td>
<td>Teacher prep and training</td>
<td>Technology Format Used</td>
<td>Level of program (i.e. state, federal, private)</td>
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<td>Journey North</td>
<td>1991 Annenberg Foundation and Corporation for Public Broadcasting</td>
<td>Yes</td>
<td>Mainly 4-6</td>
<td>Wildlife Migration and Seasonal Change</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Internet</td>
<td>US and Canada</td>
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<td>GREEN</td>
<td>1984 Dr. William Stapp, University of MI</td>
<td>Yes</td>
<td>6-12</td>
<td>Water quality within local watersheds</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Research and Internet</td>
<td>US and Canada</td>
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<td>Iowa Public Television</td>
<td>1996 Iowa Public Television and NAI</td>
<td>No</td>
<td>K-12</td>
<td>Varies</td>
<td>Yes</td>
<td>No</td>
<td>Some</td>
<td>Distance learning</td>
<td>State</td>
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<td>Rouge Education Project</td>
<td>1987 Friends of the Rouge, University of MI and Detroit schools</td>
<td>No</td>
<td>K-12</td>
<td>Watershed monitoring</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Research and computer network</td>
<td>Regional</td>
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<td>Smithsonian National Museum of Natural History</td>
<td>N/A</td>
<td>Yes</td>
<td>K-12</td>
<td>Varies</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Live electronic field trips and Internet</td>
<td>Nationwide</td>
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<td>When and by who it established</td>
<td>Available in Wisconsin</td>
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<td>Focus of Program</td>
<td>Communication and collaboration with peers and professionals</td>
<td>Authentic Research/first Hand Resources</td>
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<td>Exploratorium</td>
<td>N/A</td>
<td>Yes</td>
<td>All</td>
<td>Varies</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Webcasts and Internet</td>
<td>Nationwide</td>
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<td>Museum of Modern Art</td>
<td>N/A</td>
<td>Yes</td>
<td>All</td>
<td>Contemporary Art</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Video-conferencing</td>
<td>Nationwide</td>
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<tr>
<td>National Geographic Education</td>
<td>1989 (NG for Kids) National Geographic Society</td>
<td>Yes</td>
<td>K-12</td>
<td>Varies</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Internet</td>
<td>Nationwide</td>
</tr>
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<td>Monterey Bay Aquarium</td>
<td>N/A</td>
<td>Yes</td>
<td>All</td>
<td>Aquatic habitats</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Webcams and Internet</td>
<td>Nationwide</td>
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<tr>
<td>ENO</td>
<td>August 2000 European Commission and National Board of Education</td>
<td>Yes</td>
<td>K-12</td>
<td>Global environmental awareness</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Discussion and Internet</td>
<td>International</td>
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<td>Zoo Atlanta Education</td>
<td>1994 – DL Zoo Atlanta and assorted partners</td>
<td>No</td>
<td>K-12</td>
<td>Zoo education</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Video-conferencing</td>
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</tr>
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</table>
The GLOBE Program (http://www.globe.gov)

The Global Learning and Observations to Benefit the Environment (GLOBE) program was envisioned to allow students to “make a meaningful contribution to the study of the Earth’s environment, capitalizing on the introduction of the Internet as a means for sharing information across the globe” (GLOBE 2001).

The GLOBE program is a federal interagency program, run through a collaboration of the National Oceanic and Atmospheric Administration (NOAA), National Aeronautics and Space Administration (NASA), National Science Federation (NSF), and the Environmental Protection Agency (EPA), Departments of State and of Education. In the first five years of the program, students in over 85 countries had already participated in the program, reporting over four million observations (GLOBE 2001). Currently, students, teachers, and scientists within the United States and 95 other countries participate (GLOBE 2001). Over 140 universities and colleges have partnered with the program, as well as state and local school systems and nongovernmental organizations (GLOBE 2001). There are over 150 educational organizations in the United States that recruit, train, and mentor GLOBE teachers (GLOBE 2001).

Teachers joining GLOBE attend professional development workshop trainings, where they receive teacher guides, how-to manuals, and additional information that will help them to guide their students. Students collaborate with scientists and other schools to engage in a variety of scientific experiences and report data to a student archive via the Internet. Once the data is conveyed, students can analyze data by creating graphs and maps online. The student data is then contributed to scientists for use in research, as well as made available for students to use in their own research projects (GLOBE 2001).
Globe Offline (2000) lists four key ways that GLOBE data can help students learn on their own.

1) Students learn to examine data using “visualization tools”, that help them “begin to recognize and study trends in the data they collect, search for patterns, and become aware of parameters, averages, and ranges.”

2) Students learn how to ask good questions, by deciding what research questions to ask, and how to focus their studies in order to develop a working hypothesis, using the information provided.

3) Learning analysis is the next step. Students can do more than “make visual comparisons, or use their counting and arithmetic skills” (GLOBE 2000). They can begin to explore statistics and spreadsheets, or more advanced skills such as GIS.

4) GLOBE students learn to communicate, through work with students across the globe or within their classroom. Involved students use email and GLOBEmail to collaborate with others and share their results using the Internet (Globe 2000).

Another benefit of the GLOBE program is that participation helps students and teachers achieve educational standards, increases student awareness of the environment without advocating a particular viewpoint, and guides teachers in improving student performance in math, science, and the use of computer and network technology (GLOBE 2000). Clara Stallings, middle school science coordinator for the Department of Public Instruction in North Carolina is enamored by:
"The completeness of it, the materials support, the formalized protocols which really emphasize how all scientists do things. And the students are actually given the structure to do something meaningful with the data... GLOBE is not only the only program but is the one that best fits the competency goals in middle school.” (Globe 2000)

Professionals from across the country agree. Dr. Diola Bagayoko, GLOBE partnership coordinator at the Southern University and A&M College in Louisiana, feels that:

"GLOBE provides a comprehensive, coherent, flexible tool for the actual implementation of the prevailing science and mathematics reform blueprints... [the program] involves students in the process of ‘doing science’... and of ‘thinking science’ through the accompanying learning activities.” (GLOBE 2000)

North Carolina and Louisiana are only two of the many states that are currently working on correlating GLOBE with their state standards (GLOBE 2000).

Harcourt Science (http://www.harcourschool.com/menus/l_science.html)

A second program that uses technology to bridge the gap between the school system and the environment is the Harcourt Science program, published by Harcourt Science Publishers. This program, intended for use in schools, not only provides standard science information in the form of a textbook, but also uses technology to enhance the text through CD-ROM, computer software, video and Internet supports. These are linked to the chapter and section they appear in, and add support for the information presented. Through a teacher obtained password, classes can log on to the
Harcourt science web site, where they have access to links at three separate locations. The first is the Learning Site, where students can access a variety of resources, including recent news breaks, interactive learning games, and a glossary of science terms.

Another link is to the Smithsonian Institution, where there are topic-related sites that relate to the subject matter being studied. Through Smithsonian sites, students can take virtual tours and online exhibits, as well as have other hands-on investigations. The third link is to sciLinks, through the National Science Teachers Association. At this site, visitors can enter a grade level and choose from a range of topics. They are then presented with a list of sites that contain information relevant to the age and topic. In addition to the web sites, there is a CD-ROM to provide support, activities to aid in reading, and a program enabling students to use graphing software to organize and present data.

Jason Project (http://www.jasonproject.org)

The Jason Project is another alternative for schools interested in integrating technology into their curriculum. The goal of the Jason Project is to provide an opportunity for students and teachers in grades 4 through 9 to explore science, math, geography and other subjects using a variety of technological means. The Project consists of mainly video, with roughly 60 hours of video provided for each topic (Networking the Classroom 1995), though students also receive information through “a print curriculum, videos, interactive Internet programming, and live satellite ‘telepresence’ broadcasts” (JASON 2001). Teacher workshops are offered to train teachers in how to integrate the program into their curriculum. These teachers are also
provided with an interdisciplinary curriculum guide to help them integrate the program into their classroom.

One example of a Jason Project field trip is an expedition taken to the Kilauea Volcano in Hawaii. This experience included 5 units. The first focused on island ecology and its relation to the solar system, followed by a unit on technology and its use in probes, robots, data gathering, remote sensing, and computer communications within space. After this, students explored the nature and ecology of volcanoes and seismic activity, which lead into a discussion of living organisms within the volcanoes. Finally, the history, culture, and people of Hawaii pre and post European settlement were explored (Networking the Classroom 1995).

**Project Feederwatch** ([http://birds.cornell.edu/PFW/index.html](http://birds.cornell.edu/PFW/index.html))

The Cornell Lab of Ornithology, in partnership with the National Audubon Society, Bird Studies Canada, and the Canadian Nature Federation, operates project Feederwatch. It is currently Cornell's longest running citizen-in-science program.

Project Feederwatch runs from November until April, and uses citizen birdfeeder observations to help scientists track the movement of winter bird populations in addition to trends in bird distribution and abundance. People of all ages, skill levels, and backgrounds can participate in the program simply by signing up. Participants receive a research kit that includes instructions on reporting data, a bird ID poster, a wall calendar, data forms, and a resource guide to bird feeding. They also receive Birdscope, the Project Feederwatch newsletter (PFW 2001a).
As with the GLOBE program, the observations reported are used by scientists. Results are regularly published in scientific journals and shared with ornithologists and the general public worldwide. The Project Feederwatch website includes a map of data collection sites based on the zip codes of participants (PFW 2001b).

Classroom Feederwatch, a curriculum-based unit on research and interdisciplinary education, is a related program also developed by the Cornell Laboratory of Ornithology with funding from the National Science Foundation. The goals of the project are that

1) Students will learn the basics of ecology and gain an appreciation for the amazing complexity of the natural world;

2) Students will see connections between science and other disciplines: language arts, visual arts, social studies, mathematics, and technology; and

3) Students will use a variety of intelligences as they accomplish the above goals, and learn that everyone can be a Citizen Scientist (CFW 2001a).

The Classroom Feederwatch website includes a number of pages to help teachers decide whether to use the program, and how to implement it. These pages list steps to participate in the program, including how to set up a feeder, how to submit data over the Internet, suggestions for student research projects, and tips for publishing reports and artwork in Classroom Bardscope, the Classroom Feederwatch newsletter (CFW 2001).

Training workshops are offered by participating organizations. Those attending learn how to teach bird identification, explain the importance of birds within ecosystems,
design experiments, network with schools and teachers across North America, and more (EE News 2001).

Highway to the Tropics (http://www.raptor.cvm.umn.edu/content.asp?page=3101)

Highway to the Tropics was developed by the Raptor Center at the University of Minnesota as a result of a grant from the Minnesota legislature to explore ways to increase research and environmental education using the Internet. The program uses educational programs to expose 4th-8th grade students to ongoing raptor research.

Schools that enroll participate in multi-disciplinary lessons that focus on the osprey and its habitat. Through these lessons, students are exposed to a wide variety of information about the osprey, including such concepts as “It’s All Interconnected”, a lesson focusing on the relationships of organisms within an ecosystem; “Lake and Pond Study”, a lesson in which students learn about breeding habitats and characteristics of lakes and ponds, and the animals and plants that live within them; “Nest Watch”, a lesson in which students learn how to construct osprey nesting platforms and monitor nest sites; “Seining”, where the students focus on using seine nets to determine fish species found in areas ospreys are located; and “The Road South”, a migration tracking lesson in which students learn about geography as well as mapping.

The Highway to the Tropics website was designed to include several educational areas, originally including Teacher Lesson Plans, Family Activities, Talk to the Scientist, Update and Resources, and Migration Data, as well as case studies of birds that have been treated and released (Kennedy & Martell 1996). Currently, the site contains Teacher
Lesson Plans, Migration Data for three species of raptors, and information about raptors, raptor conservation, and bird banding.

Highway to the Tropics was evaluated in a study published by Kennedy & Martell (1996). Several challenges were noted within the evaluation. The first was that the lifespan of programs such as this varies from 2 ½ years to much shorter amounts of time. In addition, the staff time required to maintain the program is intensive, to answer teacher and student questions accurately and in a timely manner, as well as to post new information and plan and implement teacher workshops (Kennedy & Martell 1996).

**Journey North** (http://www.learner.org/jnorth/)

Journey North focuses on using media and communication within math and science education, by “engaging students in a global study of wildlife migration and seasonal change” (Journey 2001). Over 300,000 students from more than 6,000 schools participate from early February till early June, with over 300 registered participants coming from the State of Wisconsin. Though any grade is welcome, participating classes are predominantly in the 4th to 6th grades, due to single classroom structure of school at these grades (Journey 2001d).

Students have the opportunity to share their observations with other classrooms in all 50 states and 7 Canadian provinces. In addition, they are linked with scientists who lend their expertise to the program and post satellite tracked migrations on the website. Journey North is viewed as a model for math and science education reform in the United States (Journey 2001a).
The Journey North website has a wealth of information within an Online Orientation. Teachers can access pages to help them choose a focus, view tips from other Journey North teachers, and engage in Teacher Discussion chats. There are also maps, news calendars, and a section about the use of Challenge Questions within the program. These questions are based on data the students observe and are asked at key points throughout the season. The questions are meant to provide students with a chance to model good science and to use the same thinking and questioning processes as scientists (Journey 2001c).

GREEN (http://www.earthforce.org/green/aboutgreen.cfm)

The Global Rivers Environmental Education Network (GREEN) is an action-based program aimed at middle and high school aged students interested in local water quality and resources. This organization was established in 1994 to provide a venue for involving youth in environmental problem-solving within their community (About GREEN 1998). The mission of the project is to improve education through critical thinking, teamwork, problem solving, decision-making, and collaboration through a global network. Students are encouraged to learn more about their community’s water quality and to create solutions to improve and sustain the watershed. Upon signing up to participate in the program, students and schools receive water monitoring equipment, resource and action guides, an online hands-on center, and a network of support to aid them in their research.

The first GREEN group worked to research cases in which individuals contracted hepatitis from the Huron River in southeastern Michigan. The students discovered the
cause and worked with their local government to find a solution. This team was so successful that the GREEN soon expanded, currently involving students in all 50 states and a number of countries. In 1999, it became an official program of Earth Force Inc. (*About GREEN* 1998).

**Iowa Public Television Live Interactive Field Trips**

Iowa teachers have identified time, money, and transportation as barriers to traditional out-of-school field trips. Rather than simply lose the experience, Iowa Public Television (IPT) worked with interpreters from the National Association for Interpretation (NAI) to create electronic field trips. These were intended to provide students with similar information as traditional trips, in addition to interaction with a field trip presenter and with other schools. These field trips utilized the Iowa Communication Network, a two way interactive fiber optic distance-learning network.

The first pilot programs, held during 1998, allowed IPT to test their technology, introduce teachers and students to the distance-learning classroom, and train participants in using the two-way communication system built into the network. These pilot programs consisted of

1) A field trip hosted by the US Army Corps of Engineers in Saylorville Lake Gorge, demonstrating seven geological ages;

2) A tour of an 1850’s pioneer farm where interpreters demonstrated the tasks and roles of people in that era; and

3) A trip to the Desoto National Wildlife Refuge to witness and learn about snow goose migration.
After the pilot programs, IPT set to work developing new distance learning experiences. “Connections” was one such program offered. Schools could choose to participate in exploration of either prairie or forestry.

Prairie Connections, the first phase, was a collaboration between IPT and NAI members from the US Fish and Wildlife Service, Dallas County Conservation Board, and E Resources Group, Inc. In 1998, 2 sites were used for 8 field trips. Eighty schools participated, involving 2,524 students in grades 5-12. The primary goal of the program was “to provide a variety of learning environments through which students would develop an understanding and appreciation for Iowa’s tall grass prairie and how human activity has brought about change” (Zohrer 2000). Teachers were given a handbook, access to a supporting website, ideas for using the trip to lead into classroom action projects, and the opportunity to network with other schools. Prairie Connection teachers were evaluated after the program. Ninety-two percent of these teachers reported willingness to participate in another distance learning experience. Ninety percent of the teachers gained new teaching ideas, and 92% of the teachers were interested by the content.

Forestry Connections targeted classes in grades 4-8 and was broadcast on both IPT and the Iowa Communication Network. For this second phase of Connections, the Iowa Department of Natural Resources partnered with E Resources Group to adapt two programs, Trees for Kids and Trees for Teens. In addition, there were new financial partners and training in-service offered for county naturalists. Two trips were also broadcast to schools outside of Iowa.
The Iowa Distance Education Alliance Project surveyed 1,385 people who had participated in their distance learning programs. Seventy-six of those surveyed felt that interactive distance education, if implemented in K-12 Iowa schools, would benefit the students and schools. Based on survey responses, small schools (72%) would benefit more than larger ones (72%). Seventy-nine of respondents thought the use of interactive distance education would enhance the abilities of Iowa students to succeed in a world full of technology.

Iowa Public Television was honored for their interactive field trips and awarded the 1999 Points of Presence Award by the Iowa Distance Learning Association. This award is given to organizations that have demonstrated excellent program design and implementation in distance education program serving Iowa learners. In addition, IPT received the NAI Region 5 Award for “Excellence in Interpretive Support” (Zohrer 2000).

**Rouge Education Project** ([http://www.therouge.org/REP/rouge_education_project.htm](http://www.therouge.org/REP/rouge_education_project.htm))

The Rouge Education Project (REP) is a school-based watershed-monitoring program, focused on the Rouge River near Detroit, Michigan. It was begun in 1987 as collaboration between Friends of the Rouge, the University of Michigan, and 16 schools in Detroit. In its first three years, the project grew to include 45 schools. In the years since, the program has grown to include more than 100 schools in the Rouge River area.

REP is based on a model combining action, research, and community problem solving. The model includes five steps: defining and analyzing the problem, setting objectives, working in groups, building coalitions, and designing an action plan. The
project is interdisciplinary, with students participating in a wide variety of activities and investigations. These include “testing water quality at sites along the river, sharing data and observations via a computer network, analyzing individual and/or community impacts on water quality, designing and implementing action plans that address the problem which students have identified as affecting the river’s water quality, and a student congress in which students share their data, analyses, and action plans and participate in skill-building workshops” (Talsma 2001).

There is a great deal of teacher support and training in REP. During the first five years of the program, curriculum materials were developed and revised, and coupled with professional development opportunities to train the teachers and university student assistants. Currently, teachers have a vast number of opportunities to choose from. These include night and weekend training sessions about how to use the Internet and GIS, how to analyze data and interpret the results, how to control for quality assessment and quality control, a watershed bus tour, a project GREEN action workshop, and training in Project WET (Talsma 2001).

In a study done by Valerie Talsma (2001), participating teachers were surveyed as to the challenges and successes of implementing REP in their classrooms. The teachers felt that their own environmental awareness increased because of the participating in REP. This made it easier for them to initiate and facilitate student discussions in their classrooms. In addition, the more knowledge they felt they gained, the more connections they felt comfortable making between the river issues they were focusing on and other environmental issues in the media (Talsma 2001).
ENO – Environment Online (http://eno.joensuu.fi)

ENO is a “Global Virtual School for Environmental Awareness” in which students gather and share environmental data about their local area. Begun in August 2000, ENO is based in the Eno School District in Eno, Finland. Currently, 73 schools in 43 countries within 6 continents participate in the program. Since it’s inception, the program has won numerous awards for their work to deepen global environmental awareness on an international level.

Participating classrooms incorporate the program into their curriculum, engaging in a minimum of two lessons per week throughout the school year. These lessons are focused around a progression through four themes: 1) The Place We Live: My School Home and Village (Physical and Social Environment), 2) This is Our Nature: Forests (Natural Environment), 3) The Way We Live: Waste and Water (Sustainable Development), 4) This Is Our Culture: Cultural Heritage (Cultural Environment). During each, students gather data about their local area and send this via the Internet to the ENO database. Students and teachers then participate in discussion forums using this information.

Smithsonian Institute National Museum of Natural History (http://www.mnh.si.edu/)

The Smithsonian Institute uses technology to provide visitors with “what is most unique about the Smithsonian: its artifacts, documents, and objects” (Shields 2001). For example, at the Natural History museum website, one can view a digital image of Triceratops and read about how paleontologists study and reconstruct dinosaur skeletons.
In addition, the museum offers live electronic field trips, focusing on topics ranging from gems and minerals to giant squid (Smithsonian 2001).

“A Gem of a Story”, one such field trip, is a program for students in grades 7-12. Students are transported, via television, to the Janet Annenberg Hooker Hall of Geology, Gems, and Minerals. During this live, interactive trip, they are engaged in a discussion about the monetary, cultural, and aesthetic value of gems, as well as the stories and history associated with the gems. Participants are given a “tour” of the exhibit hall, the opportunity to talk to scientists and researchers, and the chance to learn about state-of-the-art technology used to analyze gems and minerals. There is also an online archive of information, activities, and resources that serve as a supplement to the broadcast (Smithsonian 2001a).

**Exploratorium** ([http://www.exploratorium.edu/](http://www.exploratorium.edu/))

Inquiry is the key to experiencing the Exploratorium, with activities designed to model constructivist learning theory (Shields 2001). One such activity is the Iron Science Teacher webcast, a show that combines the ideas of a science fair with the competitive nature of the Iron Chef, a popular cooking show. Scientists and staff from the museum take a “secret ingredient” and use it for a number of simple science experiments that students can do at home. Ingredients range from fruitcake to film canisters, from pumpkins to ping pong balls (Exploratorium 2001a). The program was designed as a supplement to classroom programming, demonstrating “best practices in instruction” (Shields 2001).
Webcasts are also used to highlight current research. For example, webcasts have been designed to focus on the Hubble Telescope and on Antarctic scientific journeys. Visitors also have the opportunity to view a webcam that showcases an Exploratorium exhibit or one that shows various views from the roof of the building.

The Exploratorium also offers a range of online “exhibits”. These are short, entertaining sites that teach visitors about such subjects as the function of cone cells in the human eye, how to create optical illusions, and how the human brain perceives images (Exploratorium 2001b).

**Museum of Modern Art** (http://www.moma.org/)

The Museum of Modern Art is another museum using technology to enhance the education they make available to students. Video-conferencing is the highlight of this museum’s technology, intended to help teachers make connections between their schools curriculum and the museum objects. The goal is to familiarize participating teachers with both contemporary art and distance learning (Shields 2001).

Another option for student interaction is the Art Safari Online. In this, students view and analyze paintings and sculptures using a series of guiding questions. This is followed by a brief discussion of the piece and the opportunity to create their own artwork to share on the website. There is also a searchable “Dadabase” that allows visitors to search the museum’s archives and library.
Monterey Bay Aquarium (http://www.mbayaq.org)

The aquarium uses their website, E-Quarium, to support aquatic learning. Visitors can view webcams that focus on a variety of habitats at the aquarium, such as kelp forests, penguin and otter exhibits, and a view from the aquarium deck overlooking the bay. The website provides an opportunity to preview new exhibits, as well. Kids E-Q, a page devoted solely to children, includes information, web links, and guided explorations of the aquatic habitats discussed.

The technology used by the aquarium also extends into actual on-site visits. Visitors can sit in front of a large video screen and watch scientists diving 3000ft down into the ocean. The educator present guides the experience by using a laserdisc to access stored footage that supplements what visitors see on the dive. Research into this exhibit has shown an increase in attention span from less than one minute per visitor to over 30 (Kaufman 1993).

National Geographic (http://www.nationalgeographic.com)

The National Geographic Society is the world's largest nonprofit scientific and educational organization, and the website reflects this. The site contains a wealth of information about current events, adventure guiding, nature and travel, as well as maps, photographs, and more. The Education page contains classroom activities such as coloring books, maps, quizzes and games, as well as teacher lesson plans and information about such events as the National Geography Bee and Cable in the Classroom programs. Teachers can also sign-up for monthly e-mail updates or browse the teacher store. The
website also contains Homework Help, a site for students to find information about animals, cultures, maps, photos and art, geography, and science and nature.

National Geographic Xpeditions are another way visitors to the site can get information. These adventures are interactive tours in which students can virtually climb mountains, view Earth from a satellite perspective, visit archaeological digs, and more. Possible Xpedition areas include the World in Spatial Terms, Places and Regions, Physical systems, Human Systems, Environment and Society, and the Uses of Geography. Lesson plans and US National Geography Standards are available to help teachers integrate the experience and activities into their classroom.

**Zoo Atlanta** ([http://www.zooatlanta.org](http://www.zooatlanta.org))

Conservation, support, education, and caring are the major themes of Zoo Atlanta. The zoo offers a wide range of educational opportunities for schools and individuals that support these themes. All programs are correlated with the Quality Core Curriculum Standards for the State of Georgia, in order to help teachers better fit the program into their curriculum. These standards are easily accessible on the zoo website. Teachers also have access to activity boxes, staff development courses, and a curriculum guide to help them plan their zoo experience.

Since 1994 the zoo has been offering a variety of video-conferencing programs to students in over 130 K-12 schools within Georgia, and several outside of state boundaries. The distance-learning program is available because of a partnership between the zoo, BellSouth, the State of Georgia, the US Department of Something, Spring, Microsoft, the Blank Foundation, and the Birdsong Foundation.
The zoo targets schools in distant communities or otherwise unable to attend the zoo, using equipment that includes video monitors, microphones, and cameras. Teachers are able to choose the program and time they wish to incorporate into class, selecting from a range of programs including “Beaks-n-Feet”, “Wild Cats”, Wonderful Wetlands”, “Saving the Giant Panda”, “Exploring Biodiversity”, and “Zoo Atlanta Safari”, among others. The interactive nature of the experience allows two-way communication between the class and the zoo, and each program includes live animal demonstrations and/or video tours of zoo exhibits.

Those schools wishing to participate in a Zoo Atlanta program, but unable to host video-conferencing sessions are able to participate in Zoomobile programs. In these, the zoo comes to the students in the form of a van equipped with live animals, zoo staff, and interactive educational activities to help students explore topics such as “Eggs to Feathers”, “Reptilepalooza”, “What’s for Lunch?”, “Zoo Business”, “Animal Training and Education”, or “Rain Forest Rap.” The zoo has also engaged in partnerships to make this possible, working with a local television station, the United Parcel Service, and Ford Motor Company, as well as other organizations.

In addition to their distance learning programs, the zoo also has an extensive educational website. The website contains information about zoo programs, pictures and life histories of a variety of animals at the zoo, news and events, conservation efforts in progress, and a Giant Panda webcam to allow visitors to watch the Giant Pandas through the Internet.
The aforementioned programs are all examples of how technology can be used to enhance educational experiences. Foa, Schwab, and Johnson (1998) mention some additional possible uses for technology:

"Some students have the opportunity to interview foreign 'key-pals' electronically. Others are able to explore archeology or weather with working experts who are 'live' at a distant site."

The challenge is to make these, and other opportunities, available to as many students as possible. In a separate article, they say

"Students are fascinated to learn that someone who comes from a different culture shares their same worries and aspirations, and they are extraordinarily motivated by the chance to do applied research about water quality or regional history with their peers" (Foa, Schwab & Johnson 1997).

OBJECTIVE 5: To explore the benefits, drawbacks, and controversy surrounding the use of instructional technology within education and, more specifically, environmental education.

Many educators agree that technology plays an important role in educational settings (Simon 2001) by improving communication (Barbour 1980), supplementing teaching and learning (Simon 2001) and providing a resource for project-based multidisciplinary lessons (Schrum 2000). The North Central Regional Educational Laboratory (2002) stresses that technology is not a means of supplanting teachers, but rather supplementing their abilities and creativity. Other educators agree with this idea, while expressing concerns that technology should be used wisely, so as to not "replace the cultural, historical, and natural world" (Kennedy & Martell 1996). Some may feel there is no option but to incorporate technology into learning. The question, however, is
how to successfully do so (North Central Regional Educational Laboratory 2002; Schrum 2000).

Jasper (1995) states

“Technology is here to stay. We need to take advantage of ways to enhance our curriculum using technology. We must expose our students to current technology... But it is imperative that we teach our students and demand that they learn communication skills; students must learn that communication skills are more important than any program or platforms to which they are exposed.”

A common belief is that, through the use of technology, educators are providing students with opportunities to learn and experience the tools and skills necessary to prepare them for the modern technological world (North Central Regional Educational Laboratory 2002; Dewey 2001; Rockman 1998; Connecting Teachers with Technology 1998). Jasper (1995) agrees that students need to learn valuable communication skills, but argues, “we cannot possibly teach the technologies our students will need in their future beyond high school because those technologies do not even exist today.” Judy Co, a Girl Scout leader in Manila, feels differently, saying that the skills students learn

“will prepare them for the global technology future, not necessarily the particular skills themselves, as those will surely be outdated in no time, but in their ability to approach, accept and learn” (as quoted in Dewey 2001).

The United States Department of Education (Thomas 2000) also believes that the acquisition of technical skills, often beyond what is believed to be possible for certain age groups, is important. A study published by the department (Thomas 2000) points out that, although technologies will assuredly change before today’s students enter the workforce, the experience and confidence gained will benefit them throughout life.
Within the field of environmental education, this debate exists as well. Clebsch and Curwen (2000) advocate the use of Global Information System (GIS) technology within the field of interpretation. They feel that GIS can "unravel meanings or a perspective that might not be found in other ways – helping people make their own connection." Kennedy and Martell (1996) also promote the use of technology within interpretation, suggesting "interpreters must find a way to stay abreast of technological changes and use them to their advantage to educate the public."

Many educators use the phrase "Think Globally, Act Locally" to encourage local action and global awareness. Young (1993) feels that the use of computer-based communication could be an effective way to do this, helping to

"Broaden public participation in the debate of global warming and other environmental issues by making previously inaccessible environmental and industrial information widely available."

Hutchinson (1998) uses global warming as an example of this.

"Teaching students in an urban setting about global warming can be difficult in the abstract, but with the help of loads of technology the abstract became very real for my students."

**Opinion Survey**

The Opinion Survey was designed to uncover professional opinions and perceptions about the value and usefulness of instructional technology at environmental and nature centers. Completed surveys were received from 20 individuals. This represents a small sample size. Responses, however, showed a wide range of opinions and insights into the topic. A summary of their responses follows.
Summary of Results (Appendix J)

How useful do you perceive instructional technology currently is at your center?

This question asked respondents to consider their opinion about current uses of instructional technology at their center, and to rate their thoughts on a Likert scale with 1 being “extremely useful” and 5 being “not at all useful”. The majority of respondents (73.6%, 14) rated their opinion as 3 or less, indicating that they feel instructional technology is not currently extremely useful but rather average or not useful.

“As a park-based, experiential ed. program, technology doesn’t apply to what we’re doing” (Pete Devine, Yosemite Institute, survey response March 22, 2002).

“We feel strongly that the best way to educate environmentally is to have a hands on experience out of the classroom and away from computers. Students get plenty of time using a computer in school. What they don't get enough of (in my opinion) is first hand experience in the out of doors.” (Robin Indermuehle, Trees for Tomorrow, survey response March 29, 2002.)

Several commented that currently there is little instructional technology in use, though “we are becoming increasingly familiar with it and using it more and more” (Carl Strang, Willowbrook Wildlife Center, survey response March 26, 2002). A second respondent replied “for the programs which use it (e.g. GIS-enhanced monitoring), the technology is essential. Unfortunately, not many programs currently make use of the technology that is available” (Bob Coulter, Missouri Botanical Garden, survey response March 20, 2002.)

Twenty-six percent (5) of respondents feel that instructional technology is quite useful at their facility. For example, one person replied that she considers “instructional technology extremely useful to the field of environmental education. It allows for many
new and creative methods of delivering and engaging students in authentic inquiry-based environmental education. It also facilitates extended instructional opportunities for environmental educators, who would otherwise most likely be limited to a ‘one shot’ teaching scenario” (Christine Kelly, Riveredge Nature Center, survey response March 21, 2002).

How useful do you perceive instructional technology will be at your center in the future?

This question asked respondents to consider the future of their center and how useful they felt instructional technology would be. Responses showed a marked change in opinion between the present and the future. Only 38.8% (7) rated their perception of the future with a 3 or lower, while 61% (11) felt that instructional technology would be quite useful within the future of their organization.

“I consider our effective use of instructional technology as a key success criteria for measuring the future of our educational programs. I believe our ability to embrace or failure to embrace educational technology will be a significant variable that determines the longevity of our center’s high quality, innovative environmental education program” (Christine Kelly, Riveredge Nature Center, survey response March 21, 2002).

Others disagree, feeling quite strongly that instructional technology should still be of minimal use in the future.

“Maybe we’ll use more tools in the field (Palm-something), but I hope we won’t ever have kids come all the way to Yosemite National Park and sit in front of computers researching trees, glaciers, wildlife, etc. That would be criminal misdirection” (Pete Devine, Yosemite Institute, survey response March 22, 2002).
Even those individuals rating the future use highly still felt similar sentiments, stating, "it will increase and approach or reach 2, though never become our primary means of interpretation" (Carl Strang, Willowbrook Wildlife Center, survey response March 26, 2002).

Please describe potential applications of instructional technology with the nature center or environmental center setting... to achieve the goals of environmental education.

This question asked respondents to consider future uses of technology that they felt could be used to help accomplish the goals of environmental education. As demonstrated in question 2, many felt that technology would become a larger part of education efforts, though not replacing current hands-on approaches. "Environmental education needs to be information rich as well as experience rich. Through the equipment... we are enhancing learning outside the classroom in the field" (Helen Fischel, Delaware Nature Society, survey response March 26, 2002).

John Blackmer, River Bend Nature Center, felt similarly, saying

"while we do not envision it to be a large part of our on-site efforts, we are continuing to grow in ways to use the internet and other tech to work with the students back in the classroom before and after visits. Without such extensions, their visit here is just a 'field trip' rather than serving as an outdoor extension to classroom learning." (survey response March 21, 2002).

Robert Mercer, Silver Lake Nature Center, reported similar thoughts. Silver Lake "would like to create floppy disks of activities or websites that can be used by teachers as pretrip and post trip activities" (survey response March 20, 2002). Mercer further describes Silver Lake's vision of using instructional technology to remain connected to
program participants, to work with a local school to develop water quality data collection over time, and to further utilize the center website to promote their program.

Responses yielded a number of perceived benefits of instructional technology, including that “people of all ages could utilize [it]. Staff would not be needed at all areas in order to be effective. The stand alone system could educate and entertain on its own. Fun and interesting addition. Builds a transition between home and nature center. Kids and adults utilize this form of entertainment daily.” (Jeff Tish, Macon County Conservation District, survey response March 27, 2002).

There were strong feelings by some that technology could be detrimental to outdoor environmental education.

“To an extent, the argument can be made that technology defeats the purposes of outdoor, experiential environmental education. The world needs more naturalists, and these aren’t made via the Internet, CD-ROM’s or the web. At best, some tech toys that can be used in the field (data loggers, cybertracker, probeware), might apply, if your goals are about field science education. But the environment is bigger than just science, we need more than just the left cerebral hemisphere connected to the natural world. Our program is after high touch, not high tech.” (Pete Devine, Yosemite Institute, survey response March 22, 2002).

“The goal is to get city kids connected to the land and nature. You can not do that infront of a computer screen. They are already too knowledgeable about ‘two-dimensional nature’. They have a very real disconnect with the real thing” (Deb McRae, Wehr Nature Center, survey response March 25, 2002).

Figure 16 compares perceptions about both current and future usefulness of technology within non-formal environmental education. Several respondents felt strongly that instructional technology should be limited so as to avoid detracting from outdoor
environmental experiences, but rather serving to enhance these experiences. However, the overall trend appears to be an increase in positive perceptions about the use of instructional technology within nature and environmental centers.

![Figure 16: Perception of I.T. Usefulness Within Nature and Environmental Centers](image)

Different perceptions about what instructional technology could be used for were highlighted by responses to this survey. A range of possible concepts was reported, including high tech displays and exhibits, environmental monitoring investigations, data collection, analysis and display, student research, live feed video coupled with phonological data, entertainment, touch screen scavenger hunts, communication with schools worldwide, virtual tours, digital photography, and more. This demonstrates that, while the field is rapidly increasing in use, professionals in the field are still exploring the multitudes of opportunities available.

The Technology Use Survey also generated opinions and personal viewpoints from several respondents. The literature itself yielded limited opinions and personal viewpoints about the use of instructional technology within environmental education.
By combining results of the surveys, literature, and WAEE poster, the information found seems to fall into three viewpoints. The first is that the use of instructional technology can be an important and beneficial addition to education. It provides increased communication (Barbour 1980), a supplement for classroom activities (Simon 2001, NCREL 2002), a venue for teaching abstract or non-local subjects (Hutchinson 1998), a means of broadening public participation (Young 1993), opportunities to gain skills necessary for the modern technological world (North Central Regional Educational Laboratory 2002; Dewey 2001; Rockman 1998; Connecting Teachers with Technology 1998), and the ability to communicate with a wide range of audiences “(Stone 1987).

Others agree that instructional technology can do all that its proponents claim, but stress caution when approaching the topic. They feel it essential to teach students communication skills rather than simply instructional technology skills (Jasper 1995), and to use the technology to enhance, rather than replace nature activities (North Central Regional Educational Laboratory 2002; Helen Fischel, Delaware Nature Society, survey response May 31, 2001; Simon 2001). The four comments gathered from the WAEE Workshop all promoted striking balance between the use of technology and actual nature experiences (see actual comments in Appendix K). Many survey responses also indicated the need to balance technology experiences with hands-on outdoor environmental experiences.

Finally, some members of the environmental education community, specifically, feel that instructional technology should not play a significant role in EE. Connie Brockman (Cincinnati Nature Center, personal communication March 26, 2001), Eileen Fielding (Connecticut Audubon Society, survey response, May 23, 2001), and Brian
Moscatello (Tenafly Nature Center, survey response May 23, 2001) all stated that their goal is to get children outside, immersed in nature, rather than immersed in the technology that is abundant in many homes and schools.

“I think our society has become too driven by technology and I have found that the more we can take technology out of environmental education the better. We spend so much time trying to find innovative way to teach EE that we forget to simply connect kids with the natural world... Some of our most memorable programs involve taking families on midnight hikes in heavily forested areas and staying motionless for a long time as we call in Great Horned Owls. The expression on those people's faces when they see this magnificent animals fly right over head in the middle of the night is something that no technology in the world can replicate.” (Rob Carmichael, City of Lake Forest Parks and Recreation, personal communication March 16, 2001).

**OBJECTIVE 6: To prepare recommendations for the future use of instructional technology in CWES programming.**

Recommendations were developed, incorporating concepts gathered from surveys, literature review, and planning meetings. These were constructed using the following characteristics:

- Overall objective for each activity.
- Components and audience activities necessary to attain the anticipated outcome.
- K-12 grade range that the activity could address.
- Integration into current programming, as well as any modifications or additions needed.
- Equipment requirements, detailing the current equipment to be utilized as well as any new equipment needed. If applicable, the location to store or implement the concept was also examined.
- Required staffing, including program related set-up (i.e. activity guide design) as well as ongoing staffing necessary (i.e. facilitate online bulletin board).
- Finances required to implement the recommendation (i.e. new equipment, staff time and training, etc.)
- Wisconsin Model Academic Standards (English Language Arts, Social Studies, Science, Mathematics, Technology Education and Information and Technology Literacy), which each activity could address, within the appropriate age range.

- A justification for the option, including how the proposed option would address the CWES mission and how the audience(s) will benefit from implementation, in addition to benefits to the UWSP-CNR and practicum students.

These recommendations were presented for revisions to the CWES director in January 2002 and revised as needed.
CHAPTER 5
RECOMMENDATIONS

This chapter describes recommendations for how the Central Wisconsin Environmental Station can use instructional technology to enhance the educational experience offered at the Station and/or to bridge the classroom experience of Wisconsin’s K-12 students with their field experience at CWES.

The majority of programs described in previous chapters focus on the use of technology to link the organization to classrooms, rather than as a technique to enhance on-site programs. Many survey respondents reported that they try to keep students in the out-of-doors as much as possible. Several expressed concern that the introduction of instructional technology into the field setting could detract from the experiential opportunities sought by nature center educators. A common suggestion posed was to use technology to enhance field trips by developing opportunities for classes to build off and enhance the field trip from their classroom. By providing these links, centers can also better integrate their field experience with school curriculum, helping to justify the need for and value of outdoor field trips.

Furthermore, research has shown that the use of pre and post visit activities can enhance and support the knowledge gained from field trips by reinforcing key concepts learned (Cox-Petersen & Melber 2001, Farmer & Wott 1995, Orion & Hofstein 1994). Orion & Hofstein (1994) recommend that pre-visit activities focus on concrete activities, such as exposing students to materials that will be used in the field and introducing students to the specific purpose and concepts that are the focus of the trip. After the field
trip, students can then be exposed to more abstract thinking and learning, using concepts from the pre-visit activities and field trip (Orion & Hofstein 1994).

Recommendations within this chapter will focus on connecting the classrooms to CWES, as the staff do not wish to replace current programming, but rather to supplement programs and help to support field trip experiences. These recommendations were developed using review literature, existing programs, survey results, and input from the CWES Planning Team. Each is described using characteristics outlined in Chapters 3 and 4, including the overall objective, activities needed to attain the objective, appropriate age range, possible integration into current programming, equipment requirements, required staffing (both for program and otherwise), needed financial support, possible academic standards addressed, and how the recommendation benefits CWES and its audience. In addition, the goals of environmental education (awareness, knowledge, etc.) addressed by the recommendation will be considered.

CATEGORIES OF RECOMMENDATIONS

1) SEASONAL CHANGES AT CWES - This category will focus on the use of the Internet to enhance student awareness and knowledge of phenological changes and how they affect humans and the environment. Many of the successful programs described within this research focus on phenological changes such as bird migration and seasonal ecosystem changes. These programs offer an opportunity for students to explore the uniqueness of their region, and focus on phenological events in their home area.
This category will highlight CWES phenological changes, making use of site features such as lakes, marshes, pine plantations, deciduous forests, among others. The seasonal changes undergone by these ecosystems, and the lessons that highlight them, would help students to not only understand the cycle the environment goes through each year, but to also see how CWES reflects these changes within programming.

2) WINTER ECOLOGY EXTENSION – CWES currently offers a 1-2 day Winter Ecology unit to students in grades 5-8. This experience focuses on the effects of winter on plants, animals, and humans, as well as how organisms and ecosystems have adapted to cope with Wisconsin winters. Lessons include 1) Winter Severity, in which students study microclimates throughout CWES in order to understand how animals use varying conditions within the environment to survive; 2) Winter Lake Study, in which students study the stability of a lake ecosystem as compared to terrestrial systems, and explore how the relative stability and seasonal changes of a lake affect the organisms dependent on it; 3) Survival of the Fattest, in which students explore the concept of accumulated energy and how energy needs vary with the winter conditions and specific needs of each animal; and 4) Survival Strategies, in which students learn about human survival in winter, and participate in a simulation to learn how to cope with emergency winter situations.

This research did not uncover any other technology-enhanced programs that focus specifically on winter’s effects on ecosystems, though winter is
included within other topics. By developing techniques to highlight the Winter Ecology program, CWES would not only promote an existing program, but serve as a model for other organizations interested in connecting their site with seasonal phenology.

3) LAND USE SIMULATION – Currently, CWES offers several lessons in multiple land use and land management. These are offered within the theme Human Interactions with the Environment to grades 5-12. Few programs discussed within the previous chapters focus on land-use and management, resulting in a gap in which an innovative land-use program could be created. The recommendations within this category would provide an opportunity for schools to explore the topic whether they had visited the Station or not, while involving students in activities that support the knowledge, skills, and ethics/values goals of environmental education. Insights gained from the activities could help CWES staff in development and evaluation of current land management programs, as well as serve to advertise these programs. The activities could also serve as pre and/or post visit activities for schools interested in the lessons.

4) CD-ROM LESSON ENHANCEMENT – This category focuses on directly connecting student experiences at CWES with the classroom, using CD-ROM and digital photography techniques. Through these connections, students would
be involved in developing the awareness, knowledge, and skill goals of
environmental education.

One-day programs accounted for 60% of classes attending CWES during the
2000-2001 academic year. Research has shown that the knowledge students gain from
short term experiences such as these is greatly enhanced with the addition of pre and post
visit activities that strengthen the concepts learned and prolong the experience. By
providing a means for students to take tangible memories home from CWES and to
further explore concepts learned, the field trip could become a larger part of student
education, helping not only to improve the education offered, but also to strengthen the
value of CWES field trips.

SEASONAL CHANGES AT CWES

1. Seasonal Photo Broadcast:

One recommendation is to create an online photo broadcast to help increase
student awareness of how one particular area of CWES changes over time (i.e. Sunset
Lake or the frog pond.) An activity guide would accompany this to help facilitate student
exploration of the changes that occur, why they occur, and how they affect the
ecosystems at CWES. This activity would best suit students in grades K-6, as it could be
easily integrated into both the Earth Explorers (grades K-3) and Adaptations (grades 4-6)
themes at CWES.
An “Ask-A-Naturalist” area of the website would be designed to allow students to post questions about their experience at CWES and/or their home or school site. A “Stump-A-Naturalist” section would also be designed to encourage students to do environmental related research and attempt to stump the CWES staff. This could provide a follow-up for a CWES visit which included the closer “Stump the Staff”, in which students win points for asking nature questions that the staff do not know the answers to. Questions and answers for each of these sections could be posted to allow all students to benefit from answers. Interactive sites such as these are quite prevalent within nature and environmental center websites, providing a means for the general public to gather information about environmental topics while being connected to the center.

This activity would fit well with the current restructuring of the Environmental Education and Interpretation program within the College of Natural Resources. Plans call for an extended practicum experience that would simulate the education department’s student teaching experience, to be split between CWES and the Schmeeckle Reserve. This extended experience would provide an opportunity for practicum students to become more involved with behind-the-scenes CWES programming such as this, giving them valuable experience with research and the Internet to prepare them for the future.

This recommendation would be fairly time intensive to develop and maintain. Staff would need to create and coordinate the online photo broadcast, and entries would need to be monitored on a regular basis. Activity guides would need to be designed and updated, and the “Ask-a-Naturalist” and “Stump-a-Naturalist” sections constantly monitored and updated. Photo releases would need to be obtained for any photographs of students. Finally, time would need to be built into existing on-site lessons to allow time
for student photography and commentary. Monetary cost would be fairly minimal, as CWES already owns a digital camera that would be sufficient.

Some standards (Appendix L) that could be addressed by this activity include

- Information and Technology Literacy: A.4.4, A.8.4, B.4.5, B.4.6
- Science: C.4.2, E.4.5
- English Language Arts: F.4.1.

There are several benefits to CWES in addition to gaining exposure through the Internet. One such benefit is the extension of school experience through online photographs and activities. Practicum students could help to develop these activities and monitor the website, giving them exposure to innovative technology and digital photography.

2. Seasonal Lake Studies

A second activity could focus on exploring the ecological changes that occur throughout the year at Sunset and Minister Lakes. This would be best done through data collection, an online databank, and discussion questions and an activity guide. Phenology is a common topic within environmental programs, used as the core of program (such as Classroom Feederwatch and Journey North) and as a means of helping people to become more aware of surroundings through website postings (such as the web cam at Monterey Bay Aquarium.) Sunset Lake and Minister Lake are both used within CWES programming, and this recommendation would provide a unique opportunity for students to explore some of the differences that exist within the two lakes on a seasonal basis, as well as how the varying seasons affect the organisms that depend on the lakes.
CWES currently offers two lessons focusing on lake ecosystems: Bottom’s Up/That’s the Limit (grades 7-12), a pair of spring lessons focusing on seasonal turnover and its effects on organisms within the lake, and Winter Lake Study (grades 5-8), which introduces students to the relative stability of a lake in winter and the effects of winter conditions on the organisms within the lake. The data gathered during each lesson is similar, so it would be relatively simple to create an online databank of lake data. The databank could then be used as the basis for interdisciplinary classroom activities and lessons with students exploring how the lakes change over time by comparing data from spring, summer, fall, and winter.

The creation of an electronic bulletin board could provide a place for students to engage in discussions regarding their research. These discussions could focus on the changes throughout the year and throughout each season, and how they think these changes might affect the organisms within the lake. Students could also compare Sunset Lake and Minister Lake and explore how the sizes of the lakes might impact the seasonal changes it undergoes. These discussions could also be continued through classroom projects that would focus on researching a particular organism within the lake and hypothesizing about what effect the seasonal changes demonstrated by the data could have on that organism. This would be particularly powerful if a list of the organisms commonly found in Minster and Sunset Lakes could be included on the website.

Grades 5-12 would be the most appropriate age range for this activity, as it would easily be integrated into Winter Lake Study, Bottom’s Up, and summer camp. This program would be similar to GREEN and the Rouge Education Project, programs focused on exploring local watersheds over time.
To implement this recommendation, a databank would need to be constructed and data entries regularly monitored. No new equipment would need to be purchased, as the Station already owns water study equipment, and practicum staff are trained in the use of such. The program staff would need to revise the Winter Lake Study and Bottom’s Up lessons to ensure that similar data was collected. These staff would also need to retain and enter data into the databank on a regular basis, as well as monitor the electronic bulletin board and facilitate discussion. The lessons could also be expanded for older students to include a search for lake organisms, in order to help students see species and abundance differences between seasons and sites. In addition, a lesson would need to be incorporated into summer camp and the fall program in order to collect data. This could be done through partnership with a local school or environmental club that could visit periodically throughout the year.

Some standards (Appendix L) that could be addressed include:

- Information and Technology Literacy: A.8.4, B.8.6, B.8.7, B.12.1, B.12.6, B.12.6, B.12.7
- English Language Arts: A.8.4, E.8.1, F.8.1

This set of activities could benefit CWES and the CWES audience by providing the opportunity to extend student experience through linking CWES activity to school activity. Audiences unable to come to CWES would have access to lake data and activities, gaining the opportunity to study lake changes through actual data. Finally, by directly linking the classrooms with CWES, field trip support would be strengthened.
3. Virtual Night Program

A third recommendation to promote the exploration of seasonal changes at CWES is to create a virtual night program that would mimic the actual night program experienced by students staying at the station for 2 or more days. One such on-site night program includes three components: 1) Stars and Stories, in which students learn to identify several constellations and explore the stories and mythologies behind them, 2) Night Hike, in which students are taken on a nighttime hike on which they use their senses to explore the differences between night and day, and 3) Campfire, in which students sing songs, participate in skits, and hear stories to unwind after a day of lessons at the Station.

The virtual version of this night program would include photographs of the CWES night sky with simultaneous voice-over recordings of students narrating constellation stories. This would be accompanied by activities designed to compare the CWES sky to the sky at their home and in different parts of the world. Other activities could explore the concept of light pollution, exposing students to differences in star clarity within cities versus at CWES.

Following the stars section would be a virtual night hike developed using either video clips or PowerPoint slides. This section would take students “into” a dark forest where they would be able to participate in several simulated night hike activities, then read about the significance of each activity. Examples could include trying to determine what color a piece of paper was while in the dark, listening for night sounds, and watching the light produced when students crunch on “moon rocks” (Wintergreen Life Savers). These scenarios would be followed with a discussion of why the human eye sees
color better during the day, the different animals that come out at night, and the chemical reactions that occur within “moon rocks”. Students could also have the opportunity to explore how different organisms’ eyes are adapted for night. While viewing a night scene, students would be able to select from a list of tools, including “owl glasses” or “deer glasses”. Once they’d selected a tool, the scene would reflect how that animal sees the scene, allowing students to compare how their eyes are different from other animals.

A virtual campfire would follow, consisting of an animated .gif file and voice over of campfire songs. Downloadable versions of the stars stories and night hike activities should be included so students can learn more about the topic and try the activities at home.

This set of activities would be appropriate for any age range, from K-12, by designing specific activities for each age level. For example, a K-3 stars lesson might focus on finding one or two constellations within the sky, while a stars lesson for grades 9-12 could delve into ecological and celestial changes associated with the change in seasons, and how the sun and moon affect seasonal changes on earth.

Program staff would need to design the website and related activities. The campfire and night hike would need to be photographed and formatted, and star stories, campfire songs and campfire stories would need to be recorded. Supplemental activities would need occasional updating, by season, and the sky would need to rephotographed on a fairly regular basis to demonstrate changes over time.

Possible standards (Appendix L) to address through this activity include:

- Information and Technology Literacy: A.4.4, A.8.4, B.4.6
- Science: E.4.4
This activity would provide a means of showing students, teachers, and parents the night program at CWES and encouraging registration. Practicum students could have an opportunity to participate in digital photography and voice-recording technology, as well as website design and maintenance. This activity could also tie CWES into the GEM Program at UWSP if designed to link CWES and Wisconsin schools with schools in different areas of the country and globe.

4. Seasonal Changes in CWES Lessons

This activity would explore how seasonal ecological changes affect student activities and lessons at CWES, while allowing students to share with others their values and feelings about their day at the Station. While at CWES, each group of students would photograph several significant activities, such as a nature hike they took or samples of lessons they were involved in, and write down their comments and thoughts about their time at the Station. These photographs and quotes would be included along with short descriptions of the activities to help illustrate the program that the students were involved in. These would then be posted on the CWES webpage.

This would be appropriate for all grade levels, as well as all lessons and themes. Care should be taken to include Wisconsin Foreestree in the fall, Winter Ecology in the winter, and the water unit in the spring, as these are the only season-specific units taught at the Station. The other CWES lessons could also be used, less as a focus in and of themselves, but rather to illustrate how those lessons differ between seasons. For example, the How Birds Make a Living lesson is taught throughout the academic year, but students
participating during the winter would see a different set of birds than those visiting in the late spring or early fall.

To implement this recommendation, the website would need to be developed and maintained, and materials posted on a regular basis. Program staff would be responsible for obtaining photo releases for photographs of students and incorporating time into the schedule for student photography and to record comments. Limited additional funds would be required, as CWES is already in possession of a digital camera.

Possible standards (Appendix L) to address through this activity could include:

- Environmental Education: A.4.4, A.8.6
- Science: E.4.5, E.4.6
- English Language Arts: B.4.1, E.4.1, E.8.1, F.4.1

CWES would benefit from this activity in a number of ways. By posting the photographs and comments, programs would be marketed year-round. CWES could facilitate partnerships between schools that come at different times of the year, while aiding students in using modern technology. These activities could be also used as a pre and/or post-visit activity, to explore why and how programs are different at different seasons, helping to support CWES' connection to Wisconsin K-12 schools.

WINTER ECOLOGY EXTENSION

As described on page 99, classes participating in the Winter Ecology Unit spend 1-3 days at the station learning about the effects of winter on plants, animals, and humans,
as well as how organisms and ecosystems have adapted to cope with Wisconsin winters. As mentioned, key lessons focus on varying conditions within microclimates, conditions within lake ecosystems, the effects of accumulated energy on animal survival, and how humans have learned to survive in outdoor winter situations.

1. Winter Ecology at School

The first recommendation within this category is to train schools to conduct Winter Severity explorations and data collection at their own site. CWES would need to provide teachers with detailed Winter Severity lesson plans, as well as information on how to locate or construct subnivean and surface thermometers, snow depth meters, wind meters and other equipment. Instruction on how to locate suitable microclimates at their site would also be available. After conducting research, schools would submit their data to an online Winter Severity databank that would include both data collected at individual schools and data gathered at CWES throughout the season.

CWES staff would facilitate online data comparison and discussion, perhaps through the use of an interactive bulletin board. One such activity could involve engaging students in a discussion of why their site conditions vary from those in other regions. Discussion could be guided by a set of questions focusing on the presence or absence of glaciation in the area, human influences such as farming or planting, overall topography of the site, time of year, and other factors. Students could also participate in discussions about how the winter might affect organisms in their area as compared to others. For example, students across Wisconsin are exposed to squirrels, though students in different types of areas (city vs. suburb vs. rural) may have different interactions with the animals.
Students could participate in a discussion about how their location might affect the food available and the overall health of squirrels, as well as the microclimates and habitats the squirrels use.

These activities could be used as a pre and/or post activity for those schools visiting the Station, or as an in-depth activity for those unable to visit the Station. The activity would be best suited for students in grades 6-8, as the current Winter Ecology unit is geared towards that age group. Assistance from participating teachers would help the CWES program staff to determine how in-depth discussions and activities should be.

In order to successfully implement this recommendation, several steps would need to be taken. First, the Winter Severity lesson plan would need to be adapted to apply to off-site use, and activity guides and discussion boards would need to be created, monitored, and facilitated. The databank would need to be designed and maintained, and student data entry would need to be monitored. The CWES program staff would be responsible for distributing lesson plans and assisting teachers in locating or constructing equipment and conducting research. In addition, teachers would need to ensure that the Winter Severity data gathered by groups at CCWES was collected and entered into the databank. This would require fairly intensive staff time at first, though time required would diminish once the system was in place.

There are several standards (Appendix L) that could potentially be addressed with this activity. They include:

- Environmental Education: A.8.1, A.8.4, A.8.5, A.8.6
- Technology Education: A.4.8
- Information and Technology Literacy: A.8.4, B.8.1, B.8.6
- Science: C.8.1, C.8.2, C.8.6, C.8.7, C.8.8, C.8.10, E.8.3,
- English Language Arts: E.8.1, F.8.1
This activity would help to support the CWES mission in a number of ways. It would provide an opportunity to extend student experiences by linking a CWES activity to a follow-up school activity. Audiences unable to come to CWES would have access to winter data and activities to explore data. While these students would not be attending CWES program, they would be experiencing environmental education, a goal of the CWES mission. Finally, this activity would help strengthen field trip support by directly linking classroom with CWES.

2. Winter Ecology Distance Learning

In this activity, Winter Ecology activities would be broadcast via distance learning technologies to schools throughout Wisconsin and potentially across the nation and globe. This would give participating students the opportunity to experience CWES ecology during the wintertime. Through guided activities, students would compare central Wisconsin to their own site. CWES would act as instructor, and later as facilitator for communication between schools. This structure could also be used as training for those schools wishing to complete Winter Severity lessons at school. (See previous recommendation). As Winter Ecology is aimed at students in grades 6-8, this activity would also be the most appropriate for that age range.

To implement this idea would require a great deal of technological training for both the staff and the schools. In addition, a technician would be required onsite to monitor, troubleshoot, and coordinate the distance learning equipment and session. Partners and interested schools would need to be located and trained, partnerships
between schools would need to be facilitated, and CWES staff would need to be trained in facilitation of distance learning activities. The activities to be used would need to be developed or adapted from existing activities, and the actual sessions taught. In addition to time and training, the cost for both CWES and schools of purchasing the equipment would be high.

Several standards (Appendix L) could be addressed by this activity, including:

- Environmental Education: A.8.4, A.8.5, A.8.6
- Information and Technology Literacy: A.8.4, B.8.6, B.8.7
- English Language Arts: C.8.3, F.8.1
- Mathematics: E.8.1, E.8.2, E.8.4

Despite the costs and time associated with this activity, it would have numerous benefits for CWES. The first is that through the modern technology used by this activity, both practicum students and K-12 students would be exposed to innovative environmental education, part of the mission of CWES. The program could serve as a model for other environmental centers interested in distance learning. In addition, by connecting CWES to schools in different geographic areas, CWES would be linking to the GEM program at UWSP.

LAND USE SIMULATION

This activity involves the use of an online simulation to help students explore the topics of land use and multiple-use management through interactive activities that focus on problem solving, teamwork, and resource management. A webpage with a map of CWES and surrounding area would be developed, using software in which students can
manipulate physical features (i.e. trails). The activity would begin with a brief introduction to land-use and multiple-use management. Students would then be introduced to a task that challenges them to design the environmental station with a certain objective in mind (i.e., recreation, wildlife, water conservation, forestry). This is similar to the program ‘Mapping the Environment’ offered by the Missouri Botanical Garden.

Guiding questions would be incorporated to help students formulate their rationale. These questions would encourage students to work as a team to solve their problems, considering how their ideas might impact wildlife, plant life, human use of the area, soil, etc. Students would submit their finished products to the station, where the staff would review them and post maps and rationale on the CWES website. This could be run as a contest with several age groups (i.e. grades 5-8 and 9-12), awarding prizes for the best proposal.

The activity could be integrated with any number of lessons taught at CWES, specifically Resource Management Role Play and Sunrise/Sunset. These two lessons focus on land use and management. Resource Management Role Play engages students in a simulation in which small groups of students are given a plot of land and a particular resource to manage for (wildlife, forestry, recreation, or water). The students must then develop their plan and present it to the larger group. Sunrise/Sunset is a similar program, though students explore the topic more in-depth.

To add validity to the experience, upon completion of their task, students could have access the CWES Forest Management Plan, to help the students compare their
results to those done by professionals and better understand the concept of multiple-use management.

Required technology would initially be fairly intensive, as the simulation would need to be developed and monitored. CWES Program Staff would be responsible for advertising for participants, creating the introduction and rules of the challenge, formulating guiding questions, and evaluating submitted maps and rationales, in addition to answering questions that may come up. The major cost in this activity would be the software required to create the manipulatable map.

Possible standards (Appendix L) to support using this activity include:

- Science: C.8.2, C.8.8, C.8.10, H.8.2
- English Language Arts: A.8.4, B.8.1, E.8.1, F.8.1
- Social Studies: A.8.1

There are several benefits to CWES in using this activity. Audiences not able to visit the station would be able to participate in the activity, broadening the CWES impact on school groups in Wisconsin and the nation. The activity could be used as a pre or post visit activity for those groups participating in land-use and multiple-use management lessons while at the station, helping to reinforce the knowledge and experience they’ll gain at the station. Finally, practicum students would gain an opportunity to participate with this rather innovating means of using technology to address the topic.
CD-ROM LESSON ENHANCEMENT

This activity would involve directly tying CWES lessons to the students' schools and homes through the use of a custom made CD-ROM. While at CWES, students would participate in lessons as usual. During the lessons, students would take digital photographs of key segments of the lesson. Before leaving the station, each student or class would be given a CD containing synopses of the lessons that they learned during the day, the photographs taken during the lessons, and a series of websites and resources to help students further explore the topics being studied, encouraging self-inquiry and continued learning about the topic. This activity could be integrated into any lesson at CWES, for any age group. The handheld data collection devices used at Bernheim Forest and the American Museum of Moving Images could be used as models for this idea.

Using digital photography and burnable CD's would lessen the cost of the devices used at those sites. CD's would need to be purchased for each student or class. A staff member would need to supervise digital photography, as well as download photographs into appropriate places in the lesson synopses. The CD burner currently at CWES could be used to burn the CD's if it is decided that each class would receive one CD. If each student is to receive a CD, however, more burners would need to be purchased to allow for rapid burning of up to 60 CD's at a time.

Program staff would also have fairly extensive duties. Time would need to be built into lessons to allow for digital photography, as well as to burn and distribute CD's. These staff would need to be trained in the use of the camera, as well as become comfortable with CD burning. Lesson synopses would need to be created to include on the disc, and appropriate links and resources would need to be researched and identified.
Potential standards (Appendix L) to be supported through this activity include:

- Science: C.4.3
- English Language Arts: E.4.1, E.8.1, F.4.1, F.8.1

CWES and the CWES audience would benefit from this activity in many of the same ways as many other activities described above. The practicum and K-12 students would become comfortable with digital photography equipment, and practicum students would gain experience with CD-burning technology. Visiting students would have the opportunity to review lessons once they arrived back in their classroom and homes, and the links and resources available on the CD would provide a means for self-inquiry and extended learning. This would be a rather innovative technique, providing unique experiences for all involved.

CONCLUSION

The use of technology is steadily increasing within education, at both a formal and non-formal level. As time has passed, educators made a transition to methods that allow students to learn while developing critical thinking, analysis, and decision-making skills. Environmental centers and related organizations have mirrored this, implementing program enhancements that aid visitors in exploring the natural world and furthering their environmental education experiences. Professional opinions gathered through this research also reflect positive perceptions of the use of instructional technology in the future.
The recommendations developed above would provide innovative educational opportunities that would continue to help CWES to enhance the educational experience offered at the Station and to bridge the K-12 classroom experience with field experiences run at and through CWES. When considering each, thought and consideration should be given to the guidelines laid out in Chapter 2. A team should be developed to further explore these recommendations. This team should include representatives of CWES, Wisconsin K-12 school administrators and teachers, UWSP CNR faculty, and professionals in the field. The team should carefully explore each recommendation, considering the mission and goals of CWES to develop a set of priorities. Prior to implementation, activities should be extensively pilot tested and evaluated to ensure appropriateness. The team also needs to consider how to integrate selected recommendations into both existing CWES programming, future program goals, and school curricula in order to provide the best fit possible for both K-12 schools, UWSP, and the Station.

Finally, care needs to be taken to ensure that the glitz and glamour of technology does not replace the hands-on environmental experiences at CWES. Technology should act as an enhancement, rather than a replacement, for traditional programs. All decisions should reflect the mission: "to foster in adults and youth the appreciation, understanding, skill development, and motivation needed to help them build a sustainable balance between environment, economy, and community." Technology can help the Station do just that, while serving as a model for organizations worldwide, providing innovative programs to visiting classes, and preparing UWSP students to enter the world of environmental education with the best experience possible.
LITERATURE CITED


PROGRAM WEBSITES


Appendix A
CWES Mission Statement

Our mission is to foster in adults and youth the appreciation, understanding, skill development, and motivation needed to help them build a sustainable balance between environment, economy, and community.

We will accomplish this mission by:

1) Training and mentoring University of Wisconsin-Stevens Point undergraduate and graduate students in environmental education in an effort to develop the most skilled and sensitive professionals possible.

2) Providing innovative environmental education experiences based on ecological principles, integrated natural resource management philosophies, balanced perspectives, and inquiry based methodologies.

3) Offering outdoor opportunities to recreate, rejuvenate and build strong personal connections to the waters, woods, wildlife, and each other.

4) Demonstrating sustainable designs and practices based on current research and technology.

5) Promoting this leadership model, in cooperation with the UW-Stevens Point College of Natural Resources, to others across the state, nation, and world.

Central Wisconsin Environmental Station (2002).
Meeting Agenda

Goal of Meeting
- Define technology
- Prioritizing CWES' needs
- Where should information be obtained from?
- How should that information be obtained?
- How should that information be used?

Outline flow of research for thesis work

Brainstorm session
- See attached questions
1. Definition of Technology
What does technology mean to you?
Because technology is such a broad topic, I've broken it down into categories.
• Staff preparation and research
  • Supplement to programming (i.e. exhibits to peruse in spare time)
  • Link from school to programming (i.e. data log accessible from school)
  • On-site part of programming
  • Technical focus (i.e. data entry and analysis or GIS work)
  • Other purposes (i.e. to prepare presentations, do slide shows, or include as a part of lessons, as in solar power display or star dome)
  • Special events or programs
  • Distance learning (tele-conferences, distance lessons)
  • Publicity and outreach
Are there any changes or additions that you can think of?

2. Priorities of CWES
Out of the categories that we've just discussed, which are most important for me to focus on? Are there any that seem more important to focus on than others?
  • Are there any categories that seem to be low priority?
Are there any that you feel would have a negative effect on CWES, and should therefore not be researched?

3. Where should I get information from?
Who has relevant information?
Will looking at environmental centers similar to ours be enough?
Should I branch out to other types of centers or programs?
  • Solely environmental centers and classrooms?

4. How should that information be obtained?
Surveys? Interviews? Other uses?
What would be the benefits of any one over the others?

5. How should this information be used?
How do you feel my results will best be utilized?
When gathering information, should I focus on any particular aspect of what I mentioned?
Do you perceive any one of those as more significant and worthwhile than any other?
Minutes from CWES Planning Team Meeting, January 26, 2001

Present: Patty Dreier, Director; Sterling Strathe, Assistant Director; Rebecca Clarke, Program Manager; Dan Lamers, Program Assistant/Facility; Teresa Mead, Outreach and Publicity; Bethany Lesure, researcher.

Categories:
Link from CWES to school – Access to data from school. Extend the CWES experience to more than 1 day. Data from their lessons or our collections. Continue their connection.

DNR wants baseline information. Collect with students here (training them to gather this.) Go home and collect more data at school. Send to us or the DNR.

Distance learning. Workshops and lessons. Outreach to teachers. For hiring (i.e. using virtual cameras to interview those away from CWES.) More minor than school link and technology programming.

Key pieces of mission to focus on –
   Training and mentoring
   Providing innovative EE experiences

Rapid changeover in technology – what will be valid in 2-3 years?

In recommendations, focus on concepts and general models, rather than specific current technology.

New learning styles and methods. Need to be up on a level with schools and universities. What’s our niche? There is no substitute for direct environmental experience.

Onsite and offsite experiences. Data collection and experience. Bridge by allowing offsite access and continuation.

- Pre/post visit activities. Interactive pre-visits allow us to go straight into the experience and discussion.
- More activity and experience at CWES. Already have the background when they come, get out and do hands-on things here, less intro and basic info on site.
- Post visit discussions and further activities.

What are others doing with pre/post?
Apply that as a demo using winter ecology. Keep continuous when back at schools. Show pictures of different severity sites. They continue their contact. In evening, go to computer lab and do their analyses.

Independent learning
Create a CD to put synopsis of lessons on. Come and experience the lesson, snapshots of experience put on the CD. Bring home and access links to more information.

Tap into other places.
   Exchange information with another place. Cross cultural experience (with Russia, etc.) Partner schools.

Time capsules to leave for future groups (i.e. their school next year). Kid to kid challenges.. help shape the next year.

Data entry, access from elsewhere. Links to related sites and information. Part of a larger data collection. Ownership of experience.
Read School in Oshkosh – their trip to CWES online. Photos and summaries.

Our site – links to schools who’ve been. Like the NatureNet teacher connection.
Standards

Practicum training – need to be up on what they’re teaching. Implications for added technology.

Recap – pre/post visits directly related to CWES experience. Use Winter Ecology as an example. A second unit with technology support.

Final product has those main best practices so we can go back and examine this when we add more or change experiences.

What to do before, during, and after visit to build the strongest educational frame possible?

Online survey and follow-up. Worth their while by providing them with resulting “best” practices. Find top 10, case study. Take concepts from each, use bits and pieces most relevant to CWES. What should we keep in mind?

Use winter ecology to make a real example out of those theoretical concepts and practices.

Constructivist theory.

Post – learning after they leave. Help schools use us to fill their needs.

Big districts are pushing away from textbooks, due to cost. These types of programs that can tie to standards, etc. Help move away from the books and into more teaching. Learning at their own pace – individualization. Problem is non-motivated students.

Where to look?
Schools that do similar programs. Do they see it as important? Do they care? What do other centers provide them? Online? Onsite?
Trying to help accomplish goals of WI standards.
To make sure they are interested
- Small survey for teachers that come. What else will they do? What would they like to do?
- Focus group – ask the kids. What do they want to do when they leave? What do they have at school?
Survey school districts in WI (our pre and post visit activities are aimed to be appropriate for them). Give a synopsis of what we want to do – are they interested? How much technology are they using? What do they expect in the future? What would be helpful for them?
Another survey for outside Wisconsin. Big name centers (Teton Science School, Keystone Science School, Audubon, etc). Are they thinking of this?

Supply – Social Ventures, etc. What do tech suppliers have available? Their cutting edge tech advice to design.

MATC – distance learning. High schools and tech.

Physical facilities. Help in designing ed center. Are we planning this the right way?

Real life DNR data station.

Recommendations on demands to teachers.

Program where teachers get credit for coming here... work on licensing and development.
Other applications at CWES for my results
Something other places can look to.

Survey – online, snail mail postcard. Include what do you do? Is it something you are interested in? Do you want to know more? Do you know of other places? Website address. Conference on this, teacher training, etc. Get credit for coming – NOT MY PROJECT.

Role CWES must be playing, based on UWSP mission and CNR mission.
What is our role? Must turn out kick-ass program. Our role is to make exceptional teachers, need exceptional programs to do so.

Teachers – not qualified to teach a lot of this. Balance standards, learning style, etc. Summer credit in how to use what we provide in the classroom.
Appendix C
Technology Use
Initial Inquiry Letter

Aren't you curious about what other centers across our Nation are doing to use technology to enhance their educational programs?

So am I! I’m a graduate assistant at the Central Wisconsin Environmental Station (CWES), a field station of the College of Natural Resources at the University of Wisconsin-Stevens Point. I’m working on a research project where I am investigating current uses of technology at Nature and Environmental Centers across the United States—specifically the ways in which technology is used to enhance educational programs for visiting school groups. My graduate committee and I thought that if we turned to the Association of Nature Center Administrators, we’d be tapping into the national leadership in our field—and that’s why we’ve contacted you.

Does your organization use technology to enhance learning opportunities for your visitors? Do you use technology as a bridge between experiences at your center and in school classrooms? Have you considered how technology can be used to further enhance the on-site experience you provide to students?

If you think you have some great ideas to share with others about how technology is used by your organization to enhance environmental education programs, I invite you to return this email to me at cwes@uwsp.edu. Then, I’ll forward a short electronic survey for you to complete and return back to me. I’ll conduct follow-ups with a few of you who seem to offer programs of high value to this research. As a way to say “thanks” for your time in completing the survey, I’ll be glad to send you a copy of the research results so that your organization may benefit from them, too.

This information will be used as part of the strategic planning process for CWES and UWSP programs. We’re guessing that many of you might also benefit from finding out what others are doing as they use various forms of technology to improve learning opportunities and build bridges across the miles. Thank you for your participation!

If you’d like more information about CWES and its programs, please check out our website: <http://www.uwsp.edu/cnr/cwes>.

Bethany Lesure
Graduate Student of Environmental Education
College of Natural Resources
University of Wisconsin - Stevens Point
Responses to Inquiry Letter Respondents

No uses to share, but please forward results.

Thank you for responding to my inquiry regarding technology use in EE. I will send you my results as soon as they are available, most likely during the spring of 2002. Thanks again.

Bethany Lesure
Graduate Student of Environmental Education
College of Natural Resources
University of Wisconsin - Stevens Point

Yes, I'd be willing to fill out a survey.

Thank you for responding to my inquiry regarding your organization's use of technology. I will be emailing you a brief survey within the next 2-3 weeks. I look forward to hearing how you are using technology within your environmental education programming. Thanks in advance for you time and assistance.

Bethany Lesure
Graduate Student of Environmental Education
College of Natural Resources
University of Wisconsin - Stevens Point
I am writing regarding research I am conducting about how technology is being used by environmental education and nature centers across the country to enhance school programs, either on-site or as a bridge to the classroom. I had sent a letter to you in March, and you had responded that you would be willing to assist me by completing a short electronic survey. Thank you for your patience in the time since then.

Below you will see a web address on which you will find the survey that I am referring to. Please take the time to complete this survey, giving your input on research that is important to the entire field of environmental education. In return, I will send my results to you when they are available. Thank you in advance for your time and assistance.

http://www.uwsp.edu/natres/blesu700/TechSurvey.htm

Bethany Lesure
Graduate Student of Environmental Education
College of Natural Resources
University of Wisconsin - Stevens Point
Survey Instrument

Thank you for agreeing to complete the brief survey below regarding your organization’s use of instructional technology. For the purpose of this survey, instructional technology refers to the use of computer-aided technology for the express purpose of enhancing educational experiences. The information gathered as a result of this survey will be used to develop a compilation of technology-based applications that are used at environmental education and nature centers. This compilation will be made available to you as soon as it is complete.

Start of survey

I. What types of instructional technology do you use at your facility? (check all that apply)
   A. COMPUTER SOFTWARE PROGRAMS OR SIMULATIONS
   B. STUDENT/VISITOR USE OF THE INTERNET
   C. ANALYSIS OF COLLECTED DATA
   D. INTERNET VIRTUAL FIELD TRIPS
   E. DISTANCE LEARNING – PROVIDING EDUCATION OFF-SITE VIA TELECOMMUNICATIONS
   F. GLOBAL INFORMATION SYSTEMS (GIS)
   G. OTHER (PLEASE DESCRIBE)

II. Why did your organization choose to use instructional technology? (check all that apply)
   A. AUDIENCE DEMAND
   B. TO MEET STATE EDUCATION REQUIREMENTS
   C. REACH AUDIENCES NOT OTHERWISE ACCESSIBLE
   D. KIDS RELATE WELL TO TECHNOLOGY
   E. OTHER (PLEASE DESCRIBE)

III. Please describe the technology-enhanced program/application of which you are most proud. If possible, please submit a sample of said program or list the web address where such a sample may be found.

IV. How do you assess the effectiveness of your technology-enhanced programs? (check all that apply)
   A. USER EVALUATIONS
   B. STAFF EVALUATIONS
   C. WE HAVE NO FORM OF ASSESSMENT AT THIS TIME
   D. OTHER (PLEASE DESCRIBE)

V. Which of the following barriers, limitations, or challenges affect your use of instructional technology in educational programs? (check all that apply)
   A. LACK OF KNOWLEDGE
   B. COSTS
   C. MAINTENANCE AND UPKEEP
   D. STAFFING
   E. COMFORT IN USING TECHNOLOGY
F. OTHER (PLEASE DESCRIBE)

VI. Please indicate which program(s) you offer (check all that apply.)
A. DAY PROGRAMS
B. SHORT TERM RESIDENTIAL PROGRAMS (1-2 NIGHTS)
C. LONG TERM RESIDENTIAL PROGRAMS/CAMPS (3+ NIGHTS)
D. SCHOOL PROGRAMMING
E. SUMMER PROGRAMMING
F. OTHER (PLEASE DESCRIBE)

VII. Please indicate the audience(s) that you serve (check all that apply.)
A. K-12 SCHOOLS – SINGLE DISTRICT
B. K-12 SCHOOLS – MULTIPLE DISTRICT
C. UNIVERSITY OR COLLEGE
D. YOUTH ORGANIZATIONS
E. TEACHERS
F. ADULTS
G. FAMILIES
H. OTHER (PLEASE DESCRIBE)

VIII. Please feel free to add any additional comments.

End of Survey

Thank you for completing this survey. Your time and assistance are greatly appreciated.

Bethany Lesure
Graduate Student of Environmental Education
College of Natural Resources
University of Wisconsin – Stevens Point
### Appendix D

**Participating Organizations**

#### Technology Use Survey Organizations

<table>
<thead>
<tr>
<th>Organization</th>
<th>Contact Person</th>
<th>Address</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee &amp; Rose Warner Nature Center</td>
<td>Tom Anderson</td>
<td>15375 Norell Ave N. Marine on St. Croix, MN 55047</td>
<td>(651) 433-2427</td>
<td><a href="mailto:Tanderson@smm.org">Tanderson@smm.org</a></td>
</tr>
<tr>
<td>Olewine Nature Center at Lake Wildwood Sanctuary</td>
<td>Nancy Dollard</td>
<td>100 Wildwood Way Harrisburg, PA 17110</td>
<td>(717) 221-0292</td>
<td><a href="mailto:NDDollard@aol.com">NDDollard@aol.com</a></td>
</tr>
<tr>
<td>Gore Range Natural Science School</td>
<td>Nate McClennen</td>
<td>PO Box 250</td>
<td></td>
<td><a href="mailto:Natem@gororange.org">Natem@gororange.org</a></td>
</tr>
<tr>
<td>National Audubon Society</td>
<td>Blair Audubon Center</td>
<td>PO Box 2601</td>
<td></td>
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<tr>
<td>Brec Bluebonnet Nature Center</td>
<td>Claire Coco</td>
<td>10503 N. Oak Hills Parkway</td>
<td>(225) 757-8905</td>
<td><a href="mailto:BBSWAMP@IDSMAIL.COM">BBSWAMP@IDSMAIL.COM</a></td>
</tr>
<tr>
<td>Bernheim Forest</td>
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<tr>
<td>Lincoln Parks &amp; Recreation</td>
<td>Terry Genrich</td>
<td>Pioneers Park Nature Center 2740 A St.</td>
<td>(402) 441-7939</td>
<td><a href="mailto:naturecenter1@alltel.net">naturecenter1@alltel.net</a></td>
</tr>
<tr>
<td>Delaware Nature Society</td>
<td>Helen Fischel</td>
<td>Hockessin, DE 19707</td>
<td>(302) 239-2334 X14</td>
<td><a href="mailto:Helen@DNSAshland.org">Helen@DNSAshland.org</a></td>
</tr>
<tr>
<td>Ashland Nature Center</td>
<td>Brice Harris</td>
<td>601 Ellsworth Bailey Rd</td>
<td>(330) 394-5247</td>
<td><a href="mailto:Tampeel@neomin.org">Tampeel@neomin.org</a></td>
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<tr>
<td>Tampeel Nature Center</td>
<td>Jackie Lane</td>
<td>PO Box 2601</td>
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<tr>
<td>Tenafly Nature Center</td>
<td>Brian K. Moscatello</td>
<td>313 Hudson Ave</td>
<td>(201) 568-6093</td>
<td><a href="mailto:Bmoscat@iix.netcom.com">Bmoscat@iix.netcom.com</a></td>
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<tr>
<td>Kerry Wood Nature Center</td>
<td>Jim Robertson</td>
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<td><a href="mailto:KWNC@telusplanet.net">KWNC@telusplanet.net</a></td>
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<tr>
<td>Poricy Park</td>
<td>Carol Kealy</td>
<td>PO Box 36</td>
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<tr>
<td>City of Lake Forest (Parks and Recreation)</td>
<td>Rob Carmichael</td>
<td>400 Hastings Rd.</td>
<td>(860) 524-8012</td>
<td><a href="mailto:audubon.society@snet.net">audubon.society@snet.net</a></td>
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<tr>
<td>Connecticut Audubon Society</td>
<td>Eileen Fielding</td>
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<td>(225) 757-8905</td>
<td><a href="mailto:BBSWAMP@IDSMAIL.COM">BBSWAMP@IDSMAIL.COM</a></td>
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<tr>
<td>Connecticut Audubon Society</td>
<td>Jay Teyan</td>
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<td>(516) 922-3200</td>
<td><a href="mailto:jteyan@audubon.org">jteyan@audubon.org</a></td>
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<tr>
<td>Theodore Roosevelt Sanctuary</td>
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<td>City of Lake Forest (Parks and Recreation)</td>
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<td>Name</td>
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<tr>
<td>Alaska Dept. of Fish and Game</td>
<td>Mark Ross</td>
<td>(907) 267-2189</td>
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<tr>
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<td>Env. Lands Division</td>
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<td>Cibolo Nature Center</td>
<td>Jan Wrede</td>
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<tr>
<td>Boerne, TX 78006</td>
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<td>(210) 699-9290</td>
<td><a href="mailto:wrede@texas.net">wrede@texas.net</a></td>
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<tr>
<td>Puget Sound Environmental Learning Center</td>
<td>Clancy Wolf</td>
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<td><a href="mailto:clancyw@pselc.org">clancyw@pselc.org</a></td>
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<td>Mohonk Preserve, Inc.</td>
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<tr>
<td>Wehr Nature Center</td>
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<td>Friends of Opal Creek</td>
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<td>Quogue Wildlife Refuge</td>
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<td>Prairie Learning Center</td>
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<td>Friends of Opal Creek</td>
<td>Mandy Summer</td>
<td>(503) 897-2921</td>
<td><a href="mailto:mandysummer@hotmail.com">mandysummer@hotmail.com</a></td>
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## Organizations Requesting Results

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<td>Long Lake Conservation Center</td>
<td>Robert Schwaderer</td>
<td>Rt 2, Box 2550, Palisade, MN 56469</td>
<td>(800) 450-LLCC</td>
<td><a href="mailto:LLCC@cpinternet.com">LLCC@cpinternet.com</a></td>
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<tr>
<td>Churchville Nature Center</td>
<td>Chris G. Stieber</td>
<td>501 Churchville Lane, Churchville, PA 18966</td>
<td>(215) 357-4005</td>
<td><a href="mailto:CNCBC@bellatlantic.net">CNCBC@bellatlantic.net</a></td>
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<tr>
<td>Jamestown Audubon Center</td>
<td>Ruth Lundin</td>
<td>1600 Riverside Rd., Jamestown, NY 14701</td>
<td>(716) 569-2345</td>
<td><a href="mailto:jaudubon@netsync.net">jaudubon@netsync.net</a></td>
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<td>Huron-Clinton Metroparks</td>
<td>Robert F. Wittersheim</td>
<td>13000 High Ridge Dr., P.O. Box 2001, Brighton, MI 48116</td>
<td>(800) 477-3182</td>
<td><a href="mailto:wittershei@metroparks.com">wittershei@metroparks.com</a></td>
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<tr>
<td>Carolina Raptor Center</td>
<td>Tom Rouse</td>
<td>3335 Willow Oak Rd., Charlotte, NC 28209</td>
<td>(704) 875-6521</td>
<td><a href="mailto:tomrouse@birdsofprey.org">tomrouse@birdsofprey.org</a></td>
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<tr>
<td>Audubon Nebraska</td>
<td>Marian Langan</td>
<td>PO Box 117, Denton, NE 68339</td>
<td></td>
<td><a href="mailto:Marian.Langan@audubon.org">Marian.Langan@audubon.org</a></td>
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<td>Cincinnati Nature Center</td>
<td>Connie Brockman</td>
<td>4949 Tealtown Rd., Milford, OH 45150</td>
<td>(513) 831-1711</td>
<td><a href="mailto:cbrockman@cincynature.org">cbrockman@cincynature.org</a></td>
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<tr>
<td>Northfield Mt. Hermon School</td>
<td>Lisa Schmitt</td>
<td>206 Main St., #2672, Northfield, MA 01360</td>
<td>(413) 498-3000</td>
<td><a href="mailto:lisa.schmitt@nmhschool.org">lisa.schmitt@nmhschool.org</a></td>
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<td>Briar Bush Nature Center</td>
<td>Dede Long</td>
<td>1212 Edge Hill Rd., Abington, PA 19001</td>
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<td><a href="mailto:dedelong@aol.com">dedelong@aol.com</a></td>
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<td>Houston Arboretum and Nature Center</td>
<td>Ruth Milburn</td>
<td>4501 Woodway Dr., Houston, TX 77024</td>
<td>(713) 681-8433</td>
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<td>Silver Lake Nature Center</td>
<td>Robert A. Mercer</td>
<td>1306 Bath Road, Bristol, PA 19007</td>
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<td>Schlitz Audubon Center</td>
<td>Elizabeth Cheek</td>
<td>1111 E. Brown Deer Rd, Milwaukee, WI 53217</td>
<td>(414) 352-2880</td>
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<td>Pine Jog Environmental Education Center</td>
<td>Janelle Shafer</td>
<td>6301 Summit Blvd., West Palm Beach, FL 33415</td>
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<td>Hartley Nature Center</td>
<td>Earl Rosenwinkel</td>
<td>228-06 Northern Boulevard, Douglaston, NY 11363</td>
<td>(718) 229-4000</td>
<td><a href="mailto:aeuler@alleypond.com">aeuler@alleypond.com</a></td>
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<td>Audubon of Florida</td>
<td>Vernita Nelson</td>
<td>444 Brickell Ave, Suite 850, Miami, FL 33131</td>
<td>(305) 371-6399</td>
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<td>Yosemite Institute</td>
<td>Pete Devine</td>
<td>P. P. Box 487, Royersford, PA 19468</td>
<td>(610) 948-8411</td>
<td><a href="mailto:pdevine@yni.org">pdevine@yni.org</a></td>
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<td>Russell W. Peterson Urban Wildlife Refuge</td>
<td>Robert F. Molzahn</td>
<td>611 Brooke Dr., Royersford, PA 19468</td>
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<td>4949 Tealtown Rd., Milford, OH 45150</td>
<td>(513) 831-1711</td>
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| **Lee & Rose Warner Nature Center**
  Tom Anderson
  15375 Norell Ave N.        | Robert A. Mercer
  1306 Bath Road             | 1306 Bath Road
  Bristol, PA 19007          | Bristol, PA 19007
  (651) 433-2427             | (651) 433-2427
  Tanderson@smm.org          | Tanderson@smm.org         |
| **Marine on St. Croix, MN**  | **Forest Preserve District of Dupage County – Willowbrook Wildlife Center**
  55047                      | Carl Strang
  (651) 451-3512             | 525 South Park Blvd.
  Bob Coulter               | Glen Ellyn, IL 61037
  PO Box 38                  | (630) 942-6200
  Gray Summit, MO 63039      | cstrang@dupageforest.com |
| **Poricy Park**             | **River Bend Nature Center**
  Carol Kealy               | John Blackmer
  PO Box 36                  | 1000 Rustad Rd.
  Oak Hill Road             | PO Box 186
  Middletown, NJ 07748      | Faribault, MN 55021
  (732) 842-5966            | (507) 332-7151
  PoricyPark@monmouth.com    | Blackmer@rbnc.org         |
| **Bernheim Forest**         | **Trees for Tomorrow**
  Claude Stephens            | Robin Indermuehle
  PO Box 130                 | P.O. Box 609
  Clermont, KY 40110        | Eagle River, WI 54521
  (502) 955-8512             | (715) 479-6456
  Cstephens@bernhem.org     | robinindermuehle@yahoo.com |
| **Delaware Nature Society** | **Prairie Learning Center**
  Ashland Nature Center      | Don Jorgensen
  Helen Fischel              | P.O. Box 399
  Box 700                    | Prairie City, IA 50228
  Hockessin, DE 19707        | (515) 994-3400
  (302) 239-2334 X14        | Don_Jorgensen@fws.gov     |
| **Macon County**            | **Cincinnati Nature Center**
  Conservation District      | C. Brockman
  Jeffrey A. Tish            | 4949 Teatown Rd.
  3939 Nearing Lane          | Milford, OH 45150
  Decatur, IL 62521          | (513) 831-1711
  (217) 423-7708             | cbrockman@cincynature.org |
| **Brec Bluebonnet Nature Center**
  Claire Coco                | **Houston Arboretum and Nature Center**
  10503 N. Oak Hills         | Ruth Milburn
  Parkway                    | 4501 Woodway Dr.
  Baton Rouge, LA 70810      | Houston, TX 77024
  (225) 757-8905             | (713) 681-8433
  BBSWAMP@IDSMail.COM        | rmilburn@neosoft.com      |
Appendix E
CWES Planning Team Meeting September 13, 2001

Present: Patty Dreier, Director; Sterling Strathe, Assistant Director; Rebecca Clarke, Program Manager; Matt Morrissey, Program Coordinator; Brenna Biron, Student Teacher; Katy Metzger, Student member of CWES Advisory Board; Bethany Lesure, researcher.

Mini-case studies presented and examined.
Reactions:
- Results are unsatisfying.
- Are the schools the ones using technology, rather than the environmental centers that we were examining?
- How do we get to them?
- Should we follow up on our list of centers to determine why they are not using technology? (This was determined to be an option for future graduate work.)
- For those centers and organizations that we follow up with, could we ask for the name and contact of a school that is participating in that program, to find out the school’s perspective on the program?
- How did they get into using this technology? What inspired it? ANCA as a sample group — all similar to CWES, but doesn’t touch back to schools or environmental education, and many are nature centers, rather than educational facilities.
- Perhaps it would be better to start with the uses and then follow it back from there. For example, who is using G.I.S. in Wisconsin, follow up on what else those organizations are doing. Could access this from central G.I.S. training group.

Possible organizations to focus further study on:
- National Science Teachers Association (NSTA)
- State DPI Environmental Education Specialists
- North American Association for Environmental Education (NAAEE)
- Conference proceedings
- Environmental Education grant programs (i.e. WEEB)
- National Environmental Education Advancement Project (NEEAP)
- Residential Outdoor Environmental Education (ROEE)
- Riverkeeper’s Association — started on Hudson River. UW Oshkosh is starting their own chapter.

Need to gather more information about larger programs, such as GLOBE and GREEN. Brainstormed ideas:
- Is there any way to start a CWES program that would link to DNR data, and allow us to compare?
- Examine EEK! website.
- Winter severity thermometers that schools could take home with them, or receive at a training workshop in spring. They could then compare their winter severity data at school with what they discover at CWES.

Possible reasons for small response group:
- Long inquiry letter
- Website to visit, rather than survey in hands
- Timing

What's the next step:
- Adapt survey to new audience
- Follow-up with those that did not answer
- Deal with what we have (determined to not be an option)
- Other venues
Hi. My name is Bethany Lesure, and I’m a graduate assistant at the Central Wisconsin Environmental Station, a field station of the University of Wisconsin-Stevens Point.

I had spoken with you last spring about my research into instructional technology at nature and environmental centers.

I’m calling today to ask if you’d be willing to help me with the next step. If so, I’ll send you a brief survey that will ask about your opinions and perceptions about the use of instructional technology within education programs at your site and within nature and environmental centers.

The survey will take you no more than 5 minutes to fill out, and will be sent to you via email. Do you have any questions about this? Would you be willing to share your thoughts?

(yes) Thank you very much. I will send that out to you shortly, and I look forward to hearing from you. Have a nice day.

OR

(no) Thank you very much for your time. As I promised last spring, I will be sending results out as soon as they are available. Have a nice day.
Survey Instrument

This is the brief survey that I spoke to you about, regarding the use of instructional technology in EE and nature centers. Thank you for agreeing to assist me with this, please try to return it to me by Friday, March 29. As promised, results will be sent to you as soon as they are available.

**Instructional technology** = the use of computer-aided technology for the express purpose of enhancing educational experiences. Examples include computer-aided learning, distance learning, virtual field trips, webcasts and other website enhancements, interactive software, digital photography, data collection techniques, etc.

Based on your experience as an environmental educator, please share your opinion about the use of instructional technology in nature centers or environmental centers. I'm specifically interested in how you perceive the potential of instructional technology to achieve and support the goals of environmental education in nature and environmental centers.

Please respond to the following questions using the scale and elaborating in the space provided.

How useful do you perceive instructional technology currently is at your center?

Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful

How useful do you perceive instructional technology will be at your center in the future?

Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful

Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.

Thank you very much for your assistance!

Bethany Lesure
Graduate Assistant
Central Wisconsin Environmental Station
University of Wisconsin - Stevens Point
Thank You Letter

Thank you for sharing your opinions and thoughts with me. The information you shared will be invaluable as I complete my research. As promised, I will send you my results as soon as they are available, most likely during the month of April. Thanks again.

Bethany Lesure
Graduate Student of Environmental Education
College of Natural Resources
University of Wisconsin - Stevens Point
Appendix G: Pilot Test Responses

From: Kathe Crowley Conn [kconn@naturenet.com]
Sent: Thursday, June 07, 2001 11:45 AM
To: Lesure, Bethany L
Subject: Re: EE research

Bethany, Are you conducting this for baseline information or for another purpose? Generally, I guess if I were you I would also want to know (from a management perspective) if technology has replaced human-human or human-nature forms of interaction and what the impact of that was; how the use of technology has impacted their operating costs; I would add to one of your questions on why they are using technology "Because it was available... (through our agency, grant, etc.)." You may have already addressed this, but do you ask what type of organization is responding (public, private, university, etc.?) I would think that that would be important to track. Good luck.

From: Rick Flood [rick.flood@riveredgenc.org]
Sent: Thursday, June 07, 2001 11:45 AM
To: Lesure, Bethany L
Subject: Re: EE research

I stumbled on getting you an actual copy of the technology program. Too time consuming since the staff are not right here when I need them in order to fill out the survey.

Good luck, Bethany!
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Appendix I: Case Studies

Bernheim Forest, Claude Stephens, Director of Education
P.O. Box 130, Clermont, KY 40110. (502) 955-8512

Background Information - “Bernheim Arboretum and Research Forest, Kentucky's official arboretum, encompasses 14,000 acres and features a nationally recognized arboretum, visitor center, large expanses of scenic natural area, 35 miles of hiking trails and a research forest. Bernheim is dedicated to the restoration, study and enjoyment of Kentucky's knob lands. Over a quarter of a million people annually benefit from Bernheim through visits and public and school programs. Numerous natural area and horticultural research projects are conducted annually in the research forest and arboretum in association with area universities.” (http://www.bernheim.org/history.htm)

Types of Instructional Technology - Bernheim uses a wide variety of instructional technology in their programming. Computer software programs/simulations are used. The Internet is utilized by students/visitors, and an Internet virtual field trip is available. Collected data is analyzed, and Global Information Systems (G.I.S.) are also utilized within programs.

The use of handheld computer devices (under development) is the technologically enhanced program that Bernheim is most proud of. "The devices will be used to provide visitors with portable information that will allow the visitor to move up and down through layers of information important to the visitor... Eventually they will be able to deliver the information that each visitor chooses... provide videos of staff approaching content from different perspectives, provide cultural information, artistic perspectives, scientific information, activities for parents to use with their children, store information from past trips, mail home information that will assist the visitor in taking 'action' on things they have learned on site, etc.” (survey response, Claude Stephens: May 25, 2001.)

Reasons for using I.T. - Bernheim chose to use instructional technology within their programming for the following reasons. 1) Audience demand; 2) To reach audiences not otherwise accessible; 3) kids relate well to technology; and 4) “To reduce the need for interpretive signs and other exhibits that would clutter the landscape with ‘things’” (survey response.)

Assessment - Evaluations are completed by users and staff.

Barriers, limitations, and/or challenges - Bernheim selected the following as barriers, limitations, or challenges to their use of Instructional Technology by their organization. 1) Lack of knowledge; 2) Costs; 3) maintenance and upkeep; 4) staffing; 5) comfort in using technology; 6) “the rapid change in technology and building information that can be transferred to emerging technologies” (survey response.)

Programs offered - At Bernheim, visiting groups can participate in day programming or short-term (1-2 nights) residential programs. School groups visit the forest, and summer programming is also offered. In addition, there are night programs, travel programs, and off-site programs. Research is also conducted at the forest.

Audiences served - Bernheim serves a wide variety of audiences. These include K-12 school groups, from multiple districts, university/college groups, and youth organizations. Teachers, adults, and families are also served by the forest. Local landowners also benefit from forest programming.
Delaware Nature Society – Ashland, Helen Fischel, Associate Director, Education
Box 700, Hockessin, DE 19707. (302) 239-2334

Background Information - “Founded in 1964, the Delaware Nature Society, a private, non-profit membership organization, fosters understanding, appreciation, and enjoyment of the natural world through education; preserves ecologically significant areas; and advocates stewardship and conservation of natural resources.” (http://www.delawarenaturesociety.org/)
“At Ashland Nature Center... you can explore four self-guiding nature trails on 200 acres of meadow, marsh, pond and forest. A native plant garden showcases a variety of plants that provide food and shelter for wildlife. Inside, visitors will find exhibits focusing on habitats and a children's discovery corner, and murals depicting changes in the landscape during the past four centuries.” (http://www.delawarenaturesociety.org/ashland.htm)

Types of Instructional Technology - The only technology being used at DNS-Ashland is student/visitor use of the Internet. The Internet is used to connect students from North America and South America studying bird migration. This is part of a unit entitled “Birds of Two Worlds.” During the visit to DNS, students (grades 6-12 or ecology clubs) explore two types of forests on-site. They search for a variety of neotropical migrant nesting birds, using binoculars and a directional microphone. When returning back to their classroom, e-mail correspondence begins between the school and Country Day students in Costa Rica, where many of the birds return for winter. The program meets 3 Delaware science standards.

A technology committee is also being formed to evaluate future possibilities.

Reasons for using I.T. - They feel that kids relate well to technology.

Assessment - User and staff evaluations are used to assess programming.

Barriers, limitations, and/or challenges - No limitations or challenges were described, though the limited amount of technology used is because the center is trying to take science out of the lab and into the outdoors. They feel technology can “enhance but not replace hands on experience” (survey response, Helen Fischel: May 31, 2001.)

Programs offered - The DNS-Ashland offers programs during school and summer. They range from day to short term (1-2 nights) residential, to long term (3+ nights) residential programs. In addition, graduate classes, public groups, and teacher education workshops are offered.

Audiences served - DNS-Ashland aims programming at a wide variety of audiences including K-12 school groups, university/college groups, youth organizations, teachers, adults, families, and underserved populations.
Background Information - “Kerrywood Nature Center is Alberta’s first federal migratory bird sanctuary, with exhibits on the natural world of central Alberta, entertaining interpretive programs for all ages, walking trails, nature-art gallery, bookstore and snack counter, affordable and unique meeting rooms.” (http://www.city.red-deer.ab.ca/kerry/general.htm)

“The mission of the Waskasoo Park Interpretive Program is to create a population of citizens interested in, aware of, concerned about and involved with their natural and cultural heritage. Some of our education goals are:

- to promote an environmental ethic
- to use the park’s and the region’s natural and cultural resources to show people’s interrelationship with the natural and built environment
- to actively facilitate the use of Waskasoo Park for educational purposes by producing support materials, conducting group leader training workshops, and providing facilities to accommodate group use.

The Interpretive Program also has a mandate to provide extension programming outside the park’s boundaries to audiences who cannot visit Waskasoo Park.” (http://www.city.red-deer.ab.ca/kerry/coming.htm)

Types of Instructional Technology - At Kerrywood Nature Center, instructional technology is used in three forms. Computer software programs/simulations are available in the form of touch-screen computer games in exhibits. There is a public access internet terminal in their library. The third type is related to their school botany program. In this, they plan to have student collect botany data and enter it into a database. Groups can then access not only their results, but results from other groups as well. This isn’t fully developed as of survey completion.

Reasons for using I.T. - Kerrywood chose to use instructional technology because they feel that kids relate well to technology.

Assessment - There is no assessment in place at this time.

Barriers, limitations, and/or challenges - There are a number of limitations to technology use at Kerrywood. These include lack of knowledge, cost, maintenance and upkeep, and staffing.

Programs offered - At Kerrywood, visitors can participate in day programming or short-term (1-2 nights) residential programming. There is both school and summer programming.

Audiences served - Kerrywood aims programming towards K-12 schools (multiple districts), youth organizations, adults, families, local residents, and tourists.
Background Information - "The Missouri Botanical Garden's mission is to discover and share knowledge about plants and their environment, in order to preserve and enrich life. Today, more than 140 years after opening, the Missouri Botanical Garden is a National Historic Landmark and a center for research, education and horticultural display."

[http://www.mobot.org/MOBOT/visitorinfo.html]

"The Garden's Education Division is dedicated to developing a scientifically literate citizenry. Working in partnership with local schools, the Garden provides outstanding programs for 108,000 children and 30,000 adults each year, including more than 2,700 teachers. Education at the Garden serves the entire community through three major goals: To educate children and adults about plants, ecology, and the environment. To improve science education in the St. Louis metropolitan area. To create learning opportunities for visitors as they enjoy the Garden."

[http://www.mobot.org/education/01goalsobjectives/goalsobjectives.html]

Types of Instructional Technology - This center uses a wide variety of instructional technology in their programming. These include computer software programs/simulations, student/visitor use of the Internet, and analysis of collected data, as well as global information systems (G.I.S.). There are currently GIS environmental education curriculum modules being developed and field-tested.

Missouri Botanical Garden is involved in a wide variety of outreach programs as well. These include being the regional training site for Journey North, GLOBE, the Jason Project, GEMS, and Partners for Growing Science. Within the Partners for Growing Science, the center offers Discovery Units, which are field trips linked with in-class studies.

The Community Atlas program, offered to grades 3-12, is a program designed to combine student research about the community with the latest mapping technology. The results are posted on the Internet for comparison to other communities who have participated in the same program. Teacher workshops were offered in the fall of 2001.

Reasons for using I.T. - Instructional technology is used for a number of reasons. I.T. meets an audience demand, and helps the center meet state education requirements. They believe that kids relate well to technology. In addition, they felt that using technology would enhance the level of inquiry possible.

Assessment - User and staff evaluations are used to assess programs.

Barriers, limitations, and/or challenges - Staffing is the main challenge to using instructional technology within programming.

Programs offered - Litzsinger Rd. Ecology Center offers both day programming and long-term (3+ nights), as well as school and summer programming.

Audiences served - Programming is aimed towards a wide variety of audiences. These include K-12 schools, university/college students, youth organizations, teachers, and adults.
Puget Sound Environmental Learning Center, Clancy Wolf, Technology Director
1601 Second Avenue, #605. Seattle, WA 98101. (206) 441-2769

Background Information - The Puget Sound Environmental Learning Center (PSELC) was built to provide quality residential outdoor education to students in the Puget Sound area. "The mission of the PSELC is to teach community and environmental stewardship to young people by linking ecology, technology, and the arts." The grand opening of the residential program is scheduled for the fall of 2002. (http://www.pselc.org/project_overview.html)

The center was designed to provide 4 day residential programming to 4th and 5th grade students during the school year, as well as weekend and summer for students in grades 4 through 12. In addition, a ten-month graduate program and professional development will be offered at the center. The PSELC website lists three goals of the curriculum: sense of place, sense of connection, and sense of purpose. The center hopes "to integrate technology into traditional science and ecological studies currently offered in environmental outdoor education. Students will have the opportunity to connect their experiences on site to their own community by using professional research techniques and technological tools used by scientists." (http://www.pselc.org/project_overview.html)

Types of Instructional Technology - PSELC uses a variety of instructional technology. Computer software programs or simulations, student/visitor use of the internet, and distance learning are all a part of PSELC. In addition, G.I.S. is used. PSELC students also use handheld devices to collect data about the resources, water, and propane used while the students are on site. This data is used to help students understand how much they use as well as how the resources are generated, etc. (survey response, Clancy Wolf: May 30, 2001)

Reasons for using I.T. - Some of the reasons PSELC uses I.T. are to reach audiences they could not otherwise reach, and because they feel kids relate well to technology. Another reason is the interest and desire of the founder of PSELC.

Assessment - User and staff evaluations are used to assess programs involving I.T.

Barriers, limitations, and/or challenges - Maintenance/upkeep, staffing, and comfort using technology are all perceived as challenges to PSELC's use of instructional technology within programming.

Programs offered - PSELC offers day programs as well as long-term residential programs (3+ nights.) Summer programs are also offered.

Audiences served - K-12 schools from multiple districts attend educational programming at PSELC, as do teachers, adults, and families.
Background Information - "TAMPEEL is sponsored by the Trumbull County Educational Service Center, Lordstown Schools and participating schools. It serves over 2000 students annually. The focal activities are the fall and spring lessons at TAMPEEL.

"Trumbull Area Multi-Purpose Environmental Education Laboratory (TAMPEEL) provides Trumbull County fifth-graders a facility in which to explore and discover science through nature. By engaging in hands-on activities and meeting curriculum requirements, students create a deep appreciation for their local environment and develop fundamental understandings of natural processes." (http://www.trumbull.k12.oh.us/tampeel/Newsletters/Jan2000/index.html)

Types of Instructional Technology - There is no computer technology used at TAMPEEL. Some groups do have the opportunity to participate in a lesson titled "Ecophotojournalism." In this, students "engage in photography discover hike (scavenger hunt). When the students are back at school, the teacher has the opportunity to use the pictures to create a variety of projects (newspaper, newsletter, slide show) based on the pictures that the students took." (survey response, Brice Harris, TAMPEEL Supervisor: May 29, 2001)

Reasons for using I.T. - TAMPEEL chose to use instructional technology in their program to help meet state education requirements and because they feel kids relate well to technology. In addition, they hoped to "encourage teachers to use the computers and have the experiences by enjoyable, while meeting science outcomes." (survey response)

‘Ecophotojournalism’ was created as a temporary lesson, but has been added to the standard curriculum TAMPEEL offers. From an educational standpoint, the lesson “incorporates application of science understanding, writing skills, presentation abilities, technology tie-in, and student collaboration.” (survey response)

Assessment - There is no form of assessment as of the date the survey was completed, though one is under development.

Barriers, limitations, and/or challenges - Comfort using technology was the main challenge for TAMPEEL when developing this program.

Programs offered - TAMPEEL offers day programming only.

Audiences served - TAMPEEL aims programming toward K-12 schools (multiple districts), youth organizations, and teachers.
Appendix J: Opinion Survey Responses

Responses received from:

- Claude Stephens, Bernheim Forest
- Claire Coco, Bluebonnet Swamp
- Connie Brockman, Cincinnati Nature Center
- Sam Chestnut, Cuyahoga Valley Environmental Education Center
- Helen Fischel, Delaware Nature Society – Ashland
- Libby Dorn, Fallen Timbers Environmental Learning Center
- Vernon Fish, Hartman Reserve
- Ruth Milburn, Houston Arboretum
- Jim Robertson, Kerrywood Nature Center
- Jeff Tish, Macon County Conservation District
- Bob Coulter, Missouri Botanical Garden
- Carol Kealy, Poricy Park
- Don Jorgensen, Prairie Learning Center
- John Blackmer, Riverbend Nature Center
- Christine Kelly, Riveredge Nature Center
- Robert Mercer, Silver Lake Nature Center
- Robin Indermuehle, Trees for Tomorrow
- Tom Anderson, Warner Nature Center
- Carl Strang, Willowbrook Nature Center
- Pete Devine, Yosemite Institute
From: Claude Stephens [cstephens@bernheim.org]
Sent: Thursday, March 21, 2002 2:03 PM
To: Lesure, Bethany L
Subject: Technology survey

How useful do you perceive instructional technology currently is at your center?
Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
Answer: 2 We currently use technology to communicate with educators (email, IT units on site, web based info. etc) and to reach visitors and students with information. Minimal current use.

How useful do you perceive instructional technology will be at your center in the future?
Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
Answer: 4.5

Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education. Website, IT units on site, hand held devices visitors carry around, to provide:
Overview and History
General Information
Trails and Maps (some interactive)
Events and Programs
Assistance in planning a visit
Reservations
Plant lists with maps
Profiles of staff, volunteers, visitors
Current research
Archives and collections
Artist in Residence programs
Sculpture collection
Flora and Fauna guides
Seasonal information
Species lists

Hand held units will eventually be hooked to GPS and GIS information bases. Digital cameras will allow visitors to collect pictures of their visit to mail to their home computers. Visitors can communicate with volunteers (possibly even working from their own homes) to get real time information and answers to questions (almost like having a volunteer right there with you). GPS units will help with emergencies and lost people on trails (Bernheim is 25 square miles in area). School groups can collect information, data and observations on hand held units and mail it back to their schools for analysis at a later date. School groups can communicate with other school groups that visited to collect data during different seasons to pull apart seasonality differences in data.... The list is virtually (no pun intended) endless.
Bernheim will be introducing hand held interactive information devices to our visitor experience in 2003. The hand held units will provide written and graphic information, sound and video recordings, information in various languages.
If need be I will be glad to discuss our technology plans in more detail with you by phone. We are currently in the final design stages and will be
going into production in late May. I can be contacted at 502-955-8512

Claude Stephens
Director of Education
Bernheim

From: Bluebonnet Swamp [bbswamp@idsmail.com]  
Sent: Wednesday, March 20, 2002 5:32 PM  
To: Lesure, Bethany L  
Subject: Re: technology and EE research

Hey Bethany,
I just filled in the blanks here. Scroll down for my responses. Let me know if you need anything further.

Hey Bethany,
I just filled in the blanks here. Scroll down for my responses. Let me know if you need anything further.

How useful do you perceive instructional technology currently is at your center?
Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
4

How useful do you perceive instructional technology will be at your center in the future?
Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
2

Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.

Currently, we have only one building that must serve the purposes for field trips, a conference facility, and general public touring. No large exhibits exist due to space constraints. What COULD be a computer learning room actually serves as office space. In the future, we have plans for a completely different education building that will contain multi-media capabilities including virtual tours of other environments (marsh, woodlands, etc.). In addition, networking with other facilities and their student programs will be a goal we intend to reach. Other possibilities would be real time weather recording equipment that reports directly to our local weather station. Children will be able to determine atmospheric conditions and see them on TV that night. Many more situations could arise, but as we are now, the money is not available for expansion.

Thank you very much for your assistance!
From: Connie Brockman [Cbrockman@cincynature.org]
Sent: Friday, March 29, 2002 10:01 AM
To: Lesure, Bethany L
Subject: RE: technology and EE

How useful do you perceive instructional technology currently is at your center?
Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
Currently we aren't using technology but plan to very soon. So for now, the answer is "5".

How useful do you perceive instructional technology will be at your center in the future?
Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
"1" - We plan on incorporating a variety of technologies into our programs by the end of the year.

Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.

We will give each school group a digital camera when they go into the woods, and if they see interesting animals or plants, they can take a picture. When they return to the building for wrap-up, we can use the computer and projector to show the entire class what each small group discovered on the trails. Also, we hope to include temperature and nitrogen probes and other technological devices on the trails to demonstrate ecological concepts, such as how compost is richer in nutrients than plain sand. Also- we hope to set up a database accessible by website where students can record their findings for others to see.

From: Sam_Chestnut@nps.gov
Sent: Tuesday, April 16, 2002 11:35 AM
To: Lesure, Bethany L
Subject: Re:RE: technology and EE research

I replied with a #1 to the first question and a #1 to the second

Sam

Sam Chestnut
Education Director
Cuyahoga Valley Environmental Education Center
3675 Oak Hill Road
Peninsula, OH 44264
From: Helen Fischel [helen@dnsashland.org]
Sent: Tuesday, March 26, 2002 9:31AM
To: Lesure, Bethany L
Subject: RE: technology and EE research

Bethany,
See my comments below.

Helen Fey Fischel
Associate Director, Education
Delaware Nature Society
P.O. Box 700
Hockessin, DE. 19707

Tel: 302-239-2334 x14
Fax: 302-239-2473
http://www.delawarenaturesociety.org

How useful do you perceive instructional technology currently is at your center? 3
   Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful

How useful do you perceive instructional technology will be at your center in the future?
A 2 since we have formed a committee to explore other items that we are not currently using.
Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful

Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education. This is what we are using currently; microscopes and a video microscope for pond studies, audio-visual presenter to enlarge stream macro-invertebrates, directional microphone and play back tape recorder to record bird songs and draw birds closer for viewing, computers for data input and communication with a Latin American school, fish shocking backpack for fish surveying, GPS devices for biodiversity studies, cow transponder equipment, dissolved O2 meter, conductivity probe, and in-stream data logger, and a stream list serve. Environmental education needs to be information rich as well as experience rich. Through the equipment above we are enhancing learning outside the classroom in the field.

Good luck with your information collection.

Cheers,
Helen
From: Libby Dorn [podwtch9@netnet.net]
Sent: Thursday, March 28, 2002 8:39 AM
To: Lesure, Bethany L
Subject: Re: technology and EE research

>How useful do you perceive instructional technology currently is at your center?
>Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
>
>I would rate this as a #2, even though I believe within the next several years this will soar to #1 - based on teacher professional development experiences, and middle-high school level students using field computers and probes, and the possibilities distance education (wireless or fiber optic) presents for educational opportunities and collaborations with other students and other organizations within the state or outside
>
>How useful do you perceive instructional technology will be at your center in the future?
>Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
>
> materiał - No Doubt!!
>Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.

>Digital still and videocameras for documenting experiences in the field
>Use of LabPro's or CBL's, with accompanying probes, for collecting data professionally and accurately. Sharing information with other students/teachers via distance education networks within the nation, state and locally - Badgernet. Using wireless technologies within the field to connect with our students on a scheduled basis - using this same technology to expand our reach throughout the state and nation
>
>Good Luck, Beth . . . how did the pictures work??

From: Vernfish@aol.com
Sent: Friday, March 22, 2002 2:01 PM
To: Lesure, Bethany L
Subject: Re: technology and EE research

Bethany,

How useful do you perceive instructional technology currently is at your center?
Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
We use computers to extensively to communicate with the public. We produce newsletters, brochures, signs, displays, letters, reports, etc. We maintain a homepage which has less then 1000 hits per year. We do not use computers in our displays or our educations programs. I would have to give this question a five if you are focusing on using technology with the public for educational programs.
How useful do you perceive instructional technology will be at your center in the future?  
Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful

I would like to think that we would be using high tech displays sometime in the future but right now they are expense to buy and we do not have the skill to do the work in house. Thus, I would give this question a 3.

Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education. I would like to see our homepage become more interactive. I would hope to be able to use computers in our displays and exhibits. These exhibits should have the ability to answer the repetitive/common questions of our visitors. We have partnered with Iowa State University to train volunteers to locate and identify local wildlife and log these observations on a program call NatureMapping.

Let me know if you need more infor

Vernon C. Fish
Nature Center Director
Hartman Reserve Nature Center
657 Reserve Drive
Cedar Falls, Iowa
319-277-2187
Visit our web site at: www.co.black-hawk.ia.us/hartman/index.html

"The purpose of interpretation is to stimulate the visitor towards a desire to widen their horizon of interest and knowledge, and gain an understanding of the greater truths that lie behind any mere statements of fact." Freeman Tilden

From: Ruth Milburn [rmilburn@neosoft.com]
Sent: Monday, March 25, 2002 8:52 AM
To: Lesure, Bethany L
Subject: RE: Survey on EE technology

How useful do you perceive instructional technology currently is at your center?  
Extremely useful 1 --- 2 --- 3 ---x 4 --- 5 Not at all useful

We are not using Instructional Technology currently in any but informal ways -- via the Internet-connected PC made available to the public in our library.

How useful do you perceive instructional technology will be at your center in the future?  
Extremely useful 1 --- 2 --- 3 ---x 4 --- 5 Not at all useful

We may utilize Internet-based instruction for follow-up projects with youngsters, but we see our niche within the local environmental education community to be the direct connection with our forest and ponds made on field trips and in other programs.
Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.

We have currently a Discovery Room with some interactive components that introduce the casual visitor to the flora and fauna of our area, and to the notions of nutrient cycling and ecological networks. This area would benefit from more formal technology-based guided explorations on focused topics.

From: Jim Robertson [kwnc@telusplanet.net]
Sent: Tuesday, April 02, 2002 1:42 PM
To: Lesure, Bethany L
Subject: Re: technology and EE research

How useful do you perceive instructional technology currently is at your center?
Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
Usually, 4 or 5
It is not something that we have much use for: some interactive computer games in the exhibits; our web site might eventually have some on it but it is not a high priority. People generally (IMHO) prefer human contact.

How useful do you perceive instructional technology will be at your center in the future?
Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
Perhaps 3? What we have/will get will appeal to a small segment of the population. We try to reach everyone, so will do it -- but recognize that it is only for a small group.

Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.

From: Macon Co Conservation Dist [mccd@fgi.net]
Sent: Wednesday, March 27, 2002 9:06 AM
To: Lesure, Bethany L
Subject: Re: Survey

Hello Bethany,
Good Luck with your project. I'm anxious to see your results.

Q & A:
How useful do you perceive instructional tech.........currently?
I vote for number 3
How useful do you perceive instructional tech......in the future?
I vote for number 2

Please describe potential..........

*People of all ages could utilize inst. tech.
*Staff would not be needed at all areas in order to be effective. The stand alone system could educate and entertain on its own.
*Fun and interesting addition. Builds a transition between home and nature center. Kids and adults utilize this form of entertainment daily. Internet, video games etc.

Keep up the good work Bethany.
Jeff Tish
Macon County Cons. Dist.
217/423-7708

From: Bob Coulter [bob.coulter@mobot.org]
Sent: Wednesday, March 20, 2002 1:53 PM
To: Lesure, Bethany L
Subject: RE: research project

>How useful do you perceive instructional technology currently is at your center?
Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
3
For the programs which use it (e.g. GIS-enhanced monitoring), the technology is essential. Unfortunately, not many programs currently make use of the technology that is available.

>How useful do you perceive instructional technology will be at your center in the future?
Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
4
We have several new initiatives planned that will make expanded use of the resources (e.g. new programs and revisions of old programs that will be enhanced through the use of the technology.

>Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.

Primarily, enhancing environmental monitoring investigations through the collection, analysis, and display of data collected on-site or downloaded from other locations.
From: Bob Coulter [mailto:bob.coulter@mobot.org]

Bob Coulter
Manager of Curriculum Development
Missouri Botanical Garden
PO Box 299
St. Louis, MO 63166-0299
(314) 577-0219
(314) 577-9435 – fax

From: poricy park [poricypark@monmouth.com]
Sent: Wednesday, March 20, 2002 1:31 PM
To: Lesure, Bethany L
Subject: Re: EE and technology research

Bethany, IT will be about a 3 on your scale for our center. We were able to put 2 computers in the classroom this year and visiting teachers are quite impressed. We use them to record the field data that students collect in the morning. The afternoon is spent doing lab work related to the day’s class trip subject. We generate some simple comparative documents i.e. temperature fluctuation over time, pond chemistry, and my personal favorite “worm weights”. I would hope the future applications would include an improved web site that is more interactive. We now have a fossil puzzle game that was developed by a volunteer. Also on-line registration for educational programs as well as fundraising opportunities such as membership dollars. I would like to include a virtual alternative for days when weather truly prohibits our field work. Thank you and good luck. Carol Kealy, Executive Director

From: Don Jorgensen@fws.gov
Sent: Friday, March 29, 2002 8:14 AM
To: Lesure, Bethany L
Subject: Re: technology and EE research

I incorporated my opinions in your survey.

How useful do you perceive instructional technology currently is at your center?

| Extremely useful | 1 | Not at all useful |

How useful do you perceive instructional technology will be at your center in the future?

| Extremely useful | 1 | Not at all useful |

Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.

We are looking at touch screens to replace curser manipulated advancing
systems. We want to develop a seasonal touch on DVD's that will provide a more interactive sequential experience. Most people cruise through the exhibit hall in less than a half hour and say they have seen everything but retain little or nothing. We have scavenger hunts available that leads the visitor through and asks them questions that can be found in the displays. This could be done on a touch screen as well but only one or a couple could use it at a time.

From: John Blackmer [blackmer@rbnc.org]
Sent: Thursday, March 21, 2002 9:33 AM
To: Lesure, Bethany L
Subject: Re: technology and EE research

Please respond to the following questions using the scale and elaborating in the space provided.

How useful do you perceive instructional technology currently is at your center?
   Extremely useful 1 --- 2 --- (3) --- 4 --- 5 Not at all useful

How useful do you perceive instructional technology will be at your center in the future?
   Extremely useful (1) --- 2 --- 3 --- 4 --- 5 Not at all useful

Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.

While we do not envision it to be a large part of our on-site efforts, we are continuing to grow in ways to use the internet and other tech to work with the students back in the classroom before and after visits. Without such extensions, their visit here is just a "field trip" rather than serving as an outdoor extension to classroom learning.

John

John Blackmer, Chief Naturalist
River Bend Nature Center
P.O. Box 186
1000 Rustad Rd.
Faribault MN 55021
507/332-7151
blackmer@rbnc.org
www.rbnc.org

From: Christine Kelly [christine.kelly@riveredgenc.org]
Sent: Thursday, March 21, 2002 11:19 AM
To: Lesure, Bethany L
Subject: RE: technology and EE research
Hello Bethany,

Rick Flood forwarded your survey to me. I have responded your questions below. In all fairness I need to admit that I specialized in educational technology as part of my science education doctorate from the University of Maryland and spent two years as the Director of Education at a start-up e-learning internet company--so my responses are very biased. :)

Good luck with your research. I look forward to reading your results.

Sincerely,

Christine

How useful do you perceive instructional technology currently is at your center?

Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful

1: I consider instructional technology extremely useful to the field of environmental education. It allows for many new and creative methods of delivering and engaging students in authentic inquiry-based environmental education. It also facilitates extended instructional opportunities for environmental educators, who would otherwise mostly likely be limited to a "one shot" teaching scenario. This being said instructional technology is currently under utilized at our center. We are taking strides to improve this situation.

How useful do you perceive instructional technology will be at your center in the future?

Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful

1. I consider our effective use of instructional technology as a key success criteria for measuring the future of our educational programs. I believe our ability to embrace or failure to embrace educational technology will be a significant variable that determines the longevity of our center's high quality, innovative environmental education program.

Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.

Christine Kelly
Associate Executive Director
Riveredge Nature Center
P.O. Box 29
Newburg, WI 53060

262/675-6888 (local)
262/375-2715 (metro)
262/375-2714 (FAX)

From: Mercer, Robert A. [ramercer@co.bucks.pa.us]
Sent: Wednesday, March 20, 2002 3:42 PM
To: Lesure, Bethany L  
Subject: RE: technology and EE research

@ questions is short!

---

How useful do you perceive instructional technology currently is at your center?
   Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful

5

How useful do you perceive instructional technology will be at your center in the future?
   Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful

3

Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.

We would like to create floppy disks of activities or web sites that can be used by teachers as pretrip and post trip activates. I would like to see all our scheduling done electronically and eventually have the teachers scheduling dates for visits. We see a mini-role in keeping dialog open with participant after program completed. WE are working with a school that hopes to develop a mechanism of the collection of water quality data for a region over time. We recently set up a website and the volunteer is interested in building it as a promotional piece and has even talked about a "Virtual tour".

---

From: robin indermuehle [robinindermuehle@yahoo.com]  
Sent: Friday, March 29, 2002 5:24 PM  
To: Lesure, Bethany L  
Subject: Re: technology and EE research

> How useful do you perceive instructional technology currently is at your center?
>   Extremely useful 1 --- 2 --- 3 --- 4
>   --- 5 Not at all useful
> 4 - We really don't use a lot of computer technology at our center. We feel strongly that the best way to educate environmentally is to have a hands on experience out of the classroom and away from computers. Students get plenty of time using a computer in school. What they don't get enough of (in my opinion) is first hand experience in the out of doors.
>
> How useful do you perceive instructional technology will be at your center in the future?
>   Extremely useful 1 --- 2 --- 3 --- 4
>   --- 5 Not at all useful
4 - Maybe for data collection, or compiling results, but I think that in the future we will still feel strongly that having students outside is more important than showing them the lastest in computer technology in the field.

> Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.

We use a video projector with power point for some of our classes. We sometimes have resource professionals come in and demonstrate how they use computers in the field, but that is really about it. We may try to implement a GPS/GIS course which would require technology. That's all I can think of at the moment.

> I hope this helps! If you have any questions or need clarification on anything, feel free to give me a call at 715-479-6456.

I'm interested to see your conclusions.

Robin Indermuehle
Trees For Tomorrow
P.O. 609
Eagle River, WI 54521

---

From: Thomas Anderson [tanderson@smm.org]
Sent: Friday, March 22, 2002 12:00 PM
To: Lesure, Bethany L
Subject: Re: technology and EE research

How useful do you perceive instructional technology currently is at your center?

> 4

> How useful do you perceive instructional technology will be at your center in the future?

> 2

> Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education. We have a strong association with the Science Museum of Minnesota. The museum has a technological learning center that we could tap into. For example we have discussed having remote site where live feeds could be directed back to the Science Museum (30 miles distant). We are hoping to provide live shots of natural communities and to provide phenological data.

Tom Anderson
Director Warner Nature Center
15375 Norell Avenue North
Marine MN 55047
www.smm.org
Hi, Bethany,

Answers below.

Regards,
Carl Strang
Naturalist
Willowbrook Wildlife Center

> > How useful do you perceive instructional technology currently is at your center?
> > Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
Between 3 and 2 at present, though we are becoming increasingly familiar with it and using it more and more.
> >
> > >
> > >
> > > How useful do you perceive instructional technology will be at your center in the future?
> > Extremely useful 1 --- 2 --- 3 --- 4 --- 5 Not at all useful
> >
> > It will increase and approach or reach 2, though never become our primary means of interpretation, which in my mind is what a 1 would imply.
> >
> >
> > Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.
> >
> >
> > We make some use of reference and game type programs we've obtained on CD-ROM and make available to our visitors.

The biggest single use has been and for the forseeable future will remain applications of digital photography. PowerPoint programs are beginning to supplant slide programs, and we are about to begin incorporating sound (recorded into the computer) into our PowerPoint programs. All our temporary exhibits now use digital photos, which allow us to quickly create attractive bulletins highlighting the day's news in our wildlife hospital and in the natural history events on our preserve.
To: Lesure, Bethany L
Subject: Re: technology and EE research

Hello, Bethany. Good luck with your projects.

--

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> How useful do you perceive instructional technology currently is at your center?
> 5: not at all useful. As a park-based, experiential ed. program, technology doesn't apply to what we're doing.
>
> How useful do you perceive instructional technology will be at your center in the future?
> 4: barely useful. Maybe we'll use more tools in the field (Palm-something), but I hope we won't ever have kids come all the way to Yosemite National Park and sit in front of computers researching trees, glaciers, wildlife, etc. That would be criminal misdirection.
>
> Please describe potential applications of instructional technology within the nature center or environmental center setting, specifically within your center, to achieve the goals of environmental education.
>
>To an extent, the argument can be made that technology defeats the purposes of outdoor, experiential environmental education. The world needs more naturalists, and these aren't made via the internet, CD-ROM's or the web. At best, some tech toys that can be used in the field (data loggers, cybertracker, probeware), might apply, if your goals are about field science education. But the environment is bigger than just science, we need more than just the left cerebral hemisphere connected to the natural world. Our program is after high touch, not high tech.
Appendix K: Opinions Gathered from WAEE Winter Workshop 2002

“What do you think about technology in EE? (instructional technology – i.e. computer-aided learning, virtual experiences, distance learning, etc.) Please feel free to write your thoughts. Beth Lesure, UWSP/CWES, Grad Student.”

Has our technology surpassed our humanity?
-Powder

It has its place, but never can or should substitute for time outdoors or face to face contact.

As much time as people are spending in front of computers, they should be spending outside.

Technology can help us learn about the natural world, but it is no replacement for it. Why study trees on a computer when the real thing is right outside your back door?
Appendix M: Wisconsin Model Academic Standards
Addressed by Recommendations

Environmental Education
A.4.1: Make observations, ask questions, and plan environmental investigations;

A.4.2: Collect information, make predictions, and offer explanations about questions asked;

A.4.3: Develop answers, draw conclusions, and revise their personal understandings as needed based on their investigations;

A.4.4: Communicate their understanding to others in simple terms;

A.8.1: Identify environmental issue questions that can be investigated using resources and equipment available;

A.8.2: Collect information from a variety of resources, conduct experiments, and develop possible solutions to their investigations;

A.8.3: Use techniques such as modeling and simulation to organize information gathered in investigations;

A.8.4: Use critical-thinking strategies to interpret and analyze gathered information;

A.8.5: Use the results of their investigations to develop answers, draw conclusions, and revise their personal understandings;

A.8.6: Communicate the results of investigations by using a variety of media and logically defending their answers.

B.4.6: Cite examples of how different organisms adapt to their habitat;

B.8.2: Explain how change is a natural process, citing examples of succession, evolution, and extinction;

B.8.3: Explain the importance of biodiversity.

B.8.5: Give examples of human impact on various ecosystems;

B.8.8: Explain interactions among organisms or populations of organisms.

B.8.10: Explain and cite examples of how humans shape the environment.

D.8.1: Identify options for addressing an environmental issue and evaluate the consequences of each option;

D.8.2: List the advantages and disadvantages of short-term and long-term solutions to an environmental issue or problem;

D.8.6: Develop a plan for improving or maintaining some part of the local environment and identify their role in accomplishing this plan.

Technology Education
A.4.8: Use tools to observe, measure, make things, and transfer information.
Information and Technology Literacy

A.4.1: Use common media and technology terminology and equipment;

A.4.2: Identify and use common media formats
- Access information using common electronic reference sources (e.g., indexes, almanacs, on-line catalogs, encyclopedias)
- Create, save, move, copy, retrieve, and delete electronic files
- Incorporate graphics, pictures, and sound into another document

A.4.3: Use a computer and productivity software to organize and create information
- Identify a database and define basic database terms (e.g. file, record, field)
- Use a prepared database template to enter and edit data, and to locate records
- Identify a spreadsheet and explain basic spreadsheet terms (e.g., column, row, cell)
- Use a prepared spreadsheet template to enter and edit data, and to produce and interpret a simple graph or chart

A.4.4: Use a computer and communications software to access and transmit information;

A.4.5: Use media and technology to create and present information.
- Use draw, paint, or graphics software to create simple signs, posters, banners, charts, visuals, etc.
- Plan a multimedia production using an outline or storyboard

A.8.1: Use common media and technology terminology and equipment;

A.8.2: Identify and use common media formats;

A.8.3: Use a computer and productivity software to organize and create information
- Move textual and graphics data from one document to another
- Use graphics software to import pictures, images, and charts into documents
- Compose a class report using advanced text formatting and layout styles (e.g., single and double spacing, different size and style of fonts, indents, headers and footers, pagination, table of contents, bibliography)
- Classify collected data and construct a simple database by defining fields, entering and sorting data, and producing a report
- Construct a simple spreadsheet, enter data, and interpret the information
- Plot and use different types of charts and graphs (e.g., line, bar, stacked scatter diagram, area, pie charts, pictogram) form a spreadsheet program
- Incorporate database and spreadsheet information (e.g., charts, graphs, lists) in word-processed documents

A.8.4: Use a computer and communications software to access and transmit information
- Access information using a modem or network connection to the Internet or other on-line information services
- View, print, save, and open a document from an Internet or other on-line sources
- Use basic search engines and directories to locate resources on a specific topic

A.8.5: Use media and technology to create and present information
- Use draw, paint, or graphics software to create visuals that will enhance a class project or report
- Design and produce a multimedia program
- Plan and deliver a presentation using media and technology appropriate to topic, audience, purpose or content
A.12.5: Use media and technology to create and present information
   • Use draw, paint, graphics, or presentation software to visually communicate ideas or concepts
   • Produce a multimedia program using text, graphics, moving images, and sound
   • Develop a document or file for inclusion into a website or web page
   • Participate in a desktop conferencing session to present and share information with others

B.4.3: Locate and access information services;

B.4.5: Record and organize information
   • Take notes or record information in their own words
   • Arrange notes to help answer the information problem or question

B.4.6: Interpret and use information to solve the problem or answer the question
   • Identify new information and integrate it with prior knowledge
   • Determine if information is relevant to the information question
   • Select information applicable to the information question
   • Seek additional information if needed
   • Apply the information gathered to solve the information problem or question

B.4.7: Communicate the results of research and inquiry in an appropriate format
   • Identify the audience for the product or presentation
   • Identify whether the purpose of the product of presentation is to inform, entertain, or persuade
   • Choose a presentation format (e.g., speech, paper, web page, video, hypermedia)
   • Develop a product or presentation to communicate the results of the research

B.8.1: Define the need for information
   • Identify the information problem or question to be resolved
   • Formulate general and specific research questions using a variety of questioning skills
   • Revise and narrow the information questions to focus on the information need

B.8.6: Interpret and use information to solve the problem or answer the question
   • Compare and integrate new information with prior knowledge
   • Analyze information for relevance to the question
   • Analyze findings to determine need for additional information.
   • Gather and synthesize additional information as needed
   • Draw conclusions to address the problem or question

B.8.7: Communicate the results of research and inquiry in an appropriate format
   • Determine the audience and purpose for the product or presentation
   • Identify possible communicate or production formats
   • Select a presentation format appropriate to the topic, audience, purpose, content, and technology available
   • Develop an original product or presentation which addresses the information problem or question

B.12.1: Define the need for information
   • State the information problem or question in clear and concise terms
   • Relate prior knowledge to the problem or question
   • Develop specific research questions or a thesis statement based on the nature, purpose, and scope of project

B.12.5: Record and organize information
• Use data gathering strategies that include summarizing, paraphrasing, comparing, and quoting
• Analyze and relate information using a variety of relational techniques (e.g., graphic organizers, database reports, spreadsheet charts, graphs)
• Organize information in systematic manner for unity, coherence, clarity, and emphasis

B.12.6: Interpret and use information to solve the problem or answer the question
• Interpret new information to formulate ideas which address the question or problem using comparison, evaluation, inference, and generalization skills
• Synthesize new ideas, evidence, and prior knowledge to address the problem or question
• Draw conclusions and support them with credible evidence

B.12.7: Communicate the results of research and inquiry in an appropriate format
• Determine the audience and purpose for communicating the information
• Compare strengths and weaknesses of possible presentation methods and products
• Select the most appropriate format for the product or presentation
• Develop a product or presentation that utilizes the strengths of the medium, and supports the conclusions drawn in the research effort

C.4.1: Pursue information related to various dimensions of personal well-being and academic success;

C.8.1: Pursue information related to various dimensions of personal well-being and academic success.

Science
C.4.2: Use the science content being learned to ask questions, plan investigations, make observations, make predictions, and offer explanations;

C.8.1: Identify questions they can investigate using resources and equipment they have available;

C.8.2: Identify data and locate sources of information including their own records to answer the questions being investigated;

C.8.6: State what they have learned from investigations, relating their inferences to scientific knowledge and to data they have collected;

C.8.7: Explain their data and conclusions in ways that allow an audience to understand the questions they selected for investigation and the answers they have developed;

C.8.8: Use computer software and other technologies to organize, process, and present their data;

C.8.10: Discuss the importance of their results and implications of their work with peers, teachers, and other adults;

E.4.4: Identify celestial objects (starts, sun, moon, planets) in the sky, noting changes in patterns of those objects over time.

E.4.5: Describe the weather commonly found in Wisconsin in terms of clouds, temperature, humidity, and forms of precipitation, and the changes that occur over time, including seasonal changes;

E.4.6: Using the science themes, find patterns and cycles in the earth's daily, yearly, and long-term changes.

E.8.3: Using the science themes during investigations, describe climate, weather, ocean currents, soil movements, and changes in the forces acting on the earth.
H.8.2: Present a scientific solution to a problem involving the earth and space, life and environment, or physical sciences and participate in a consensus-building discussion to arrive at a group decision.

**English Language Arts**

A.8.4: Read to acquire information;

B.4.1: Create or produce writing to communicate with different audiences for a variety of purposes;

B.8.1: Create or produce writing to communicate with different audiences for a variety of purposes;

C.8.3: Participate effectively in discussion;

E.4.1: Use computers to acquire, organize, analyze, and communicate information;

E.8.1: Use computers to acquire, organize, analyze, and communicate information;

F.4.1: Conduct research and inquiry on self-selected or assigned topics, issues, or problems and use an appropriate form to communicate their findings.

F.8.1: Conduct research and inquiry on self-selected or assigned topics, issues, or problems and use an appropriate form to communicate their findings.

**Mathematics**

E.8.1: Work with data in the context of real-world situations by
- Formulating questions that lead to data collection and analysis;
- Designing and conducting a statistical investigation;
- Using technology to generate displays, summary statistics, and presentations;

E.8.2: Organize and display data from statistical investigation using
- Appropriate tables, graphs, and/or charts (e.g., circle, bar, or line for multiple sets of data);
- Appropriate plots (e.g., line, stem-and-leaf, box, scatter).

E.8.4: Use the results of data analysis to
- Make predictions;
- Develop convincing arguments;
- Draw conclusions.

E.8.5: Compare several sets of data to generate, test, and, as the data dictate, confirm or deny hypotheses.

**Social Studies**

A.8.1: Use a variety of geographic representations, such as political, physical, and topographic maps, a globe, aerial photographs, and satellite images, to gather and compare information about a place.