CONDITIONS FOR IMPLEMENTATION THAT AFFECT THE LEVEL OF USE OF INSTRUCTIONAL TECHNOLOGY AMONG PROJECT LEARNING TREE EDUCATORS

by

KRISTEN MARK IRWIN

(Under the Direction of Robert Maribe Branch)

ABSTRACT

This study used an Internet survey to examine eight conditions that facilitate the implementation of instructional technology (Ely, 1990, 1999) in the context of environmental education. A total of 884 members of the Project Learning Tree community participated in the study and represented the three primary role groups: educators, facilitators, and state coordinators. A modified version of the Implementation Profile Inventory (IPI) survey by Ensminger and Surry (2008) was used to collect data over an eight week period starting August 10, 2010. Project Learning Tree educators were found to have higher IPI scores than facilitators and state coordinators. When the level of use of technology was correlated to the eight conditions for implementation, six of the eight conditions were found to be significant. Regression analysis produced a four-variable model with an adjusted R^2 = .103. Characteristics of a PLT educator most likely to implement technology describes a person as having completed a PLT workshop after January 1, 2007; they use technology and encourages students to learn with technology; they are less than 25 years old; and do not live in the North Central PLT region.

INDEX WORDS: Environmental education, implementation, instructional technology

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CONDITIONS FOR IMPLEMENTATION OF INSTRUCTIONAL TECHNOLOGY IN THE CONTEXT OF ENVIRONMENTAL EDUCATION

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DEDICATION

I dedicate this dissertation to my wife Jennifer, who tolerated my absence from our life together during the past seven years, and who helped me stay focused when I was on the verge of calling it quits. To my mother, who is very proud of my accomplishment for being the first PhD in our family. To my brothers, Keever and Kelly, who will thoroughly enjoy calling me “the absent minded professor.” To my grandparents, who taught me to work hard, be persistent, and make every day count. A special dedication goes to my Grandma Bird, who understood the value and enjoyment of life-long learning.

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CHAPTER 1

INTRODUCTION

After talking with her colleagues about the many different applications of instructional technology they use in their classrooms and observing their students learning with the technology, a veteran high school biology teacher decided it was time to integrate instructional technology into her teaching. The technology she was most interested in using were laptop computers because they are portable, durable, and capable of running various software and hardware products. Prior to making her final decision to incorporate technology, she put forth a great deal of effort preparing herself by reading research literature about technology implementation and pedagogy for technology in science education, attending technology training workshops that taught her how to use different technology tools and addressed the subject of technology, pedagogy, and content knowledge. As a veteran teacher with a constructivist teaching philosophy, she knew she must plan carefully to create learning experiences that accounted for students' prior knowledge and level of skill using the technology. Motivated by her preparation and decision to move forward, she submitted and received a technology grant to purchase a classroom set of laptop computers.

After receiving the laptop computers, she made a concerted effort to provide her students time to become comfortable using different software products. Then, when she was satisfied that both she and her students were confident in their ability to use the available technology, she started class one day by informing the students they were going to learn about the water cycle, and were going to do so by actively living the life of a water molecule. In preparation for the lesson, the teacher selected a topic-specific activity from a prominent environmental education curriculum. The particular curriculum she selected to use was chosen because it provided suggestions for implementing technology.

As part of the introduction to the activity, she informed the students to keep a detailed record of their journey as a water molecule. She provided a simple example to make sure the students understood they were to record the name of each station they visited. The students were allowed 20 minutes to complete the activity. After students completed the activity, the teacher followed the suggested pedagogy in the curriculum guide and asked the students to use the laptop computers to design and develop a presentation that would tell their story as a water molecule. The students were encouraged to be creative. To initiate student's thinking about how to develop their presentations, the teacher provided an example and described how they could produce a movie or slide show using graphic presentation software and to write a short story using word processing software. When students completed the assignment they eagerly shared their presentations with the rest of the class. At the end of the unit, the teacher noticed that student scores on the part of the test that dealt with the water cycle were clustered on the high end of the grading scale, and higher compared to her previous classes. The teacher interpreted this positive student learning experience as evidence of success and made the decision to continue using technology and the environmental education curriculum.

The scenario above describes the hypothetical journey of a teacher who implemented the use of laptop computers as a learning tool to help her students create new knowledge about the water cycle. The teacher, without consciously thinking about it, was participating in what Rogers (2003) refers to as the innovation-decision process. This example describes how the teacher was able to satisfy the conditions that facilitate successful implementation of instructional technology (Bauer & Kenton, 2005; Ely, 1990 & 1999), and overcome the barriers of incorporating environmental education (Ernst, 2007; Powers, 2004) into her pedagogical approach to teaching specific content. There is a need for environmental educators to routinely and systematically incorporate instructional technology into environmental education (Payne, 2006). However, evidence from the environmental education literature indicates that the case described above is atypical.

Purpose of Study

The purpose of this study was to examine the conditions that facilitate the implementation of instructional technology in the context of environmental education. In this study, the term instructional technology (IT) refers to product innovations, in particular the use of various software and hardware products. Software products include word processing, spreadsheets, databases, presentation graphics and graphics organizers. Hardware products include digital/video cameras, peripherals, and internet connectivity. This study examined the eight conditions that facilitate implementation of instructional technology identified by Ely (1990, 1999). The eight conditions identified by Ely are:

1. Dissatisfaction with the status quo;
2. Existing knowledge and skills;
3. Available resources;
4. Time;
5. Rewards and incentives;
6. Level of participation;
7. Commitment; and,
8. Leadership

Guided by Ely's concept, this study investigated the conditions that facilitate implementation of instructional technology and the effect of these conditions on environmental educator's use of technology tools.

Conceptual Framework

There are three principal concepts that guided this study: implementation, instructional technology (IT), and environmental education (EE). The relationship between these three concepts is presented in Figure 1-1.

Figure 1-1. Relationships between the primary concepts

Implementation is the first concept to be examined. Implementation is a component of the diffusion process. Rogers (2003) describes diffusion as the process whereby new ideas about an innovation are communicated over time by members of a community that results in changes to the structure and function of a social system. However, for structural and functional changes to occur within the social system, the innovation must first be implemented. Implementation is the "process of putting into practice an idea, program, or set of activities new to the people attempting or expected to change" (Fullan, 1982, p. 54). Implementation is one of the five stages of the innovation-decision process: 1) knowledge, 2) persuasion, 3) decision, 4) implementation, and 5) confirmation (Rogers, 2003). How the five stages of the innovation-decision process apply in practice is exemplified using the scenario from above:

Stage 1: Conversations with colleagues, observing students using technology in the classroom, and attending training sessions developed the teacher's *knowledge* about using computer technology innovations;

Stage 2: Recognizing that laptop computers would compliment her teaching philosophy, the teacher passed through the stage of *persuasion*;

Stage 3: Writing and submitting the technology grant demonstrated her *decision* to adopt the innovation;

Stage 4: The *implementation* stage was completed when she assigned her students the task of using the laptop computers to construct a presentation that clearly demonstrated their knowledge of the water cycle; and,

Stage 5: Motivated by observing her students engaged in active learning and turning in high assessment scores, the teacher decided to continue integrating the application of laptop technologies into her teaching strategy, thus reaching the *confirmation* stage.

The example of how the teacher progressed from one stage to the next portrays the innovation-decision process as a series of linear events starting with *knowledge* (Stage 1) and ending with *confirmation* (Stage 5). According to Ensminger & Surry (2008), research has not yet uncovered and developed a clear understanding about all of the variables associated with the implementation stage of the innovation-decision process. This identified lack of research is the primary reason this study will focus on implementation.

Implementation is significant to the field of instructional technology. In their research to identify the factors that influence the implementation of instructional technology, Surry and Farquhar (1997) wrote, "Instructional technology's greatest challenge, therefore, is not developing effective products, but developing effective products that people want to use" (p. 8).

There are many technology innovations designed for educational use, but implementation of instructional technology is a commitment made by an individual who desires to add the affordances of technology to their instructional strategies.

Instructional technology is the second concept involved in this study. Instructional technology (IT), which is used synonymously with educational technology in this study, is defined as “the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources” (Association for Educational Communications and Technology, 2007, p. 1). Thirteen key elements are identified by the Association for Educational Communications and Technology (AECT) that further define and support the concept of instructional technology: study, ethical practice, facilitating, learning, improving, performance, creating, using, managing, appropriate, technological, processes, and resources (AECT, 2007). The goal of instructional technology is to help a person learn. The definition does not indicate what subject is to be learned; only that IT can facilitate learning (Robinson, Molenda, & Rezabek, 2007). The field of instructional technology is constantly evolving and adapting to the ever changing and accelerated production rate of product and idea technology. Like IT, the field of environmental education is a dynamic field of study and practice focused on facilitating learning.

Environmental education is the third conceptual piece of this study. During the late 1960s there were many cultural conflicts in the United States; most notable was the Vietnam War. Somewhat less notable was the environmental movement and the concern for a growing disconnect between humans and their relationship to the environment. In an attempt to reach citizens of all ages, a new approach was created and called environmental education (EE). The first formal definition of EE was presented by Stapp, Bennet, Bryan, Fulton, Swan, Wall, &

Havlick (1969): “Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution” (p. 34). In 1975, an international environmental education definition was born from the work of attendees of the Belgrade Working Conference on Environmental Education. Then, in 1977, a result of the Tbilisi Intergovernmental Conference on Environmental Education was the acceptance of five core concepts that inform the approach of environmental education: *awareness*, *knowledge*, *attitudes*, *skills*, and *participation* (UNESCO, 1978). These concepts are also known as the Tbilisi Declaration. Guided by these five concepts, environmental education strives to enhance learner’s environmental literacy as they develop deeper understanding of complex environmental systems and issues and become actively engaged in environmental-related decisions and policy.

Environmental education is an accommodating instructional system that supports the use of IT innovations. The affordances of instructional technology as learning tools (Gagne′, Wagner, Golas, & Keller, 2005) can be illustrated using the five concepts of environmental education identified in the Tbilisi Declaration as described above. Technology affords students the ability to conduct online research to increase their *awareness* and *knowledge* of current environmental issues and examine other’s *attitudes* about the environment. Students can develop effective presentation and communication *skills* using software and hardware technology, and become active *participants* using social network technology to support or fight against environmental policies and regulations. The implementation of IT depends largely on the structure and management of the learning environment, attributes and attitude of the teacher, and flexibility of the educational system to integrate instructional technology (Hooper & Rieber, 1995). An examination of the theories associated with implementation and environmental education will clarify how these concepts are linked, and what factors impede or facilitate the use of instructional technology in the context on environmental education.

Theoretical Framework

There are two theories that guide this study: diffusion theory and constructivist learning theory. Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system (Rogers, 2003). The diffusion theory has been successfully integrated into the field of instructional technology (Burkman, 1987; Surry & Farquhar, 1997), and was used by Ely (1990 & 1999) to support his proposed eight conditions that facilitate the implementation of instructional technology. Following Ely's lead, Ensminger and Surry (2008) investigated how representatives from three different communities of practice (K-12, higher education, and business) ranked the eight conditions regarding their level of implementation of instructional technology. This study will investigate environmental educators' ranking of Ely's eight conditions and the relationship to their level of use of technology tools.

Environmental education is an effective pedagogy that uses the natural world to teach critical thinking and problem solving skills by creating a learner-centered environment that facilitates collaborative and engaged learning. Environmental education is grounded by the constructivist theory (American Forest Foundation, AFF, 2009; Dillon, 2003; Klein & Merritt, 1994; Loughland, Reid, & Petocz, 2002), and evidence is growing that indicates environmental education produces positive learning outcomes (Athman & Monroe, 2004; Ernst, 2005; Lieberman & Hoody, 1998). Project Learning Tree (AFF, 2009) is an example of a prominent internationally recognized environmental education curriculum that applies the constructivist learning theory (Piaget, 1952) to the instructional design of their activities. Constructivist theory is important to this study because there is a strong affinity between constructivism and the affordances of technology to support student-centered learning. Constructivism, as a theory and practice has also been acknowledged by instructional technologists (Surry & Brennan, 1998). There are many instructional technologies available to environmental educators teaching with curricula grounded by constructivist theory, but there is a void in the literature connecting the implementation of IT within the framework of environmental education.

Practical Framework

There are two practical applications of this study. The first is the identification of conditions that facilitate, or impede the implementation of instructional technology within the context of the Project Learning Tree (PLT) environmental education (EE) program. The second application will be to inform the environmental education community about the results of this study. The results from this study may help the directors of national EE programs develop new approaches to training environmental educators to use instructional technology to support learning with their EE curricula. National EE programs may also choose to incorporate topic specific strands into their national conference agendas that focus on implementation of instructional technology. They may be able to use results from this study to inform the instructional design process when revising their curriculum. State EE program coordinators may be able to use this information when organizing educator and facilitator training sessions. Armed with an understanding of the reasons why environmental educators implement instructional technology, state EE coordinators will be able to make appropriate adjustments to training protocols that include modeling of how to use IT. Also, state coordinators may decide to highlight technology applications in their newsletters or develop an FAQ section on their website that help environmental educators increase and improve their use of technology.

Importance

This study is important to the fields of instructional technology and environmental education. The field of instructional technology will benefit because this study will expand the literature about technology innovation adoption and implementation (Surry & Brennan, 1998). Similar to the work of Ensminger and Surry (2008) who examined three occupational groups (K-12, Higher Education, and Business), this study will examine how users of PLT materials rank the importance of the eight conditions (Ely, 1990, 1999) that facilitate the implementation of technology innovations. Informed by the methodology used by Ensminger & Surry (2008), this study will collect data from a new occupational group and provide construct reliability of a modified Implementation Profile Inventory instrument focused on environmental educators who use the PLT curriculum. This study is important to environmental education because research in the field has been described as "plagued by methodological and statistical problems" (Zimmerman, 1996, p. 42) and according to Potter (2010) there is a need for stringent assessment, evaluation, and research in the field of environmental education. Specifically, the PLT program will be able to use results and recommendations from this study to inform strategic planning, revision of training protocols, and prioritization of curriculum revisions.

While a significant amount of time was devoted to developing this study, the scope was limited to members of the Project Learning Tree community of practice because of access and level of familiarity with the program organization and operation. The decision to focus on implementation of technology was based on observations and communications with practitioners of the PLT curriculum and their lack of use of technology. Several questions were formulated such as, what factors may influence their technology use? Was there a gap in the knowledge or skills of PLT educators that prevented them from incorporating technology? Combined, these factors guided the development of the research questions developed for this study.

Research Questions

This study focused on users of the Project Learning Tree environmental education curriculum. The following questions guided this study:

Research Question #1

Do the Implementation Profile Inventory scores for each of the eight conditions for implementing technology differ between Project Learning Tree educators, facilitators, and state coordinators?

Research Question #2

Is there a correlation between the eight conditions for implementation and the level of use of technology tools by PLT educators?

Research Question #3

What is the effect of significantly correlated conditions on PLT educator's level of use of technology tools?

Research Question #4

What are the characteristics of a PLT educator who is most likely to implement technology?

CHAPTER 2

REVIEW OF RELATED LITERATURE

The review of related literature for this study will pull from the fields of environmental education, instructional technology, and implementation. Specifically, examination of the goals, theory, and practice of environmental education (EE) will provide the context for this study. This will be followed by review of the field of instructional technology and the relationship with the practice of EE. This chapter will conclude by discussing the conditions for implementation of technology innovations, and examine a change model used to evaluate the influence of the conditions required for implementation of technology.

Environmental Education

The field of environmental education is relatively new when compared to other fields of science-based education such as biology or chemistry. The concept of environmental education (EE) was first defined by Stapp et al., (1969). The definition by Stapp and colleagues describes EE as a method of educating all citizens to be knowledgeable and motivated to find solutions to environmental problems. The world community adopted a definition of environmental education during the Belgrade Working Conference on Environmental Education in 1975. Then, during the 1977 Tbilisi Intergovernmental Conference on Environmental Education, core concepts were identified to inform the approach of environmental education. The five concepts are known as the Tbilisi Declaration, and include:

1. *Awareness* – acquire an awareness and sensitivity to the total environment and its allied problems

2. *Knowledge* – to gain a variety of experiences in and acquire a basic understanding of, the environment and its associated problems
3. *Attitudes* – to acquire a set of values and feelings of concern for the environment and motivation for actively participating in environmental improvement and protection
4. *Skills* – to acquire the skills for identifying and solving environmental problems
5. *Participation* – to encourage citizens to be actively involved at all levels in working toward resolution of environmental problems (UNESCO, 1978)

These five concepts guide the practice of environmental education, and through the practice of EE, we strive to reach the learning outcome of increasing environmental literacy of citizens. The concept of environmental literacy was a product of the environmental movement in the late 1960s. Environmental literacy (EL) was first described by Roth (1968), and since that time, the concept has evolved to describe a person's knowledge, attitude, and behavior towards the environment. An environmentally literate person has the capacity to perceive and interpret the relative health of environmental systems and take appropriate action to maintain, restore, or improve the health of those systems (Disinger & Roth, 1992). The five concepts of the Tbilisi Declaration reveal the interdisciplinary approach of EE and how it supports educators' effort to combine content from the social and natural sciences, arts, mathematics, and humanities to help students fully comprehend and confront complex environmental issues (Gaudiano, 2006; Hungerford, 2002). As the world population continues to increase so too will the demand for renewable and nonrenewable natural resources. To face these challenges, citizens will need to be environmentally literate, and able to identify and resolve environmental problems and issues. Environmental education is one approach to meeting this challenge.

Environmental education is designed to be an interdisciplinary curriculum. Unfortunately, EE is often delivered within the framework of the science curriculum only and lacks sufficient association with the other sciences (Cole, 2007; Simmons, 1989). The job of an environmental educator is to use the interdisciplinary approach to help students understand the relationships that exist between humans and human activity, and the environment, (Shepardson, 2005). The environmental educator must therefore employ activities and pedagogy that helps students learn how to think critically, communicate effectively, understand the economic impacts of their decisions, and be responsible citizens that take action. In an attempt to define the role of the environmental educator, Hug (1977) identified the duality between being an environmentalist and environmental educator. The environmental educator, according to Wilke (1997), is exemplified by the following statement:

> "Professional environmental educators are advocates for balanced and, let me emphasize, scientifically accurate education. Environmental educators attempt to provide the knowledge and skills people need to make wise decisions on environmental issues. Environmental educators' help people examine the range of positions associated with environmental issues and encourage them to make their own decisions. They do not simply advocate one set of positions or values. Environmental educators provide people with critical thinking and citizen participation skills. They do not advocate particular actions but provide the skills necessary for people to be responsible citizens who can effectively make informed decisions." (p.1)

The goal of EE is to prepare citizens with skills and motivation to take action within their own communities to resolve environmental-related problems and issues. Therefore, environmental educators must creative and develop new skills and teaching strategies that work for them (Cole, 2007). Devoted environmental educators trained to teach using quality environmental education curricula and using appropriate pedagogy for EE can meet this goal.

Project Learning Tree (PLT) is an international award winning environmental education curriculum for students in grades PreK-12. The mission of PLT is to stimulate students' critical and creative thinking, and to develop their ability to make informed decisions and take responsible action on behalf of the environment (AFF, 2009). The mantra of PLT is to teach students how to think, not what to think about the environment. Grounded by constructivist leaning theory, PLT curriculum materials are designed with a student-centered focus aimed at increasing environmental knowledge, attitude, and behavior (Klein & Merritt, 1994; Rickinson, 2001). The capacity of PLT to influence student learning is supported by Marcinkowski and Iozzi (1994) who conducted a study using a modified, quasi-experimental pre-test/post-test control group design, to investigate the effect of selected PLT activities on student knowledge and attitude scores in grades PreK-8. Based on 115 usable responses (47% response rate) student pre-test/post-test scores for environmental knowledge and attitude were found to increase significantly. In addition, student scores increased when taught by teachers who had completed the PLT educator training and executed the PLT activity as designed.

The instructional design of PLT curriculum materials is continually updated and subjected to strenuous review and field testing before a new edition is printed. The national PLT program is known for innovation when it comes to curriculum development. Yet, it was not until 2006 that the instructional design of the PLT PreK-8 Activity Guide included recommendations for using technology to enhance student learning (AFF, 2006). Technology recommended for use with PLT activities include word processing software, spreadsheet/database software, presentation software, graphic and graphic organizer software, digital video/camera hardware, peripheral hardware, and Internet resources. The PreK-8 Activity Guide contains 96 activities, and all but 14 have recommendations for using technology as part of the learning experience. The reluctance of the PLT organization to incorporate instructional technology into their curriculum is somewhat perplexing. In a review of research from 1979-1993, Zimmermann (1996) identified evidence supporting the positive influence of media on student attitudes and knowledge about the environment (Iozzi, 1989; Novak, 1991). Many technology innovations were available prior to 2006 including the World Wide Web, Internet, digital camera, laptop computers, hand-held devices, and USB drives. Providing teachers with quality environmental education materials and training how to apply appropriate pedagogical methods that include instructional technology can support students' construction of new knowledge about the environment (Arvai, Campbell, Baird, & Rivers, 2004; Potter, 2010). Exploring the field of instructional technology and the application of technology to environmental education will provide a conceptual foundation for this study.

Instructional Technology

Instructional technology, as a practice, is a foundational concept for this study. From the influence of the Sophists who used systematic teaching procedures to train youth in the art of rhetoric in the mid-fifth century (Saettler, 1990) to learning from the Internet (Jonassen, Howland, Moore, & Marra, 2003), a trail of linked events, inventions, theories, and practices can be traced that illuminates development of the concepts, theories, and practices of instructional technology today. Presently, several different titles are used to identify the field of instructional technology including visual instruction, audiovisual specialists, instructional systems technology, and educational technology (Persichitte, 2008; Reiser, 2011). Persichitte (2008) acknowledged there are more than eleven titles used to describe the field, and this proliferation of titles is the result of the evolution of the field itself. The rationale for moving away from the 1994 definition that refers to the field as "Instructional technology" (Seels & Richey, 1994, p.1) and returning to "Educational technology" (AECT, 1977; AECT, 2007, p.1) is predicated on the hierarchy that instruction is a subset of education; therefore, instructional technology is a subset of educational technology (Januszewski & Persichitte, 2008). Another reason for using educational technology is because it encompasses the processes in "all aspects of human learning" (AECT, 1977, p.1). Educational technology is favored over instructional technology because it embraces both planned and spontaneous learning events, and addresses the application of technology in both formal and informal learning environments (Januszewski & Persichitte, 2008). Undoubtedly, the lack of a single identifying title creates confusion within the field, but more importantly, the multiplicity of titles makes it difficult for anyone outside the field to make the connection between a title and the profession of instructional technology (Reiser, 2011). Although educational technology is the title currently used to define the field and profession (AECT, 2008), the title of instructional technology will be used in this study to describe the concept, field, and profession. As a concept, instructional technology is defined as "the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (AECT, 2008, p. 1). From this definition thirteen key terms, or elements, are identified that further define and support the concept of instructional technology: study, ethical practice, facilitating, learning, improving, performance, creating, using, managing, appropriate, technological, processes, and resources (AECT, 2008). A brief description of each element follows:

1. As a result of *study* within the field of IT, research interests have moved away from establishing that technology is an effective tool for instruction toward investigations of application of IT and the outcome of learning.
2. The *ethical practice* of IT is more about achieving success through exemplary professional conduct (Welliver, 2001) than establishing standards.
3. The role of instructional technology has moved away from the original paradigm where it was thought to control the learning process (Ely, 1963), to the role of *facilitating* student learning by supporting and engaging the learner to construct knowledge.
4. Active use of instructional technology supports the goal of *learning*.
5. The ability to *improve* performance identifies the capacity of IT to produce effective learning.
6. Product and idea technologies can help learners and educators improve their *performance* by applying new knowledge to real-world situations outside the context of the learning experience.
7. The affordances of digital and analog technology allow instructional designers to *create* materials and learning environments that challenge students to employ prior knowledge and build new skills to solve a problem.
8. The element of *using* has two levels: the first level is diffusion of the technology from designers and developers to the educator who integrates it into their instructional strategies, and the second level is the physical connection between the learner and technology.
9. *Managing* the process of instructional technology is a responsibility that requires multi-management skills.

10. Selection of *appropriate* technology resources implies the ethical responsibility to match the technology with learning outcomes based on best practices.
11. The *technological* element is a concept used to define the processes and resources used in and associated with instructional technology.
12. The *process* element recognizes instructional technologists and instructional designers employ specialized processes to create resources.
13. *Resources* are all things including people, machines, and raw materials used to produce learning.

The central tenet of instructional technology is focused on learning, but is it learning with technology or from technology? The debate about students learning *from* technology or *with* technology went public when Clark (1983) suggested "that media do not influence learning under any conditions" (p. 445) and, "that media are mere vehicles that deliver instruction but do not influence student achievement" (p. 445). Clark posited that it is the content, not the vehicle that can influence achievement. Following a meta-analysis approach published by Glass in 1976 (as cited in Clark, 1983), Clark concluded that "it seems not to be media but variables such as instructional methods that foster learning" (p. 449), and that student persistence, a result of the novelty effect created by media, is responsible for increased achievement gains. Kozma (1994) published a persuasive response to Clark's position and took the opportunity to rephrase Clark's question to read "*will* media influence learning" (Kozma, p. 7). Kozma contended that the lack of evidence showing a relationship between media and learning existed because a relationship had not yet been established. To understand the role of media in learning, Kozma stated that,

> "we must ground a theory of media in the cognitive and social processes, by which knowledge is constructed, we must define media in ways that are compatible and

> complementary with these processes, we must conduct research on the mechanisms by which characteristics of media might interact with and influence these processes, and we must design our interventions in way that embed media in these processes" (Kozma 1994, p. 8)

Perhaps the most compelling assertion made by Kozma (1994) was his connection of medium and method with the process of instructional design, whereby, instructional design is the enabling process that takes advantage of the medium's capacity to support the methods, and that the methods have the capacity to express the medium's potential. The focus of contention between Clark and Kozma was instruction- and media-centered, but others felt their efforts were misguided. Jonassen, Campbell, and Davidson (1994) disagreed with Clark and Kozma, and argued the debate must move beyond instructional methods and media attributes to focus on the learner and the "the role of media in supporting, not controlling the learning process" (p. 31). Media, in this context, is synonymous with instructional technology, and from this assertion, evidence exists to support the concept that instructional technology supports learning.

Learning is defined as "a persisting change in human performance or performance potential" (Driscoll, 2005, p. 9) and learning is the consequence of "the learner's experience and interaction with the world" (Driscoll, 2005, p. 9). Learning requires thinking (Jonassen et al, 2003), is situational (Lave, 1988), and is a process that is both personal and affected by others within the shared community (Driscoll, 2007). As a practice, instructional technology is focused on the learner and their interaction with technology. Roblyer (2006) identified multiple benefits of using instructional technology in the learning process:

1. Learners are provided immediate feedback which influences self-efficacy;
2. learning is self-paced and private;

3. simulations and interactivity facilitate visualization of abstract concepts and systems;
4. learners are afforded access to information and resources; and,
5. learners are motivated to work collaboratively.

Instructional technology can be used to motivate learners. Technology is a tool that can gain the attention of the learner (Roblyer, 2006), and motivation controls learning and performance (Keller, 2007). Learner motivation is either intrinsic or extrinsic. For example, an intrinsically motivated learner who developed skills using Flash software may apply these new skills to create an animated movie about the values of recycling and post it on a personal web page. The same learner may be extrinsically motivated to earn extra credit in AP biology by applying their animation skills to produce an animated sequence that demonstrates their understanding of the processes involved in cell division.

Another benefit of instructional technology is its functionality as a multi-tool. Learners are able to use this multi-tool to demonstrate knowledge and skills in a real-world context (Kozma, 1994; Roblyer, 2006). An example of this type of benefit is the *Jasper Woodbury Series*, a videodisk product designed for middle school students produced by the Cognition and Technology Group at Vanderbilt (1990). The videodisk situates the main character, Jasper Woodbury, in different real-world contexts. After viewing the scene that defines the context students are required to apply mathematical skills using the available data to solve the problem facing Jasper. Working in teams, students are guided by the teacher to search for information presented in the scenario that will help them solve the problem. The Jasper Woodbury Series situates students in an environment where they must apply their school-learned skills and knowledge to a set of circumstances outside of the classroom. Some students may find this difficult because they lack adequate problem-solving skills and strategies. The inability of a learner to transfer new knowledge to conditions and performance outside the learning environment to real-world conditions is what Whitehead (1929) referred to as the “inert knowledge problem” (as cited in Kozma, 1994, p. 10). Applying technology tools in the context of environmental education and guided by principles of constructivist learning theory may reduce inert knowledge problems experienced by students.

Connecting student learning to real-world situations within familiar local environments is possible by availing of the affordances of technology and environmental education. Sherman and Kurshan (2005) identified eight teaching and learning concepts consistent with the constructivist theory, and provided examples of effective applications of instructional technology for each item. The concepts they identified are: learner centered, interesting, real life, social, active, time, feedback, and supportive. While Sherman and Kurshan validate the value of IT and demonstrate its adaptability to learning and teaching, they recognize the challenge of creating a learning environment that embodies all eight concepts. A contributing factor for success falls on the teacher and their level of confidence and knowledge using technology (Oliver & Sharpio, 1993). The specific knowledge required to successfully integrate technology in a classroom is dependent upon the technology, pedagogy, and content knowledge (TPACK) of the teacher.

Literature about technology, pedagogy, and content knowledge (TPACK) informs our thinking about the types of knowledge environmental educators must have to effectively implement technology tools. The concept of TPACK proposed by Koehler and Mishra (2009) evolved from the original work by Shulman (1986, 1987) whom is credited for the concept of *pedagogical content knowledge* (PCK). Shulman (1987) described PCK as “an understanding of how particular topics, problems, or issues are organized, presented, and adapted to the diverse interests and abilities of learners, and presented for instruction” (p. 8), and utilizes the “most useful forms of representation of these ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations – in a word, the ways of representing and formulating the subject that make it comprehensible to others" (p. 9). The concept of TPACK, but more specifically, the technological and pedagogical components can be applied to this study.

Pedagogical Content Knowledge (PCK)

The concept of pedagogical content knowledge (PCK) is widely recognized within the ranks of teachers, and teacher educators today. However, this has not always been the case. Unbeknownst to members of the educational community in the late 19th and early 20th centuries, the concept of PCK was part of the teacher education reform movement underway at that time (Bullough, 2001). During the 1907 National Education Association conference, many speakers focused on the quality of secondary teacher education. Arguments were made comparing university and normal school pre-service programs. Normal schools were established to train teachers to meet the educational needs of the growing rural populations in the United States. Universities valued academic training over pedagogical training, while normal schools focused on pedagogical training. Charles Judd (1907), a psychologist at the University of Chicago, held fast to the position that college training of secondary educators was superior to normal school programs. This view was also supported by Fredrick Bolton, a Professor of Education at the State University of Iowa who made reference to the normal school courses as "ceaseless flittering about" (1907, p. 611-612). There was a clear division between teacher educators and their philosophies about appropriate methods to prepare secondary teachers. Normal schools slowly relented; placing greater emphasis on teaching content knowledge over pedagogy, and teacher educators who believed content and pedagogy should be blended were a minority at best.

This divisional debate over teacher education continued for decades. Then in 1986, Lee S. Shulman, a Professor of Education in the School of Education at Stanford University published his ideas about teaching reform and the types of knowledge a teacher must develop to be an effective educator.

Teaching is a skill that can be learned, but what knowledge must an educator possess to be a good teacher? Shulman (1986) identified three types of knowledge that should be developed by a teacher: content knowledge, pedagogical knowledge, and curricular knowledge. Shulman described content knowledge as "the amount and organization of knowledge per se in the mind of the teacher" (1986, p. 9). Pedagogical knowledge is another type of content knowledge that, according to Shulman (1986), "goes beyond knowledge of subject matter per se to the dimension of subject matter knowledge *for teaching*" (1986, p. 9). The combination of content knowledge and pedagogical knowledge produces a teacher with command of subject-specific content and the ability to arrange the order of ideas and select appropriated methods to deliver it effectively, and is referred to as pedagogical content knowledge (PCK). In 1987, Shulman published, *Knowledge and Teaching: Foundations of the New Reform*, where he identified PCK as unique because "it identifies the distinctive bodies of knowledge for teaching" (1987, p. 8). Since that time, the concept of PCK and adoption of it as a component of teacher education has been applied to different teacher education programs.

Pedagogical content knowledge has been used to guide the development of teacher education programs in different fields. Phillips, De Miranda, and Shin (2009) described how PCK was used to reform industrial design educator training. Science teacher education identified PCK as a knowledge base for science teachers (Anderson & Mitchener, 1994). Further support for PCK by the science education community came when it was included in the National Science

Education Standards, and identified as a specialized knowledge that “distinguishes the science knowledge of teachers” and “defines a professional teacher of science” (National Research Council, 1996, p. 62). While PCK has been adopted and successful at reforming traditional teacher education programs, Darling-Hammond (1991) reported students attending non-traditional educator training programs, but who lacked adequate formal educator training, had difficulty comprehending the concept of pedagogical content knowledge. Overall, the concept of pedagogical content knowledge has been adopted as a framework for describing the competencies required of teachers, both pre-service and in-service. The profession of teaching is challenging; it is practiced in a complicated and dynamic environment that requires a teacher to integrate and apply knowledge of content, teaching, and student learning. Now, the digital age asserts a new knowledge base a teacher must master, the knowledge of teaching and student learning with technology known as technology, pedagogy, and content knowledge (TPACK).

Technology, Pedagogy, and Content Knowledge (TPACK)

Teaching with technology can challenge even the most experienced teacher. In the following discussion, let technology represent digital product technologies such as computers, digital cameras, handheld devices, and computer software products. Since the advent of personal computers and the Internet, access and availability of computer technology in the classroom has increased dramatically. From 1994 to 2002, access to the Internet in public schools increased from 35 to 99 percent (Kleiner & Lewis, 2003). Access and availability to technology does not assure implementation of technology by a teacher. Many factors influence the use of technology including planning, experience, and training to teach with technology (Levin & Wadmany, 2008; Smerdon, Cronen, Lanahan, Anderson, Iannotti, & Angeles, 2000). Much is known about what teachers need to know to use technology (Zhao, 2003), but teachers must develop a knowledge base about how technology is connected to pedagogy and content.

Instructional technologies have changed the learning environment, and the affordances of technology empower a teacher to utilize teaching methods appropriate for the content, that accommodates students' prior knowledge, and achieves the desired learning outcomes. Using the foundation established by Shulman (1986, 1987) for the concept of PCK, Mishra and Koehler (2006) articulated the need to include technology (T) as part of the PCK model, introduced what they called "technological pedagogical content knowledge" or TPCK (2006, p. 1028), which was later changed to technology, pedagogy, and content knowledge, or TPACK (Koehler & Mishra, 2009). The TPACK framework is presented in Figure 2-1.

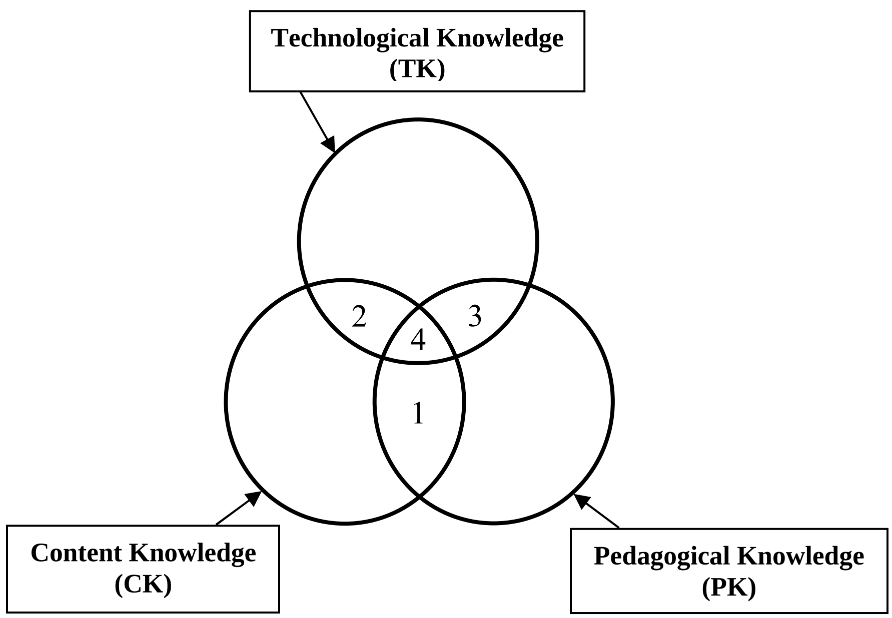

Figure 2-1. Framework for TPACK adapted from Koehler & Mishra (2009)

The three primary components of the TPACK framework are technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). The relationships between the three primary components are: pedagogical content knowledge (PCK) = 1; technological content knowledge (TCK) = 2; pedagogical technological knowledge (PTK) = 3; and technological pedagogical content knowledge (TPCK) = 4. The primary components of pedagogical knowledge (PK) and content knowledge (CK) are the two components Shulman (1986, 1987) used in his original PCK model. The addition of technological knowledge forms a triad resulting in two new interactions; technological content knowledge (2) and pedagogical technological knowledge (3). The union of all three components creates technological pedagogical content knowledge (4). Mishra and Koehler (2006) declared that TPCK was “an emergent form of knowledge that goes beyond all three components (content, pedagogy, and technology)” (p. 1028), and describe TPCK as,

> “the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive way to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students’ prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones” (2006, p. 1029).

Establishing TPACK as a necessary knowledge base for teachers created interest from researchers who examined how TPACK works in practice.

The methods used to teach new content knowledge to pre-service teachers has the capacity to influence how they teach the same content once they enter the profession. The same may be said about technology, if a pre-service teacher learns content knowledge through the lens of technology, they may be more likely to use technology to teach that same content to their students. In a one-year study looking at TPACK of 22 graduate student teachers in a science and mathematics teacher preparation program, Niess (2005) observed that not all students developed an acceptable level of TPACK even though all courses emphasized TPACK during the study period. Qualitative results collected by Niess provided insight as to why some students lacked adequate TPACK, for example, “Denise simply rejected the consideration of the science of the technology thinking of the technology as a tool to do science rather than a tool embodying science” (2005, p. 520). Based on the results of the study presented above, the notion that TPACK of student teachers will increase if they are provided sufficient experiences is not supported. There could be other factors involved such as the design of the course, and the level of conceptual understanding and ability of the course instructor to convey the relationships between content, pedagogy, and technology (Koehler & Mishra, 2005; Niess, 2005). This brings up a question about how student teachers are taught to teach with technology.

Reaching an adequate level of TPACK can not be accomplished by attending a weekend workshop or one-day professional development seminar alone, but requires a significant investment of time and effort. Koehler and Mishra (2005) investigated how the learning by design process could be used to develop situated understanding of the relationships between technology, content, and pedagogy to increase TPACK of 22 graduate students. Koehler and Mishra (2005) reported students tasked with designing an online course developed new thinking about the pedagogy connected to technology and the implications for how they teach and what they teach. From a constructivist view, the students’ prior knowledge about instructional design, teaching, and technology was challenged, and as the course progressed they constructed new knowledge and developed new teaching skills that incorporated technology. Another method used to train new teachers how to design a course that incorporates technology is technology mapping. Technology mapping was described by Angeli and Valanides (2009) as the “process of establishing connections among the affordances of a tool, content, and pedagogy” (p. 161).

They found that teaching instructional design following a “model for the design of technology-mediated learning” (2009, p. 160) and using a “design- and progress-based assessment of teachers’ competencies to teach with technology” (2009, p. 163) increased students’ TPACK knowledge. Learning by design and technology mapping are two approaches identified as successful methods that have the capacity to build teacher confidence and competency to teach with technology. Teacher readiness to use instructional technology in the classroom was the focus of a study conducted by Thompson, Schmidt, and Davis (2003). They found evidence suggesting that technology should be a part of the entire preservice teacher education experience. They also found that mentoring and administrative support for technology integration would likely increase classroom use of technology. The idea of using mentors to support technology integration has been researched by others. Kopcha (2010) presented a systems-based mentoring model for technology integration. Unlike other mentoring approaches, Kopcha’s model established a teacher-led community of practice. In contrast, peer interventions do not always produce positive results. In a study involving 86 community college students, Wright (2008) conducted a comparative assessment using pre-test/post-test scores to examine the differences of students’ knowledge, belief, opinion, and self-perception. The participants of this study were college students enrolled in an introductory environmental science course. One group (n=28) participated in an online course, which required a significant amount of self-directed learning. The other group (n=58) participated in a face-to-face class setting, with a strong teacher-centered orientation but students were given time for in-class group discussions. The results of this exploratory study indicated that students in the online group had significantly lower post-test knowledge and opinion scores than those in the classroom group. Wright could only speculate as to why the scores were significantly different and provided insightful ideas including, “the in-class learning experience may encourage students to form more holistic perspectives on environmental issues" and, "monitoring of online responses … indicated that Web-based students in the present study were not engaged with the subject matter" (p.41). The results of Wright's study are in no way indicative of all Web-based learning, but they do bring up the issue that technology is not always going to produce positive learning outcomes and much depends on the technology and the context in which it is implemented.

To better understand technology use by environmental educators, Heimlich (2003) compared users and nonusers of the World Wide Web, and looked at their use of the Web, comfort level, perceived barriers, and familiarity with EE websites. He found the primary use of the Web by environmental educators in this study was for "direct communications and acquisition of information and resources" (p. 10). In the review of the literature, Heimlich mentions conducting a "cursory review of the 10 years of 3 of the journals dominant in EE" (p. 5) in an attempt to find articles addressing the use of computers and distance education in environmental education. Concerned that only 15 articles were found, Heimlich expressed discontent that most of the articles "provided case studies of an applied use of a technology and gave suggestions for other educators to adapt it" (p. 5). The purpose of Heimlich's study was to understand how and why environmental educators use technology, specifically, the Web. In this study, the purpose was to understand what factors limit or enable environmental educators' use of instructional technology, which leads to a discussion about diffusion and implementation.

Diffusion and Implementation

The adoption and implementation of instructional technology in environmental education needs to be better understood and conveyed to environmental education program leaders if they expect to continue designing instructional materials and training environmental educators using methods that can interest and motivate their primary audience – students in grades K-12. The complexity of a technology is not the only factor that determines adoption and implementation; it goes much deeper and includes social, economic, organizational, and individual factors (Pool, 1997; Segal, 1994). Diffusion of Innovations theory is one of the most predominantly used adoption models in the field of instructional technology (Berger, 2005; Ely, 1990, 1999; Hooper & Rieber, 1995; Porter, 2005; Sahin & Thompson, 2006; Surry & Brennan, 1998; Surry & Ely, 2001). Other models based on diffusion theory include the Critical Factors in Adoption Checklist developed by Stockdill and Morehouse (1992); User-Oriented Instructional Development model by Burkman (1987); and the Concept of Adoption Analysis proposed by Farquhar and Surry (1994). The diffusion theory has been used as the framework for implementation studies; therefore, there is justification for its use in this study.

The diffusion theory is comprised of three sub theories: 1) adopter categories, 2) attributes of innovations, and 3) the innovation-decision process. The level of innovativeness influences a person's rate of adoption, and Rogers (1962) developed a standardized method and nomenclature allowing adopter categories from one study to be compared to another study. Comparisons of different studies are best achieved using diffusion curves. Diffusion curves can be represented by an S-shaped cumulative curve or bell-shaped frequencies curve (Rogers, 2003). The five adopter categories according to Rogers (2003) are:

1. *Innovators*. Members of this group are venturesome. They are the first to adopt an innovation, and represent only 2.5% of all members in a system. The innovator is often viewed with little respect by their peers. However, they play an important role in the diffusion process by taking the innovation from one system and applying it to their local system.

2. *Early Adopters*. Members of this group are respected. Unlike the innovators, this group holds the greatest leadership role, and they are considered to be "the individual to check with before adopting a new idea" (Rogers, 2003, p. 283). Early adopters respected by their peers and represent 13.5 percent of all members in a system. The early adopter is a role model and sought after by change agents to help market new innovations. If a member of this group adopts an innovation, then others are very likely to follow.
3. *Early Majority*. Members of the early majority are deliberate. They are not an opinion leader, but represent one of the largest groups (34%) of all members in a system. Compared to innovators and early adopters, they take a longer time to make up their mind to adopt or not.
4. *Late Majority*. Members of this group are skeptical. They adopt after the average member in a system. Like the early majority group, the late majority group comprises 34 percent of the all members in a system. They adopt based on economic or peer pressure.
5. *Laggards*. Members of this group are considered to be traditional. They sit on the outskirts of the social network in their system. They are suspicious and resist change, primarily due to limited economic resources and fear of failure. Laggards represent 16 percent of all members in a system.

The level of innovativeness is influenced by other characteristics including socioeconomic status, personality values, and communication behaviors (Rogers, 2003). While these characteristics are important, the research literature is large and beyond the scope of this study. It is more important to understand how the attributes of an innovation and the innovation-decision process support this study.

The second sub-theory defines the attributes of an innovation. A great deal of attention has been given to this theory, so much, that it has been found to explain nearly half of the variance in the rate an innovation is adopted (Rogers, 2003). The five attributes of innovations as described by Rogers (2003) are:

1. *Relative advantage*. The degree to which the new innovation is better than the one currently used. Rate of adoption of an innovation is positively related to the relative advantage.
2. *Compatibility*. The innovation is evaluated by potential adopters. Compatibility is based on juxtaposition of the new innovation to the one it stands to replace. The more compatible the innovation, the more likely it will be adopted.
3. *Complexity*. The perceived degree of difficulty of the innovation regarding its use and understanding. The more complex the innovation, the longer it will take members of a system to decide whether or not to adopt.
4. *Trialability*. Potential adopters have time to 'test drive' the innovation. The longer the innovation is available on a trial basis, the more likely it will be permanently adopted.
5. *Observability*. The outcomes or results produced by the innovation must be visible to members of the system. The greater the results, the more likely the innovation will be adopted.

It is important to understand how potential adopters perceive an innovation. A clear understanding about adopter's perceptions of an innovation will be significant to the innovation-decision process.

The last sub-theory related to the diffusion theory is the innovation-decision process. Rogers (2003) defines the innovation-decision process as:

> "the process through which an individual (or other decision-making unit) passes from gaining initial knowledge of an innovation, to forming an attitude toward the innovation, to making a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision" (p. 168).

From this definition, five sequential stages are prominently identified:

1. *Knowledge*. When an individual becomes aware that an innovation exists and learns of its function.
2. *Persuasion*. When an individual develops an attitude, positive or negative, towards the innovation.
3. *Decision*. When an individual takes action to either accept or refuse the innovation.
4. *Implementation*. When an individual has accepted the innovation and puts it into use.
5. *Confirmation*. When an individual looks for positive evidence to confirm they made the right decision to adopt an innovation.

Reiterating that the purpose of this study is to evaluate environmental educator's use of instructional technology; the implementation stage of the innovation-decision process is a critical component informing this study.

Implementation of instructional technology in education, in the context of change, has been a research focus for decades. Based on experience as a change agent and supported by an extensive review of the literature, Ely (1976) identified a collection of conditions he considered useful to implement technology change in libraries. Also, Fullan and Pomfret (1977) studied implementation as it related to change in schools. These same authors are cited by Ely (1999) as prominent scholars and practitioners of implementation, and responsible for bringing attention to the question, what is innovation adoption without implementation?

After collecting years of educational change data, Ely (1990) identified eight conditions that facilitate implementation of technological and non-technological innovations (Surry & Ensminger, 2002). The eight conditions for technology change are:

1. *Dissatisfaction with the Status Quo*. The feeling that things could be better if something changes.
2. *Knowledge and Skills*. Those who will implement the innovation must have adequate knowledge and skills to operate the innovation.
3. *Resources*. Access to the materials and supplies to make the innovation work.
4. *Time*. Those implementing the innovation must have time to learn, adapt, integrate, and reflect on their use of the innovation.
5. *Rewards and Incentives*. Some type of reward, either intrinsic or extrinsic, must be present to provide a reason to change.
6. *Participation*. The innovator must be involved in the decision-making process or it is unlikely the innovation will be implemented.
7. *Commitment*. Support from administrators and managers must come directly to those who are implementing the innovation.
8. *Leadership*. Support for innovators from those considered to be the leaders.

These eight conditions have guided research by others interested in understanding the implementation phase in the field of instructional technology (Ensminger & Surry, 2008; Surry & Ensminger, 2002; & Surry, Ensminger, & Haab, 2005). While most expressed agreement with Ely and his selection and description of the eight conditions, Porter (2005) disagreed with Ely's condition of *time*. The premise of his argument focused on why should the change process be constrained by time? Porter feels that time should not be related to the other seven conditions for implementation identified by Ely.

Within the literature related to implementation, several studies were found and used to guide this current study. The first was by Ensminger and Surry (2008) who compared how individuals from three different professions in the United States rank the importance of Ely's eight conditions on innovations. This led to further review of three previous studies authored by Ensminger, Surry, Porter, & Wright (2004), and Surry and Ensminger (2002, 2004). All three studies investigated the notion of using Ely's eight conditions as a framework to determine the relative ranking of the conditions for a particular group based on responses from representatives from that group. According to Ensminger and Surry, their 2008 study was "the first study to address the prescriptive value of the eight implementation conditions" (p. 1). The prescriptive value they are referring to is the ability to help an organization develop an implementation plan using appropriate strategies to account for the different rankings of the eight conditions by the individuals in the organization. Data collection was facilitated by an online survey referred to as the Implementation Profile Inventory (Ensminger & Surry, 2008). The original IPI questions and associated conditions are listed in Appendix A. The Ensminger and Surry (2008) study forms the basis for the creation of the Implementation Profile Inventory used in this study which includes new questions aligned to match the Project Learning Tree program.

Summary

The goal of environmental education is to increase knowledge and promote positive environmental attitudes and behaviors. Grounded in constructivism, both instructional technology and environmental education support the goal of learning. Implementation of instructional technology, in conjunction with environmental education curricula, has the ability to foster student interest and stimulate motivation to be actively engaged in their learning experiences. Adequate literature exists covering the fields of adoption and implementation, environmental education, and instructional technology. However, study of implementation of instructional technology in the context of environmental education is scarce. This study will provide a unique opportunity to investigate the members of the PLT system and discover what conditions facilitate the implementation of instructional technology when they are teaching environmental education.

CHAPTER 3

METHODS

The purpose of this study was to examine the conditions that facilitate the implementation of instructional technology in the context of environmental education, specifically by individuals using the Project Learning Tree (PLT) curriculum. This chapter describes the study participants, the environment in which data were collected, data collection methods including the pilot study, survey instrument development, and the processes used to analyze the data. The following research questions guided this study:

1. Do the Implementation Profile Inventory scores for each of the eight conditions for implementing technology differ between Project Learning Tree educators, facilitators, and state coordinators?
2. Is there a correlation between the eight conditions for implementation and the level of use of technology tools by PLT educators?
3. What is the effect of significantly correlated conditions on PLT educator's level of use of technology tools?
4. What are the characteristics of a PLT educator who is most likely to implement technology?

Participants

The participants of this study were members of the PLT environmental education community of practice. Members of the PLT community are classified into three primary roles based on their level of involvement with the PLT program. The three PLT primary roles are:

1. *PLT Educator*: The PLT educator represents the largest group within the PLT community. A PLT educator has completed the required six-hour training course that teaches how to use the PLT curriculum materials. A PLT educator, for example, may be a formal teacher in a classroom, an informal educator at a nature center, or a parent who home schools their children. The National PLT office acknowledges that over 500,000 people have completed the educator training since 1976.

2. *PLT Facilitator*: A PLT facilitator is the lead instructor for PLT educator training workshops. A PLT facilitator has typically, but not always, completed the PLT educator training prior to becoming a facilitator. Each state PLT program determines training requirements for facilitator status. A common approach to becoming a facilitator is to attend a 2-day facilitator training workshop taught by a PLT state coordinator. Another option some states have adopted is a mentor program, whereby a PLT educator is given responsibility of conducting two PLT educator workshops while under the tutelage of a facilitator. The National PLT office currently recognizes around 1,200 active PLT facilitators.

3. *PLT State Coordinator*: A PLT State Coordinator is responsible for the operation of all PLT related activities in their state. Responsibilities of the state coordinator include coordinating PLT educator training, training new facilitators, conducting meetings of their state PLT steering committee, and submitting all reports and documentation to the National PLT office. A PLT state coordinator is a PLT facilitator and educator. The National PLT office currently recognizes 80 state coordinators.

Context

This study was conducted within the context of the National Project Learning Tree Program network of environmental educators. The PLT program is present in all 50 states, most of the territories of the United States, and eight countries outside the United States. Since the program began in 1976, over 500,000 individuals around the world have completed the PLT educator training (AFF, 2008). The typical educator training is a six-hour workshop guided by a PLT facilitator. During the training session the facilitator is required to discuss the PLT program and model how to use the PLT environmental education curriculum materials. Participants are then required to lead a teach-back session for at least one activity, after which, the facilitator provides feedback.

At the end of a PLT educator training workshop, the facilitator is required by the National PLT office to have participants complete an evaluation. The last item on the evaluation invites participants to voluntarily provide a current email address if they would like to receive an electronic copy of the quarterly PLT newsletter entitled *The Branch*. The National PLT office maintains a database of the email addresses provided voluntarily by individuals. Currently, the newsletter database contains over 43,000 emails, and is referred to as the email distribution list by the National PLT office. The email distribution list is managed by MailerMailer, LLC. MailerMailer is a privately owned email marketing service located in Rockville, Maryland, USA. The National PLT office pays a monthly service fee to MailerMailer which allows them to send 100,000 individual emails per billing cycle. The billing cycle begins the 14^{th} day of each month. Permission was granted by the executive director of PLT to use the email distribution list to facilitate communication of information specific to this study, and dissemination of the electronic survey instrument used in this study.

Limitations

Before collecting data for this study, it was important to identify all possible limitations. First, it was important to keep this scope of this study manageable. The four research questions were written with a specific purpose to examine the conditions of implementation and use of technology related to Project Learning Tree. Data collection and management was the next issue addressed. No outside funding was available to conduct this study, but adequate in-kind contributions and support was available. It was determined that the email distribution list managed by the national PLT office would be used to collect data because it contained over 44,000 email addresses and facilitated the use of an Internet survey developed using the expanded version of SurveyMonkey. The electronic survey also would make data management much easier and reduced the likelihood of data entry errors. The monthly service fee paid by PLT allowed 100,000 emails to be sent each month, and this facilitated the distribution of the prenotification, notification, and follow-up emails without extra expense to PLT. Expanding this study beyond the context of the PLT community was not economically feasible.

Data Collection

This study collected data from human subjects using an internet survey. The Institutional Review Board (IRB) approved this study on May 17, 2010 (Appendix B). Part of this study included a pilot to check the reliability and construct validity of the survey instrument.

Pilot

The purpose of the pilot was to test the reliability and construct validity of the items for the nine constructs in the survey. The pilot followed the three step process that Vaske (2008) refers to as *pretesting*. The three tasks of pretesting include: expert review, pilot study, and final check (analysis). The tasks of pretesting were accomplished during the time period from March 1, 2010 to June 21, 2010. A description of how these tasks were addressed is presented below.

Task 1: Expert Review

Experts were contacted to serve as reviewers of the survey instrument. The expert reviewers included, Dr. Martha Monroe, University of Florida (environmental education), Dr. David Ensminger, Loyola University (survey design), and Dr. Dan Surry, University of South Alabama (implementation). Reviewers received a paper copy of the survey instrument and were asked to provide written comments. All three reviewers submitted written comments. The majority of comments returned focused on the wording of items within the nine constructs. Only two comments addressed concerns with demographic questions. Follow-up phone calls to each of the expert reviewers were conducted to clarify recommended changes. After making revisions provided by the experts, a new survey was submitted to three individuals representing the target population and two staff members at the National PLT office in Washington, DC. Similar to the expert reviewer process, this group was asked to review the document and provide written comments. Follow-up phone conversations were conducted to clarify editorial comments. Once all corrections were completed, four individuals were asked to complete the survey and time how long it took them to complete it. The average time for the four individuals was 13 minutes.

Task 2: Pilot Testing

Before collecting data, ten PLT State Coordinators from California, Colorado, Florida, Georgia, Kansas, New Hampshire, Ohio, Oklahoma, South Carolina, and Texas were contacted and asked if they would assist in conducting the pilot study. All ten coordinators agreed to participate. The coordinators were asked to recruit three PLT educators and three PLT facilitators in their state to complete the pilot survey. After receiving official IRB approval, the ten state coordinators received an email on May 26, 2010 containing a link to the Internet survey (Appendix C). The state coordinators were instructed to forward the email to the six people they identified as pilot study participants. A reminder email was sent to the state coordinators on June 1, 2010 and again on June 3, 2010 informing them that the survey will close at noon (Eastern Time) on June 7, 2010.

Task 3: Final Check (Analysis)

Out of the 60 people contacted by the state PLT coordinators to participate in the pilot study, a total of 46 responded (77%) by June 7, 2010. Sections 1 (What is Technology Connections?) and 11 (Demographics) were subjected to descriptive statistical analysis, and Sections 2 thru 10 (nine constructs) were subjected to item analysis to test reliability within constructs. All data analyses were conducted using SPSS v.17.

Pilot Results

The pilot targeted a total of 60 participants; six participants from ten different states. A total of 46 participants from 10 states responded to the survey: Colorado (CO) = 3; Florida (FL) = 6; Georgia (GA) = 5; Kansas (KS) = 3; North Carolina (NC) = 1; New Hampshire (NH) = 6; Ohio (OH) = 8; Oklahoma (OK) = 7; South Carolina (SC) = 3; and Texas (TX) = 4. The pilot study had a response rate of 77 percent. Although North Carolina was not included in the original list of ten states invited to participate, there was a single participant who identified North Carolina (NC) as the state where they live. California (CA) was invited to participate but no responses were received.

Demographic Information

Demographic items were based on relevance to the study and results from the literature review (AFF, 2009; Heimlich, 2003; Ensminger & Surry, 2008). All demographic items were placed in the last section of the survey because it is important to begin a survey with questions that demonstrate the relevance of the survey to the participants (Dillman, 2007). Results for demographic data of sex, age, and primary role are presented in Table 3-1.

Table 3-1. Demographic information from pilot

Variable	Subcategory	*f*	%
Sex	Male	5	11
	Female	41	89
Age	Less than 25	0	0
	25-34	5	11
	35-44	6	13
	45-54	18	39
	55 and above	16	35
Primary Role	Educator	14	30
	Facilitator	32	70

Other demographic data collected included educational setting where PLT materials are used most often, which PLT Activity Guide the participant uses most often (i.e. grades PreK-8 or high school guides), and when the participant completed the PLT training and received a copy of the PreK-8 Activity Guide. Nearly 65 percent (n = 46) of the participants identified a school setting (grade PreK-16) as the place they use PLT most often. Nearly 87 percent (n = 46) of the participants indicated they use the PreK-8 Activity Guide most often. Participants were asked to indicate if they completed their training prior to December 2006 or after January 1, 2007: 29 (63%) indicated they had completed training prior to December 2006, and 17 (37%) indicated they had completed training after January 1, 2007.

The first section of the pilot study survey asked questions about Technology Connections and item responses are represented in Table 3-2.

Table 3-2. Frequency and percent responses: What is Technology Connections?

Item	Item Choices	*f*	%
1. How familiar are you with Technology Connections as it is presented in the PLT PreK-8 Activity Guide?	Not familiar	3	7
	Somewhat familiar	18	39
	Familiar	18	39
	Very familiar	7	15
2. How helpful would it be to add Technology Connections as a prominent section in the sidebar of the PLT high school modules?	Not helpful	2	4
	Slightly helpful	2	4
	Fairly helpful	21	46
	Very helpful	20	44
3. How comfortable are you at using technology tools (software and hardware) with PLT?	Very uncomfortable	0	0
	Uncomfortable	4	9
	Comfortable	30	65
	Very Comfortable	12	26
4. How often do you integrate Technology Connections as part of the learning experience with teaching a PLT activity?	I do not integrate technology	4	9
	I seldom integrate technology	19	41
	I often integrate technology	21	46
	I always integrate technology	2	4

Item Analysis

Results of reliability testing for all items in the nine constructs (Sections 2-10) of the survey are presented in Table 3-3. Higher mean summated scale scores represent greater levels of agreement with each statement in the construct.

Table 3-3. Summated scale scores of pilot study survey IPI constructs

IPI Construct	Cronbach's Alpha	Summated Scale Score[a] (Min/Max)	Mean Summated Scale Scores (SD)
Level of Innovativeness *(6 items)*	0.51*	6/42	27.58 (4.65)
Dissatisfaction with the Status Quo *(4 items)*	0.70	4/28	18.28 (4.71)
Knowledge and Skills *(4 items)*	0.70	4/28	17.69 (4.62)
Resources *(4 items)*	0.72	4/28	18.54 (4.59)
Time *(4 items)*	0.48*	4/28	17.59 (3.78)

Rewards and Incentives *(4 items)*	0.84	4/28	19.96 (5.38)
Participation *(4 items)*	0.80	4/28	17.65 (4.56)
Commitment *(4 items)*	0.91	4/28	17.44 (5.72)
Leadership *(4 items)*	0.82	4/28	18.65 (4.90)

Note. *Scores below the 0.7 recommended threshold (Nunnly, 1978)
[a] Item response scales were 1 = Strongly Disagree to 7 = Strongly Agree

Of the nine constructs in the pilot survey, only Level of Innovativeness (Section 2) and Time (Section 6) had alpha coefficients below the acceptable threshold of 0.70 (Nunnly, 1978). Level of Innovativeness had six items and a Cronbach's alpha coefficient of 0.51. The construct of Time had four items and a Cronbach's alpha coefficient of 0.48. Item analysis statistics revealed that deleting items within each of these two constructs would lower the reliability scores. Therefore, all items were retained.

Study

Based on the results of the pilot, the structure of the PLT Implementation Profile Inventory Survey (Appendix C) required changes before collecting data for the main study. The changes made to the study survey instrument focused primarily on modifying items in Section 1. The revised PLT Implementation Profile Inventory (Appendix E) was submitted to University of Georgia IRB office on August 2, 2010, and approved on August 10, 2010.

A prenotification email informing potential participants about the survey was sent to 44,785 individuals on the PLT email distribution list on August 3, 2010. The practice of sending a prenotification letter increases response rates of paper surveys and internet surveys (Dillman, 1991 & 2007; Dillman, Clark, & Sinclair, 1995). The prenotification sent for this study informed participants another email containing the link to the internet survey would be sent on August 10, 2010.

On August 10, 2010 a total of 43,423 individuals received the first email notification that the PLT IPI Survey was open, and they were invited to click on the link to complete the survey. The purpose and procedures of the survey were restated and the link to the PLT IPI Survey created using SurveyMonkey was prominently displayed within the email text. The first follow-up email was sent August 24, 2010 to 43,096 individuals. The second follow-up email was sent September 21, 2010 to 41,549 individuals. The second email reminder encouraged recipients to complete the survey and informed them the survey will officially close on October 5, 2010 at midnight. The PLT email distribution list database was purged of undeliverable emails after each mailing event. Purging of the database of undelivered emails is the reason the number of individuals receiving the email notifications between August 3, 2010 and September 21, 2010 is different.

Data Collection Tool

Data for this study were collected using the PLT Implementation Profile Inventory (IPI) Survey (Appendix E). This survey instrument was developed using SurveyMonkey, an Internet survey tool available at www.surveymonkey.com. Using the Internet to conduct survey research has the advantage of providing anonymity (Simsek & Veiga, 2000) and is considered a valid and useful tool to collect data (Dillman, 2007).

The survey created for this study was modeled after the Implementation Profile Inventory (IPI) developed by Ensminger and Surry (2008). The IPI model was selected because it is aligned with Ely's (1990, 1999) eight conditions for implementation of a technology innovation. Other change models were evaluated prior to selecting the IPI model.

The RIPPLES model (resources, infrastructure, people, policies, learning, evaluation, and support) is similar to the IPI, but was deemed inappropriate for this study because it is designed to evaluate implementation of technology by higher education organizations (Ensminger & Surry, 2008). Another education change model evaluated for use in this study was the Concerns Based Adoption Model (CBAM) created by Hall and Hord (1987). The CBAM was eliminated because it is used to identify organizational process changes that must occur when implementing a technology innovation. This study focused on members of the PLT community of practice, not the PLT organization.

The questions used in the original IPI survey created by Ensminger and Surry (2008) were modified for this study. Modifications focused on inserting appropriate language familiar to members of the PLT community of practice (Appendix D). The final survey instrument used in this study was constructed with 10 sections, and had a total of 44 items (Appendix E).

Data Analysis

Research Question 1

Prior to any analysis, alpha was set ($\alpha = 0.05$) for tests of significance. Analysis of Variance (ANOVA) was used to evaluate mean score differences for each of the eight IPI conditions between the three PLT primary role groups (educator, facilitator, and state coordinator). Cohen's d (effect size) was used to compare mean differences that were found to be significantly different at alpha = 0.05. Effect sizes will be evaluated as small (0.2), medium (0.5), or large (≥ 0.8) (Brand, Bradley, Best, & Stoica, 2008; Cohen, 1988). To test for homogeneity of variances and verify this assumption of ANOVA, Levene's statistic was used. If the Levene statistic indicated significance ($p \leq 0.05$) the value from the Games-Howell post-hoc multiple comparison analysis was reported. If the Levene statistic was not significant then the value from the Tukey post-hoc multiple comparison analysis was reported.

Research Question 2

Examining the potential association between the conditions to implement and level of use is a vital aspect of this study. Correlation has been used to evaluate what factors impact implementation of computer technologies by others (Wozney, Venkatesh, & Abrami 2006). The Pearson Correlation Coefficient (r) was used to examine the relationships between the IPI conditions (independent variable) and the level of use of technology tools (dependent variable). The Pearson Correlation Coefficient was used in this study instead of the Spearman correlation because Spearman is a nonparametric correlation based on rank order of the data and not the values (Vaske, 2008).

Research Question 3

A backward regression analysis was used to determine the regression model for the eight IPI conditions. The backward method was selected because all independent variables are included in the model at the beginning, and variables that explain the least amount of variance in the dependent variable are removed in sequential order (Vaske, 2008). The level of technology use was the dependent variable for this analysis. To test for homogeneity of variances and verify this assumption of ANOVA, Levene's statistic was used. If the Levene statistic indicated significance ($p \leq 0.05$) the value from the Games-Howell post-hoc multiple comparison analysis was reported. If the Levene statistic was not significant then the value from the Tukey post-hoc multiple comparison analysis was reported. Effect was defined as the ability of each independent variable to significantly explain additional variance as examined using the R-squared statistic in the regression analysis.

Research Question 4

Various analysis procedures were used to characterize PLT educators most likely to implement Technology Connections when using the PLT materials. Significantly associated independent variables from the regression model were used to describe the characteristics of PLT educators most likely to implement technology. Interaction effects were not tested because the scope of this question was not focused on the change in the relationship between independent variables (S. Olejnik, Professor Emeritus, personal communication, April 6, 2011). Additional analysis techniques included ANOVA, t-test, and descriptive statistics. Cohen's d was used to compare mean differences that were found to be significantly different at alpha = 0.05. Effect sizes were evaluated as small (0.2), medium (0.5), or large (≥ 0.8). To test for homogeneity of variances and verify this assumption of ANOVA, Levene's statistic was used. If the Levene statistic indicated significance ($p \leq 0.05$) the value from the Games-Howell post-hoc multiple comparison analysis was reported. If the Levene statistic was not significant then the value from the Tukey post-hoc multiple comparison analysis was reported.

Summary

The eight conditions (Sections 2-9) in the PLT IPI Survey, containing four items each, were subjected to reliability testing using Cronbach's Alpha (Cronbach, 1951). Descriptive statistics (frequencies, means, and standard deviations) were used to analyze demographic data. State of residence was collected using the two letter state code and collapsed into the four PLT regions (Northeast, North Central, South, and West). The Pearson's correlation coefficient was used to identify which conditions for implementation were to be included in the regression analysis. The backward regression method produced a reduced model containing four variables.

This study was guided by four research questions (Figure 3-1), and all data was analyzed using SPSS v.18.

Research Question	Data Analysis Procedure
1. Do the Implementation Profile Inventory scores for each of the eight conditions for implementation differ between PLT educators, facilitators, and state coordinators?	ANOVA
2. Is there a correlation between the eight conditions and the decision to implement technology?	Pearson's Correlation
3. What is the effect of significantly correlated conditions on PLT educator's decision to implement technology?	Multiple Regression Dependent Variable = Level of Use
4. What are the characteristics of a PLT educator who is most likely to implement technology?	Multiple Regression ANOVA t-Test Descriptive statistics

Figure 3-1. Data analysis plan

CHAPTER 4

RESULTS

This chapter presents the results of the data analysis procedures described in Chapter 3. This study was guided by four research questions with the purpose of understanding how the eight conditions originally identified by Ely (1990, 1999), and examined again by Ensminger and Surry (2008), effect implementation of technology by members of the Project Learning Tree community of practice. A description of the participants will be presented first followed by results for each of the four research questions. It is important to remember that there is a difference between PLT educator, facilitator, and state coordinator. However, there are times that 'PLT educator' is used inclusively such as research questions 3 and 4.

Description of Participants

Participants in this study are environmental educators who use the Project Learning Tree (PLT) environmental education curriculum. During the 56-day time period the survey was open, a total of 1,306 participants opened the Internet survey. Of these, a total of 1,194 agreed to the consent form and started the survey, and 112 declined to take the survey. Of the 1,194 participants who started the survey, nearly 68 percent (884) completed the survey.

The first demographic item asked participants to select one of three choices that best describes their primary role with the PLT organization. Of the 767 who responded, 67 percent of them self-identified as a PLT educator. The primary role data is summarized in Table 4-1.

Table 4-1. Primary role of survey participants'

Primary Role	*f*	%
Educator	513	66.9
Facilitator	211	27.5
State Coordinator	43	5.6
Total	767	100

Of the 884 completing the survey, a total of 782 (88%) identified their sex: 642 identified themselves as female and 140 identified themselves as male. Eighty-seven percent of the participants selected the age group matching their current age. Of the 773 answering this item, nearly 62 percent reported being older than 45 (Table 4-2).

Table 4-2. Age of survey participants'

Age	*f*	%
Less than 25	35	4.5
25-34	116	15.0
35-44	144	18.6
45-54	256	33.1
55 and above	222	28.7
Total	773	100

Participants were asked to select the state where they currently live. The data was collapsed into the four PLT regions and is presented in Table 4-3. A total of 785 (89%) responded to this item. The South region produced the over half (52%) of the total number of responses. No responses were received identifying any of the eight international Project Learning Tree partners.

Table 4-3. Frequency and percentage of participants by PLT region

PLT Region	*f*	%
Northeast (CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT, WV)	69	9.0
North Central (IL, IN, IA, KS, MI, MN, MO, ND, NE, OH, SD, WI)	135	17.0
South (AL, AR, FL, GA, KY, LA, MS, NC, OK, SC, TN, TX, VA)	408	52.0
West (AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA, WY)	173	22.0
Total	785	100

When asked to identify the educational setting where the participant uses PLT most often, a total of 745 (84%) responded. The Primary school (32.8%) and Middle school (19.9%) were the educational settings where over half of the participants use PLT materials most often. A summary of the data is presented in Table 4-4. In addition to the ten items listed in Table 4-4, an "Other" category yielded a total of 86 responses. The qualitative responses were examined, and three common domains were identified: Unique, Professional Development/Adult Education, and K-12 Inclusive (Table 4-5).

Table 4-4. Educational setting where survey participants use PLT most often

Setting	*f*	%
Early Childhood (Age 3-6 yrs.)	36	4.8
Preschool (Grades PreK-2)	79	10.6
Primary School (Grades 3-5)	244	32.8
Middle School (Grades 6-8)	148	19.9
High School (Grades 9-12)	78	10.5
College	49	6.6
Nature Center (All ages)	56	7.5
Museum (All ages)	9	1.2
Community Youth Program (Grades PreK-12)	37	5.0
Scouts	9	1.2
Total	745	100

Table 4-5. Domains identified under "Other" educational setting category

Domains	*f*	%
Unique (Zoo, Gifted, Summer Camp, 4-H, etc.)	34	40
Professional Development/Adult Ed.	28	32
K-12 Inclusive	24	28
Total	86	100

The focus of this survey was the implementation of Technology Connections which is part of the PLT *PreK-8 Environmental Education Activity Guide*. Therefore, it was important to know how many participants use the *PreK-8 Environmental Education Activity Guide* most often. A total of 756 (86%) responded to this item, of which, 650 (86%) indicated they use the PLT PreK-8 Activity Guide most often (Table 4-6).

Table 4-6. PLT Activity Guide used most often

Guide	*f*	%
PreK-8 Activity Guide	650	86
High School Modules	106	14
Total	756	100

The *PLT PreK-8 Environmental Education Activity Guide* was revised in late 2006, and "Technology Connections" was a new addition to the instructional design of the publication. Participants were asked to identify when they completed a PLT workshop where they received a copy of the most recently published guide. A total of 735 (83%) answered this item, with 214 (32%) indicating they completed a training "Prior to December 2006", and 521 (68%) indicating they completed a training after "January 1, 2007."

Section 1 of the survey (Appendix E) was structured to gather data about participant's level of familiarity with Technology Connections, level of use of technology tools (dependent variable for study), level of agreement about the importance to incorporate technology tools when recommend to do so in the PLT activity, and level of confidence in ability to use technology tools when teaching with the PLT curriculum.

A total of 893 participants responded when asked about their level of familiarity with Technology Connections as it is presented in the PLT PreK-8 Activity Guide (Table 4-7). This is the only item that had more responses than the total number of participants completing the survey. Possible response values ranged from 1 to 4, and the mean response to this question was 2.14 (SD = 0.91).

Table 4-7. Level of familiarity with Technology Connections

Level of Familiarity	*f*	%
Not familiar	244	27.3
Somewhat familiar	354	39.6
Familiar	224	25.1
Very familiar	71	8.0
Total	893	100

The PLT PreK-8 Activity Guide recommends the use of eight different technology tools. The top three technology tools used by survey participants were Internet resources, word processing software, and presentation software, with mean scores of 3.34, 2.85, and 2.72, respectfully. Participant's self-reported level of use for the eight technology tools is summarized in Table 4-8.

Table 4-8. Level of use of technology tools (dependent variable)

Technology Tools	Frequency of Response (%) 1*	2	3	4	5	Mean (SD)
Word Processing Software	211 (24.7)	168 (19.7)	150 (17.6)	187 (21.9)	137 (16.1)	2.85 (1.424)
Spreadsheet/Database Software	286 (33.6)	261 (30.6)	139 (16.3)	123 (14.4)	43 (5.0)	2.27 (1.209)
Presentation Software	221 (26.2)	181 (21.4)	151 (17.9)	195 (23.1)	97 (11.5)	2.72 (1.37)
Graphic Software	309 (37.0)	210 (25.1)	145 (17.3)	120 (14.4)	52 (6.2)	2.28 (1.226)
Graphic Organizer Software	334 (39.8)	213 (25.4)	135 (16.1)	119 (14.2)	38 (4.5)	2.18 (1.226)
Digital/Video Cameras	255 (30.1)	199 (23.5)	173 (20.4)	140 (16.5)	81 (9.6)	2.52 (1.325)
Peripherals	364 (43.7)	219 (26.3)	127 (15.2)	91 (10.9)	32 (3.8)	2.05 (1.171)
Internet Resources	126 (14.9)	121 (14.3)	146 (17.2)	245 (28.9)	209 (24.7)	3.34 (1.378)

Note. *Response Values: 1 = Never (0% of the time); 2 = Seldom (about 25% of the time); 3 = About half the time; 4 = Usually (about 75% of the time); and 5 = Always (100% of the time)

Nearly 62 percent of the participants agreed it is important to incorporate technology tools when recommended for use in the PLT PreK-8 Activity Guide (Table 4-9).

Table 4-9. Level of importance to incorporate technology tools

Item	Frequency of Response (%) 1*	2	3	4	5	6	7	Mean (SD)
It is important to incorporate technology tools when it is recommended in the PLT PreK-8 Activity Guide.	17 (2.0)	57 (6.6)	83 (9.6)	177 (20.4)	145 (16.7)	164 (18.9)	225 (25.9)	5.04 (1.65)

Note. *Response values where 1=Strongly Disagree to 7=Strongly Agree

When asked about the level of confidence participant's have in their ability to use technology tools when teaching with the PLT curriculum, 67 percent indicated they had confidence in their ability to use technology tools (Table 4-10).

Table 4-10. Level of confidence to use technology tools

Item	Frequency of Response (%)							Mean (SD)
	1*	2	3	4	5	6	7	
I am confident in my ability to use technology tools when teaching with the PLT curriculum.	30 (3.5)	63 (7.2)	68 (7.8)	127 (14.6)	154 (17.7)	192 (22.1)	235 (27.0)	5.10 (1.72)

Note. *Response values where 1=Strongly Disagree to 7=Strongly Agree

Cronbach's alpha was computed to examine the reliability for the eight IPI conditions (Table 4-11). The reliability score for the "Time" condition (0.41) was the only condition found to have a score below the target of 0.70 (Nunnly, 1978).

Table 4-11. Reliability coefficients for conditions

Condition	N	Cronbach's Alpha (α)	Scale Scores (Max/Min)	Mean Summated Scale Scores (SD)
Status Quo	830	0.78	4/28	20.87 (4.71)
Knowledge & Skills	815	0.71	4/28	20.31 (4.90)
Resources	806	0.80	4/28	20.27 (4.91)
Time	791	0.41	4/28	18.23 (3.83)
Rewards & Incentives	801	0.81	4/28	19.28 (5.17)
Participation	793	0.87	4/28	17.28 (5.40)
Commitment	784	0.86	4/28	17.46 (5.42)
Leadership	779	0.78	4/28	19.07 (4.93)

Research Question 1

Do the Implementation Profile Inventory scores for each of the eight conditions for implementation differ between PLT educators, facilitators, and state coordinators?

The analysis of variance (ANOVA) for condition scores for the three primary role groups are presented in Table 4-12. Results of the ANOVA indicate that five of the eight conditions are significant at the alpha = 0.05 level.

Table 4-12. ANOVA for conditions by primary role

Conditions		Sum of Squares	df	Mean Square	F	Sig.
Status Quo	Between Groups	.899	2	.449	.021	.979
	Within Groups	16374.124	756	21.659		
	Total	16375.022	758			
Knowledge & Skills	Between Groups	143.889	2	71.945	3.033	.049*
	Within Groups	17764.524	749	23.718		
	Total	17908.414	751			
Resources	Between Groups	218.629	2	109.315	4.714	.009*
	Within Groups	17438.160	752	23.189		
	Total	17656.789	754			
Time	Between Groups	396.800	2	198.400	14.222	.000*
	Within Groups	10379.202	744	13.951		
	Total	10776.003	746			
Rewards & Incentives	Between Groups	391.852	2	195.926	7.544	.001*
	Within Groups	19660.084	757	25.971		
	Total	20051.936	759			
Participation	Between Groups	27.660	2	13.830	.476	.621
	Within Groups	21954.451	756	29.040		
	Total	21982.111	758			
Commitment	Between Groups	224.031	2	112.016	3.869	.021*
	Within Groups	21744.554	751	28.954		
	Total	21968.585	753			
Leadership	Between Groups	498.264	2	249.132	10.524	.000*
	Within Groups	17659.843	746	23.673		
	Total	18158.107	748			

Note. *Significant at alpha = 0.05

Based on the mean condition scores (Table 4-13), post hoc comparisons found no significant difference between the three primary role groups for conditions of status quo, knowledge & skills, and participation (Table 4-14). Five conditions were found to have significant differences between Group 1 and Group 2, and three conditions were found to be significantly different between Group 1 and Group 3. No significant differences were found between Group 2 and Group 3.

Table 4-13. Mean condition scores by primary role group

	N			Mean Summated Scale Score[b] (SD)		
Condition	1[a]	2	3	1[a]	2	3
Status Quo	506	210	43	20.84 (4.59)	20.89 (4.81)	20.98 (4.60)
Knowledge & Skills	501	208	43	20.66 (4.91)	19.73 (5.0)	19.72 (3.57)
Resources	504	209	42	20.68 (4.74)	19.72 (5.02)	18.98 (4.73)
Time	497	207	43	18.75 (3.69)	17.27 (3.94)	16.93 (3.10)
Rewards & Incentives	508	209	43	19.76 (5.10)	18.33 (5.29)	17.86 (4.04)
Participation	507	209	43	17.36 (5.52)	16.93 (5.25)	17.16 (4.36)
Commitment	502	209	43	17.79 (5.40)	16.57 (5.59)	17.79 (3.85)
Leadership	499	208	42	19.59 (4.76)	18.32 (5.19)	16.64 (4.43)

Note. [a]Primary Role: 1=Educator, 2=Facilitator, and 3=State Coordinator
[b]Summated Scale Score min/max for each condition = 4/28

Table 4-14. Post hoc comparison of mean condition scores by primary role

Condition	Mean Comparison of Primary Role Groups p-value (Effect Size[a]) Group 1 – Group 2	Group 1 – Group 3	Group 2 – Group 3
Status Quo	.992	.982	.993
Knowledge & Skills	.063	.257	1.0
Resources	.040* (0.2)	.070	.634
Time	.000* (0.4)	.006* (0.5)	.850
Rewards & Incentives	.003* (0.3)	.015* (0.4)	.790
Participation	.588	.959	.949
Commitment	.021* (0.2)	1.0	.198
Leadership	.005* (0.3)	.001* (0.6)	.103

Note. *Significant at alpha = 0.05.
[a]Effect Size calculated using Cohen's d where small = 0.3, medium = 0.5, and large = 0.8

Research Question 2

Is there a correlation between the eight conditions and the decision to implement technology?

The Pearson Correlation Coefficient was used to determine if any relationships exit between the IPI conditions and the self-reported level of use of technology tools recommended in the PLT *PreK-8 Environmental Education Activity Guide*. Six of the eight conditions were found to have significant positive Pearson Correlation values at the 0.05 level, and Participation had medium positive correlation. Pearson correlation values were not significant for conditions of Knowledge & Skills and Resources (Table 4-15).

Table 4-15. Pearson correlation coefficients for conditions

Condition	N	Mean Summated Scale Score (SD)	Pearson Correlation Coefficient (r)	p-value
Status Quo	758	20.87 (4.71)	.140	.000*
Knowledge & Skills	744	20.31 (4.90)	-.007	.842
Resources	739	20.27 (4.91)	.019	.597
Time	723	18.23 (3.83)	.080	.031*
Rewards & Incentives	732	19.28 (5.17)	.265	.000*
Participation	725	17.28 (5.39)	.313	.000*
Commitment	718	17.46 (5.42)	.249	.000*
Leadership	710	19.07 (4.93)	.262	.000*

Note. *Significant at alpha = 0.05 (2-tailed)

Research Question 3

What is the effect of significantly correlated conditions on PLT educator's decision to implement technology?

ANOVA of the full regression model (6 variables) and reduced regression model (4 variables) were both significant (Table 4-16). Evaluation of the tolerance and variance inflation factor (VIF) indicated multicollinearity was not present in either model.

Table 4-16. ANOVA of regression for significantly correlated conditions

Model (Full)	Sum of Squares	df	Mean Square	F	Sig.
Regression	5642.191	6	940.365	13.721	.000*
Residual	45780.541	668	68.534		
Total	51422.732	674			
Model (Reduced)					
Regression	5570.700	4	1392.675	20.350	.000*
Residual	45852.032	670	68.436		
Total	51422.732	674			

Note. *Significant at alpha = 0.05.

The coefficients for the full and reduced regression models were level of use of technology tools was used as the dependent variable are presented in Table 4-17. The significantly correlated conditions in the reduced model accounted for nearly 11% of the variability in the level of use of technology by PLT educators, facilitators, and state coordinators.

Table 4-17. Regression coefficients for full and reduced models

	Unstandardized Coefficients		Standardized Coefficients	
Model (Full)[a]	B	Std. Error	Beta	Sig.
Constant	11.365	1.909		
Status Quo	.018	.074	.010	.810
Time	-.324	.109	-.140	.003*
Rewards & Incentives	.185	.080	.109	.022*
Participation	.324	.079	.197	.000*
Commitment	.091	.095	.056	.337
Leadership	.188	.105	.104	.074*
Model (Reduced)[b]				
Constant	11.416	1.689		
Time	-.302	.106	-.131	.004*
Rewards & Incentives	.195	.079	.115	.014*
Participation	.346	.075	.211	.000*
Leadership	.237	.092	.132	.010*

Note. [a]R^2 = .110 and Adjusted R^2 = .102
[b]R^2 = .108 and Adjusted R^2 = .103
* Significant at alpha = 0.05

Using the Coefficient values for the reduced model (Table 4-17), the regression equation to predict level of use of technology takes the form of:

Level of Use of Technology = -.302(T) + .195(R&I) + .346 (P) + .237(L) + 11.416

Where: T = Summed score for Time condition
R&I = Summed score for Rewards & Incentives condition
P = Summed score for Participation condition
L = Summed score for Leadership condition

Research Question 4

What are the characteristics of a PLT educator who is most likely to implement technology?

Five demographic items in Section 10 of the PLT IPI survey (Appendix E) were analyzed against the four items of Section 1 of the PLT IPI survey. The demographic data collected from the items in Section 10 included:

1. Date participant completed a PLT educator training where they received a new PLT PreK-8 Activity Guide.
2. Primary Role with PLT
3. Sex
4. Age
5. PLT Region

The data collected from the four items in Section 1 included:

1. Familiarity with Technology Connections;
2. Level of use of each technology tools;
3. Level of importance to incorporate technology tools; and,
4. Level of confidence in ability to use technology tools.

Date of Training

The mean score for those who completed PLT training prior to December 2006 was 2.01, while those completing training after January 1, 2007 had a mean score of 2.29. There was a significant difference between these mean scores ($p<.001$), and the effect size (0.3) was small. The results are presented in Table 4-18.

Table 4-18. Level of familiarity with Technology Connections by date of training

Date of Training	N	Mean[a] (SD)	Mean Difference	t-statistic	df	p-value	Effect Size[b]
Before December 2006	238	2.01 (0.93)	0.28	4.03	753	.000*	0.3
After January 1, 2007	517	2.29 (0.87)					

Note. *Significant at alpha = 0.05.
[a]Mean where 1=Not familiar, 2=Somewhat familiar, 3=Familiar, and 4=Very familiar
[b]Effect Size was calculated using Cohen's d where small = 0.3, medium = 0.5, and large = 0.8

There was a significant difference ($p<.01$) between sample means for the level of agreement when participants where asked to rate the importance to incorporate technology tools when it is recommended in the PLT PreK-8 Activity Guide (Table 4-19).

Table 4-19. Level of importance to incorporate technology tools by date of training

Date of Training	N	Mean[a] (SD)	Mean Difference	t-statistic	df	p-value	Effect Size[b]
Before December 2006	236	4.74 (1.71)	0.399	3.101	753	.002*	0.2
After January 1, 2007	519	5.14 (1.61)					

Note. *Significant at alpha = 0.05
[a]Mean: 1=Strongly Disagree to 7=Strongly Agree
[b]Effect Size was calculated using Cohen's d where small = 0.3, medium = 0.5, and large = 0.8

There was no significant difference between the mean scores of the groups when asked about the level of confidence they have in their ability to use technology tools (Table 4-20).

Table 4-20. Confidence in ability to use technology tools by date of training

Date of Training	N	Mean[a] (SD)	Mean Difference	t-statistic	df	p-value
Before December 2006	237	5.03 (1.76)	-0.087	-0.645	753	.519
After January 1, 2007	518	5.11 (1.69)				

Note. [a]Mean: 1=Strongly Disagree to 7=Strongly Agree

There was no significant difference when date of training was analyzed against the summated scale scores for each of the eight IPI conditions (Table 4-21).

Table 4-21. Independent sample t-test for condition score by date of training

Condition	Group[a]	N	Mean[b] (SD)	t	df	p-value
Status Quo	1	238	20.83 (4.56)	-.272	752	.786
	2	516	20.93 (4.64)			
Knowledge & Skills	1	234	20.20 (4.60)	-.521	746	.603
	2	514	20.40 (4.99)			
Resources	1	235	20.30 (4.58)	-.146	748	.884
	2	515	20.35 (4.93)			
Time	1	231	17.86 (3.72)	-1.686	740	.092
	2	511	18.37 (3.84)			
Rewards & Incentives	1	238	19.25 (5.26)	.222	753	.825
	2	517	19.16 (5.12)			
Participation	1	238	17.29 (5.37)	.483	752	.629
	2	516	17.09 (5.36)			

Commitment	1	237	17.13 (5.70)	-.914	748	.361
	2	513	17.51 (5.27)			
Leadership	1	235	19.02 (4.96)	-.123	744	.902
	2	511	19.06 (4.91)			

The dependent variable in this study was the self-reported level of use for the eight technology tools presented in the PLT *PreK-8 Environmental Education Activity Guide*. Participants were asked to rate their level of use for the eight technology tools, where 1 = Never and 5 = Always. No mean differences greater than 1.0 where found between the groups, and all were found to be significantly different with less than small effect sizes (Table 4-22).

Table 4-22. Level of use of technology tools by date of training

Technology Tools	Group[a]	N	Mean[b] (SD)	t	df	p-value (Effect Size[c])
Word Processing Software	1	230	2.64 (1.37)	2.515	741	.012* (0.2)
	2	513	2.92 (1.41)			
Spreadsheet/ Database Software	1	229	2.07 (1.12)	3.168	482	.001* (0.2)
	2	512	2.37 (1.24)			
Presentation Software	1	226	2.52 (1.34)	2.892	735	.004* (0.2)
	2	511	2.83 (1.34)			
Graphic Software	1	222	2.10 (1.22)	2.711	726	.007* (0.2)
	2	506	2.37 (1.27)			

Graphic Organizer Software	1	225	1.98 (1.14)	3.134	464	.002* (0.2)
	2	506	2.28 (1.24)			
Digital/Video Cameras	1	228	2.39 (1.23)	2.242	475	.025* (0.2)
	2	511	2.61 (1.35)			
Peripherals	1	225	1.92 (1.08)	2.393	479	.017* (0.2)
	2	504	2.13 (1.21)			
Internet Resources	1	227	3.15 (1.36)	2.952	736	.003* (0.2)
	2	511	3.46 (1.34)			

Note. *Significant at alpha = 0.05.
[a]Groups: 1=Before December 2006 and 2=After January 1, 2007
[b]Scale: Response Values: 1 = Never (0% of the time); 2 = Seldom (about 25% of the time); 3 = About half the time; 4 = Usually (about 75% of the time); and 5 = Always (100% of the time)
[c]Effect Size was calculated using Cohen's d where small = 0.3, medium = 0.5, and large = 0.8

Primary Role

The PLT organization recognizes three primary roles within the organization: educator, facilitator, and state coordinator. The level of familiarity with the Technology Connections by the three primary role groups was subjected to ANOVA ($F(2, 757) = 26.105$, $p = .000$), and the mean differences between groups were found to be significantly different ($p<.001$). Post hoc comparisons of the group means indicated significant differences between groups (Table 4-23).

Table 4-23. Level of familiarity with Technology Connections by primary role group

Primary Role[a]	N	Mean[b] (SD)	Mean differences between Primary Role Groups (p-value/Effect Size[c]) Group 1 – Group 2	Group 1 – Group 3	Group 2 – Group 3
Group 1	508	2.06 (0.83)			
Group 2	209	2.41 (0.96)	0.342 (.000*/0.4)	0.842 (.000*/0.2)	0.500 (.003*/0.2)
Group 3	43	2.21 (0.87)			

Note. *Significant at alpha = 0.05.
[a]Primary Role Groups: 1=Educator; Group 2=Facilitator; Group 3=State Coordinator
[b]Mean where 1=Not familiar, 2 = Somewhat familiar, 3 = Familiar, and 4=Very familiar.
[c]Effect Size was calculated using Cohen's d where small = 0.3, medium = 0.5, and large = 0.8

When asked about the importance of incorporating use of technology tools when it is recommended in the PLT PreK-8 Activity Guide, the between group difference was significant ($F(2, 757) = 6.215$, $p<.01$). Post hoc comparisons found a medium effect size between educators and state coordinators (Table 4-24).

Table 4-24. Level of importance to incorporate technology tools by primary role group

Primary Role[a]	N	Mean[b] (SD)	Mean differences between Primary Role Groups (p-value/Effect Size[c]) Group 1 – Group 2	Group 1 – Group 3	Group 2 – Group 3
Group 1	508	5.15 (1.65)			
Group 2	209	4.87 (1.65)	0.275 (.107)	0.820 (.002*/0.5)	0.545 (.072)
Group 3	43	4.33 (1.41)			

Note. *Significant at alpha = 0.05.
[a]Primary Role Groups: 1=Educator; Group 2=Facilitator; Group 3=State Coordinator
[b]Mean based on scale where 1 = Strongly Disagree to 7 = Strongly Agree.
[c]Effect Size was calculated using Cohen's d where small = 0.3, medium = 0.5, and large = 0.8

When asked about the level of confidence in ability to use technology tools significant differences were found between the primary role groups F (2, 757) = 6.824, p = .001. A medium effect size was found for the difference between facilitators and state coordinators (Table 4-25).

Table 4-25. Confidence to use technology tools by primary role group

			Mean differences between Groups (p-value/Effect Size[c])		
Primary Role[a]	N	Mean[b] (SD)	Group 1 – Group 2	Group 1 – Group 3	Group 2 – Group 3
Group 1	507	5.03 (1.73)			
Group 2	210	5.43 (1.58)	0.399 (.008*/0.2)	0.495 (.147)	0.894 (.005*/0.6)
Group 3	43	4.53 (1.62)			

Note. *Significant at alpha = 0.05.
[a]Group 1 = Educator; Group 2 = Facilitator; Group 3 = State Coordinator
[b]Mean based on scale where 1 = Strongly Disagree to 7 = Strongly Agree
[c]Effect Size was calculated using Cohen's d where small = 0.3, medium = 0.5, and large = 0.8

The ANOVA indicated between group means were significantly different (p<.05) for the conditions of knowledge & skills, resources, time, rewards & incentives, commitment, and leadership (Table 4-26).

Table 4-26. ANOVA for conditions by primary role group

Conditions		Sum of Squares	df	Mean Square	F	Sig.
Status Quo	Between Groups	.899	2	.449	.021	.979
	Within Groups	16374.124	756	21.659		
	Total	16375.022	758			
Knowledge & Skills	Between Groups	143.889	2	71.945	3.033	.049*
	Within Groups	17764.524	749	23.718		
	Total	17908.414	751			
Resources	Between Groups	218.629	2	109.315	4.714	.009*
	Within Groups	17438.160	752	23.189		
	Total	17656.789	754			
Time	Between Groups	396.800	2	198.400	14.222	.000*
	Within Groups	10379.202	744	13.951		
	Total	10776.003	746			

Rewards & Incentives	Between Groups	391.852	2	195.926	7.544	.001*
	Within Groups	19660.084	757	25.971		
	Total	20051.936	759			
Participation	Between Groups	27.660	2	13.830	.476	.621
	Within Groups	21954.451	756	29.040		
	Total	21982.111	758			
Commitment	Between Groups	224.031	2	112.016	3.869	.021*
	Within Groups	21744.554	751	28.954		
	Total	21968.585	753			
Leadership	Between Groups	498.264	2	249.132	10.524	.000*
	Within Groups	17659.843	746	23.673		
	Total	18158.107	748			

Note. *Significant at alpha = 0.05

Post hoc comparisons found significant differences (p<.05) between the educator group and both the facilitator and state coordinator groups, but not between the facilitator and states coordinator groups (Table 4-27).

Table 4-27. Post hoc comparison of condition means by primary role group

Condition	Primary Role Group[a]	N	Mean[b] (SD)	Mean Differences between Groups (p-value/Effect Size[c]) Group 1 – Group 2	Group 1– Group 3	Group 2 – Group 3
Status Quo	Group 1	506	20.84 (4.59)	0.05 (.992)	0.14 (.982)	0.09 (.993)
	Group 2	210	20.89 (4.81)			
	Group 3	43	20.98 (4.59)			
Knowledge & Skills	Group 1	501	20.66 (4.90)	0.93 (.063)	0.94 (.257)	0.01 (1.0)
	Group 2	208	19.73 (5.00)			
	Group 3	43	19.72 (3.58)			
Resources	Group 1	504	20.68 (4.74)	0.97 (.047*/0.2)	1.71 (.073)	0.74 (.631)
	Group 2	209	19.72 (5.02)			
	Group 3	42	18.98 (4.73)			

Time	Group 1	497	18.75 (3.70)			
	Group 2	207	17.27 (3.94)	1.48 (.000*/0.4)	1.82 (.002*/0.5)	0.34 (.808)
	Group 3	43	16.93 (3.10)			
Rewards & Incentives	Group 1	508	19.76 (5.10)			
	Group 2	209	18.33 (5.29)	1.43 (.003*/0.3)	1.90 (.015*/0.4)	0.47 (.790)
	Group 3	43	17.86 (4.04)			
Participation	Group 1	507	17.36 (5.52)			
	Group 2	209	16.93 (5.25)	0.43 (.588)	0.20 (.959)	0.23 (.949)
	Group 3	43	17.16 (4.36)			
Commitment	Group 1	502	17.79 (5.40)			
	Group 2	209	16.60 (5.59)	1.19 (.021*/0.2)	0.00 (1.0)	1.19 (.198)
	Group 3	43	17.79 (3.85)			
Leadership	Group 1	499	19.60 (4.76)			
	Group 2	208	18.32 (5.19)	1.28 (.007*/0.3)	2.96 (.000*/0.6)	1.68 (.083)
	Group 3	42	16.64 (4.43)			

Note. *Significant at alpha = 0.05
[a]Group 1 = Educator; Group 2 = Facilitator; Group 3 = State Coordinator
[b]Means are based on summated scores where minimum = 4 and maximum = 28
[c]Effect Size was calculated using Cohen's d where small = 0.3, medium = 0.5, and large = 0.8

Significant differences ($p<.05$) between primary role groups' mean level of use were found for six of the eight technology tools. The ANOVA is presented in Table 4-28.

Table 4-28. ANOVA for level of use of technology tools by primary role group

Technology Tools		Sum of Squares	df	Mean Square	F	Sig.
Word Processing Software	Between Groups	27.899	2	13.950	7.219	.001*
	Within Groups	1441.444	746	1.932		
	Total	1469.343	748			
Spreadsheet/Database Software	Between Groups	7.841	2	3.920	2.707	.067
	Within Groups	1077.560	744	1.448		
	Total	1085.400	746			
Presentation Software	Between Groups	16.039	2	8.020	4.441	.012*
	Within Groups	1336.391	740	1.806		
	Total	1352.431	742			
Graphics Software	Between Groups	35.217	2	17.609	11.335	.000*
	Within Groups	1135.629	731	1.554		
	Total	1170.846	733			
Graphic Organizer Software	Between Groups	53.593	2	26.797	18.872	.000*
	Within Groups	1039.405	732	1.420		
	Total	1092.999	734			
Digital/Video Cameras	Between Groups	3.202	2	1.601	.918	.400
	Within Groups	1294.508	742	1.745		
	Total	1297.710	744			
Peripherals	Between Groups	15.337	2	7.669	5.611	.004*
	Within Groups	1000.396	732	1.367		
	Total	1015.733	734			
Internet Resources	Between Groups	15.754	2	7.877	4.368	.013*
	Within Groups	1336.370	741	1.803		
	Total	1352.124	743			

Note. *Significant at alpha = 0.05.
Means based on response values where 1 = Never (0% of the time); 2 = Seldom (about 25% of the time); 3 = About half the time; 4 = Usually (about 75% of the time); and 5 = Always (100% of the time)

Post hoc comparisons of the mean levels of use by primary role groups revealed no differences between the groups and their use of spreadsheet/database software and digital video/cameras. However, significant differences ($p<.05$) were found for the remaining six technology tools (Table 4-29).

Table 4-29. Post hoc comparison of level of use of technology tools by primary role groups

Technology Tools	Primary Role Group[a]	N	Mean[b] (SD)	Mean Differences between Groups (p-value/Effect Size[c]) Group 1 – Group 2	Group 1 – Group 3	Group 2 – Group 3
Word Processing Software	Group 1	502	2.98 (1.42)	0.35 (.007*/0.2)	0.61 (.006*/0.4)	0.26 (.403)
	Group 2	206	2.63 (1.36)			
	Group 3	41	2.37 (1.14)			
Spreadsheet/Database Software	Group 1	501	2.35 (1.24)	0.20 (.096)	0.28 (.224)	0.08 (.898)
	Group 2	205	2.15 (1.15)			
	Group 3	41	2.07 (1.01)			
Presentation Software	Group 1	498	2.85 (1.38)	0.27 (.042*/0.2)	0.47 (.056)	0.20 (.590)
	Group 2	205	2.58 (1.30)			
	Group 3	40	2.38 (1.19)			
Graphics Software	Group 1	491	2.44 (1.30)	0.38 (.001*/0.3)	0.73 (.000*/0.6)	0.35 (.080)
	Group 2	202	2.06 (1.17)			
	Group 3	41	1.71 (0.90)			
Graphic Organizer Software	Group 1	492	2.38 (1.26)	0.51 (.000*/0.4)	0.78 (.000*/0.6)	0.27 (.163)
	Group 2	203	1.87 (1.09)			
	Group 3	40	1.60 (0.78)			
Digital/Video Cameras	Group 1	498	2.59 (1.32)	0.07 (.814)	0.27 (.296)	0.20 (.546)
	Group 2	206	2.52 (1.35)			
	Group 3	41	2.32 (1.11)			

Peripherals	Group 1	491	2.15 (1.19)			
	Group 2	203	1.95 (1.16)	0.20 (.082)	0.54 (.006*/0.5)	0.34 (.154)
	Group 3	41	1.61 (1.02)			
Internet Resources	Group 1	498	3.48 (1.36)			
	Group 2	207	3.17 (1.34)	0.31 (.017*/0.2)	0.33 (.212)	0.02 (.997)
	Group 3	39	3.15 (1.11)			

Note. *Significant at alpha = 0.05
[a]Primary Role where Group 1 = Educator; Group 2 = Facilitator; Group 3 = State Coordinator
[b]Means where 1 = Never to 5 = Always
[c]Effect Size was calculated using Cohen's d where small = 0.3, medium = 0.5, and large = 0.8

Sex

There was no difference between males and females with respect to their mean level of familiarity with Technology Connections. The results are presented in Table 4-30.

Table 4-30. Level of familiarity with Technology Connections by males and females

Group	N	Mean[a] (SD)	t-statistic	df	p-value
Males	136	2.13 (0.85)	.688	773	.492
Females	639	2.19 (0.91)			

Note. [a]Mean based on scale where 1 = Not familiar to 4 = Very familiar

No significant difference was found between male and female rating of the level of importance to use technology tools. The results are presented in Table 4-31.

Table 4-31. Post hoc comparison of importance to use technology tools by males and females

Group	N	Mean[a] (SD)	Mean Diff.	t-statistic	df	p-value
Male	138	4.80 (1.56)	0.29	1.859	770	.063
Female	634	5.09 (1.66)				

Note. [a]Mean based on scale where 1 = Strongly Disagree to 7 = Strongly Agree

Table 4-32 shows that male and female participants did not differ in their level of confidence using technology tools when teaching with PLT materials.

Table 4-32. Post hoc comparison of confidence to use technology tools by males and females

Group	N	Mean[a] (SD)	Mean Diff.	t-statistic	df	p-value
Male	139	5.01 (1.60)	0.08	0.468	771	.640
Female	634	5.09 (1.75)				

Note. [a]Means based on score where 1 = Strongly Disagree to 7 = Strongly Agree

Post hoc comparison of the mean condition scores between males and females indicate significant differences between three of the eight conditions: Status Quo, Resources, and Participation. Results are presented in Table 4-33.

Table 4-33. Post hoc comparison of mean condition scores between males and females

Condition	Group	N	Mean[a] (SD)	Mean Diff.	t-statistic	df	p-value (Effect Size[b])
Status Quo	Male	139	20.22 (4.03)	0.79	2.028	231	.044* (0.1)
	Female	633	20.01 (4.76)				
Knowledge & Skills	Male	136	19.99 (4.76)	0.47	1.018	763	.309
	Female	629	20.46 (4.92)				
Resources	Male	138	19.07 (4.71)	1.53	3.434	205	.001* (0.3)
	Female	629	20.60 (4.84)				
Time	Male	139	18.06 (3.53)	0.23	0.648	757	.517
	Female	620	18.29 (3.86)				
Rewards & Incentives	Male	139	19.33 (4.14)	0.03	0.070	770	.944
	Female	633	19.30 (5.38)				

Participation	Male	139	17.96 (4.60)	0.88	1.966	235	.050* (0.2)
	Female	632	17.08 (5.54)				
Commitment	Male	137	17.98 (4.41)	0.63	1.222	763	.222
	Female	628	17.36 (5.64)				
Leadership	Male	135	18.97 (4.54)	0.14	0.289	758	.773
	Female	625	19.11 (5.01)				

Note. [a]Means based on summate scale scores with minimum = 4 and maximum = 28
[b]Effect Size was calculated using Cohen's d where small = 0.3, medium = 0.5, and large = 0.8

The mean difference for the level of use of technology tools by males and females was significant (p<.05) for three of the eight technology tools: Graphic Software, Graphic Organizer Software and Digital Video/Cameras. The results of are presented in Table 4-34.

Table 4-34. Post hoc comparison of level of use of technology tools by males and females

Technology Tools	Group	N	Mean[a] (SD)	Mean Diff.	t	df	p-value (Effect Size[b])
Word Processing Software	Male	138	2.63 (1.29)	0.24	1.831	759	.067
	Female	623	2.87 (1.44)				
Spreadsheet/ Database Software	Male	137	2.23 (1.13)	0.04	0.405	756	.686
	Female	621	2.27 (1.22)				
Presentation Software	Male	137	2.66 (1.26)	0.09	0.487	753	.626
	Female	618	2.73 (1.38)				
Graphic Software	Male	135	2.10 (1.05)	0.21	1.983	234	.049* (0.2)
	Female	610	2.31 (1.30)				

Graphic Organizer Software	Male	134	1.99 (1.05)	0.23	2.273	224	.024* (0.2)
	Female	612	2.22 (1.25)				
Digital/Video Cameras	Male	137	2.31 (1.17)	0.27	2.391	223	.018* (0.2)
	Female	620	2.58 (1.35)				
Peripherals	Male	137	2.01 (1.10)	0.04	0.425	745	.671
	Female	610	2.05 (1.18)				
Internet Resources	Male	136	3.21 (1.34)	0.17	1.322	754	.187
	Female	620	3.38 (1.37)				

Note. *Significant at alpha = 0.05
[a]Mean based on scale where 1 = Never to 5 = Always
[b]Effect Size was calculated using Cohen's d where small = 0.3, medium = 0.5, and large = 0.8

Age

There were no significant differences between the mean levels of familiarity with Technology Connections by age group (Table 4-35).

Table 4-35. Level of familiarity with Technology Connections by age group

Age Group	N	Mean[a] (SD)
Less than 25	35	2.37 (0.81)
25-34	116	2.21 (0.86)
35-44	143	2.25 (0.85)
45-54	255	2.22 (0.95)
55 or more	217	2.07 (0.92)

Note. Mean based on scale where 1 = Not familiar to 4 = Very familiar

All five age groups agreed that it is important to incorporate technology tools when it is recommended in the PLT PreK-8 Activity Guide (Table 4-36). No significant differences ($p<.05$) were found between age groups.

Table 4-36. Level of importance to incorporate technology tools by age group

Age Group	N	Mean[a] (SD)
Less than 25	35	5.77 (1.29)
25-34	113	4.93 (1.53)
35-44	143	5.11 (1.65)
45-54	254	4.98 (1.66)
55 or more	218	5.06 (1.71)

Note. [a]Mean based on scale where 1= Strongly Disagree to 7 = Strongly Agree.

When asked about the level of confidence in ability to use technology tools when teaching with PLT, four of the five age groups had an average rating greater than 5 on a 7 point scale. The 55 or more age group had the lowest mean score of 4.83 (Table 4-37).

Table 4-37. Level of confidence to use technology tools by age group

Age Group	N	Mean[a] (SD)
Less than 25	35	5.69 (1.16)
25-34	114	5.13 (1.55)
35-44	143	5.10 (1.65)
45-54	253	5.15 (1.72)
55 or more	219	4.83 (1.87)

Note. [a]Mean based on scale where 1 = Strongly Disagree to 7 = Strongly Agree.

The ANOVA indicated significant between group differences ($p<.05$) for the level of confidence to use technology tools. Post hoc comparison of means found that the Less than 25 age group was significantly different than the 55 or more age group ($p<.01$), and found to have a medium (0.5) effect size. Mean group condition scores for each of the five age groups are presented in Table 4-38.

Table 4-38. Mean condition scores by age group

Condition	Age Group	N	Mean (SD)
Status Quo	Less than 25	35	22.74 (3.28)
	25-34	115	19.83 (4.67)
	35-44	143	20.88 (4.43)
	45-54	253	20.81 (4.59)
	55 or more	217	21.18 (5.02)
Knowledge & Skills	Less than 25	34	21.47 (3.54)
	25-34	114	20.05 (4.79)
	35-44	143	19.98 (4.99)
	45-54	249	20.41 (4.82)
	55 or more	216	20.55 (5.30)
Resources	Less than 25	35	20.43 (4.90)
	25-34	113	19.57 (4.54)
	35-44	143	19.94 (4.76)
	45-54	251	20.38 (4.76)
	55 or more	216	20.72 (5.26)

Time	Less than 25	34	18.79 (3.04)
	25-34	113	17.78 (3.63)
	35-44	139	17.85 (4.12)
	45-54	250	18.60 (3.74)
	55 or more	215	18.11 (3.93)
Rewards & Incentives	Less than 25	35	21.37 (3.78)
	25-34	115	19.51 (4.99)
	35-44	143	18.40 (5.42)
	45-54	251	19.11 (5.42)
	55 or more	219	19.60 (5.03)
Participation	Less than 25	35	19.71 (4.04)
	25-34	115	17.20 (5.24)
	35-44	140	16.51 (5.40)
	45-54	252	17.24 (5.45)
	55 or more	220	17.30 (5.48)
Commitment	Less than 25	35	19.29 (4.90)
	25-34	115	16.68 (5.07)
	35-44	142	17.27 (5.33)
	45-54	250	17.56 (5.41)
	55 or more	216	17.71 (5.78)

Leadership	Less than 25	35	20.71 (5.67)
	25-34	112	18.75 (4.60)
	35-44	142	18.66 (4.69)
	45-54	249	18.94 (4.89)
	55 or more	214	19.50 (5.16)

The ANOVA (Table 4-39) indicates between group mean condition scores for Status Quo, Rewards & Incentives, and Participation were significant (p<.05).

Table 4-39. ANOVA for mean condition scores by age group

Condition		Sum of Squares	df	Mean Square	F	Sig.
Status Quo	Between Groups	269.709	4	67.427	3.116	.015*
	Within Groups	16400.446	758	21.636		
	Total	16670.155	762			
Knowledge & Skills	Between Groups	81.571	4	20.393	.834	.504
	Within Groups	18356.846	751	24.443		
	Total	18438.417	755			
Resources	Between Groups	117.914	4	29.479	1.238	.293
	Within Groups	17928.351	753	23.809		
	Total	18046.265	757			
Time	Between Groups	91.623	4	22.906	1.567	.181
	Within Groups	10905.972	746	14.619		
	Total	10997.595	750			
Rewards & Incentives	Between Groups	300.355	4	75.089	2.794	.025*
	Within Groups	20370.496	758	26.874		
	Total	20670.852	762			
Participation	Between Groups	290.504	4	72.626	2.526	.040*
	Within Groups	21760.845	757	28.746		
	Total	22051.349	761			
Commitment	Between Groups	206.860	4	51.715	1.752	.137
	Within Groups	22230.628	753	29.523		
	Total	22437.488	757			

Leadership	Between Groups	172.333	4	43.083	1.773	.132
	Within Groups	18156.385	747	24.306		
	Total	18328.718	751			

Note. *Significant at alpha = 0.05.

Post hoc comparisons of group mean condition scores (Table 4-40) revealed between group differences (p<.05) for three of the eight conditions: Status Quo, Rewards & Incentives, and Participation.

Table 4-40. Significant post hoc comparisons for condition scores by age group

Condition	Age Group[a]	Mean Diff.	SE	p-value[b]	Effect Size[c]
Status Quo	1 – 2	2.92	0.7043	.001	0.7
	1 – 4	1.93	0.6243	.025	0.4
Rewards & Incentives	1 – 3	2.97	0.9776	.021	0.6
Participation	1 – 3	3.21	1.0132	.014	0.6

Note. [a]Age Group where 1 = Less than 25; 2 = 25 – 34; 3 = 35 – 44; and 4 = 45 – 54
[b]Significant at alpha = 0.05
[c]Effect Size calculated using Cohen's d where small = 0.3, medium = 0.5, and large = 0.8

The ANOVA for level of use by age group found significant between group differences for six of the eight technology tools: word processing, spreadsheet/database software, presentation software, graphic organizer software, digital video/cameras, and peripherals (Table 4-41).

Table 4-41. ANOVA for level of use of technology tools by age group

Technology Tools		Sum of Squares	df	Mean Square	F	Sig.
Word Processing	Between Groups	29.485	4	7.371	3.725	.005*
	Within Groups	1478.068	747	1.979		
	Total	1507.553	751			
Spreadsheet/ Database Software	Between Groups	14.100	4	3.525	2.424	.047*
	Within Groups	1081.894	744	1.454		
	Total	1095.995	748			

Presentation Software	Between Groups	21.773	4	5.443	2.965	.019*
	Within Groups	1360.441	741	1.836		
	Total	1382.214	745			
Graphics Software	Between Groups	13.271	4	3.318	2.061	.084
	Within Groups	1178.170	732	1.610		
	Total	1191.441	736			
Graphic Organizer Software	Between Groups	24.919	4	6.230	4.221	.002*
	Within Groups	1081.758	733	1.476		
	Total	1106.678	737			
Digital/Video Cameras	Between Groups	22.261	4	5.565	3.177	.013*
	Within Groups	1301.454	743	1.752		
	Total	1323.715	747			
Peripherals	Between Groups	23.426	4	5.857	4.338	.002*
	Within Groups	989.513	733	1.350		
	Total	1012.939	737			
Internet Resources	Between Groups	12.847	4	3.212	1.720	.144
	Within Groups	1385.284	742	1.867		
	Total	1398.131	746			

Note. *Significant at alpha = 0.05

The mean values presented in Table 4-42 were subjected to post hoc comparison. Significant mean differences between age groups are presented in Table 4-43.

Table 4-42. Mean level of use of technology tools by age group

Technology Tools	Age Group	N	Mean (SD)
Word Processing	Less than 25	34	3.53 (1.24)
	25-34	114	2.53 (1.43)
	35-44	142	2.83 (1.42)
	45-54	247	2.80 (1.39)
	55 or more	215	2.93 (1.42)

Spreadsheet/Database Software	Less than 25	34	2.85 (1.16)
	25-34	113	2.24 (1.25)
	35-44	142	2.37 (1.26)
	45-54	246	2.24 (1.19)
	55 or more	214	2.21 (1.17)
Presentation Software	Less than 25	34	3.47 (1.05)
	25-34	114	2.63 (1.33)
	35-44	141	2.79 (1.42)
	45-54	245	2.67 (1.37)
	55 or more	212	2.68 (1.34)
Graphics Software	Less than 25	33	2.88 (1.08)
	25-34	112	2.20 (1.26)
	35-44	141	2.33 (1.35)
	45-54	243	2.24 (1.25)
	55 or more	208	2.28 (1.27)
Graphic Organizer Software	Less than 25	34	2.97 (1.17)
	25-34	114	2.13 (1.25)
	35-44	140	2.29 (1.32)
	45-54	241	2.15 (1.22)
	55 or more	209	2.09 (1.13)

Digital/Video Cameras	Less than 25	34	3.15 (1.35)
	25-34	114	2.31 (1.30)
	35-44	142	2.68 (1.36)
	45-54	244	2.53 (1.28)
	55 or more	214	2.49 (1.35)
Peripherals	Less than 25	34	2.82 (1.14)
	25-34	112	1.94 (1.14)
	35-44	140	2.11 (1.23)
	45-54	242	2.03 (1.13)
	55 or more	210	1.98 (1.16)
Internet Resources	Less than 25	34	3.91 (1.26)
	25-34	114	3.25 (1.45)
	35-44	142	3.40 (1.34)
	45-54	247	3.36 (1.36)
	55 or more	210	3.30 (1.36)

All post hoc comparisons identified the youngest group (less than 25) as being significantly different from the other groups for each technology tool (Table 4-43).

Table 4-43. Significant post hoc comparisons for level of use by age group

Technology Tool	Age Group[a]	Mean Diff.	SE	p-value[b]	Effect Size[c]
Word Processing	1 – 2	1.0	0.275	.003	0.7
	1 – 4	0.728	0.257	.039	0.5
Spreadsheet/Database Software	1 – 4	0.617	0.221	.042	0.5
	1 – 5	0.643	0.223	.003	0.5

Presentation Software	1 – 2	0.839	0.219	.003	0.7
	1 – 3	0.676	0.213	.022	0.5
	1 – 4	0.801	0.201	.002	0.6
	1 – 5	0.791	0.202	.002	0.6
Graphic Organizer Software	1 – 2	0.839	0.237	.004	0.7
	1 – 3	0.685	0.232	.027	0.5
	1 – 4	0.825	0.223	.002	0.7
	1 – 5	0.880	0.225	.001	0.8
Digital/Video Cameras	1 – 2	0.840	0.259	.011	0.6
Peripherals	1 – 2	0.866	0.228	.001	0.8
	1 – 3	0.716	0.222	.011	0.6
	1 – 4	0.790	0.213	.002	0.7
	1 – 5	0.847	0.215	.001	0.7

Note. [a]Age Group where 1 = Less than 25; 2 = 25 – 34; 3 = 35 – 44; 4 = 45 – 54; and 5 = Older than 55
[b]Significant at alpha = 0.05
[c]Effect Size calculated using Cohen’s d where small = 0.3, medium = 0.5, and large = 0.8

PLT Region

The last demographic item asked participants to select the state where they currently reside. The data was collapsed into the four PLT Regions (Table 4-3). The mean level of familiarity with Technology Connections by PLT region is presented in Table 4-44. The Northeast region reported the highest level of familiarity.

Table 4-44. Mean level of familiarity by PLT region

PLT Region	N	Mean[a] (SD)
Northeast	69	2.36 (0.97)
North Central	134	2.13 (0.91)
South	403	2.24 (0.90)
West	172	2.03 (0.90)

Note. [a]Mean based on scale where 1 = Not familiar to 4 = Very familiar

The ANOVA indicates significant between group differences for the level of familiarity with Technology Connections by PLT region (Table 4-45).

Table 4-45. ANOVA of level of familiarity by PLT region

PLT Region	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.944	3	2.648	3.312	.020*
Within Groups	618.771	774	0.799		
Total	626.716	777			

Note. *Significant at alpha = 0.05.

Post hoc comparison of mean differences for the level of familiarity found the South and West regions were significantly different ($p < .05$) and 0.2 effect size.

All PLT regions agree that it is importance to incorporate technology tools when it is recommended in the PLT PreK-8 Activity Guide (Table 4-46).

Table 4-46. Level of importance to incorporate technology tools by PLT region

PLT Region	N	Mean[a] (SD)
Northeast	68	4.74 (1.76)
North Central	135	4.82 (1.63)
South	404	5.21 (1.65)
West	169	4.91 (1.58)

Note. [a]Mean based on scale where 1 = Strongly Disagree to 7 = Strongly Agree

The ANOVA (Table 4-47) indicates significant between group differences for the mean level of importance to incorporate technology tools between the PLT Regions.

Table 4-47. ANOVA for importance to incorporate technology tools by PLT region

PLT Region	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	26.544	3	8.848	3.280	.020*
Within Groups	2082.585	772	2.698		
Total	2109.129	775			

Note. Significant at alpha = 0.05

The F test (Table 4-47) is significant ($p<.05$), but the Tukey post hoc comparison did not indicate which, if any, of the pair of means (Table 4-48) were significantly different. Homogeneity of variances was not significant, therefore, a possible reason this happened for this particular analysis is that the Tukey HSD is conservative (Stoline, 1981). The mean level of confidence to use technology tools is greatest in the South PLT region (Table 4-48).

Table 4-48. Level of confidence to use technology tools by PLT region

PLT Region	N	Mean[a] (SD)
Northeast	68	4.96 (1.90)
North Central	135	4.69 (1.66)
South	404	5.26 (1.67)
West	170	4.98 (1.80)

Note. [a]Mean based on scale where 1 = Strongly Disagree to 7 = Strongly Agree

The ANOVA for the level of confidence to use technology tools by PLT region indicated significant differences ($p<.01$) between groups (Table 4-49).

Table 4-49. ANOVA of mean level of confidence to use technology tools by PLT region

PLT Region	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	36.547	3	12.182	4.139	.006*
Within Groups	2275.417	773	2.944		
Total	2311.964	776			

Note. *Significant at alpha = 0.05.

Multiple comparisons of mean level of confidence to use technology tools found only one significant mean difference ($p<.05$) between PLT Region 2 (North Central) and PLT Region 3 (South); mean difference = 0.57, SE = 0.171, and p-value = .005, with a small effect size = 0.3.

No significant differences between groups are indicated by the ANOVA (Table 4-50) of conditions by PLT region.

Table 4-50. ANOVA of conditions by PLT region

Condition		Sum of Squares	df	Mean Square	F	Sig.
Status Quo	Between Groups	35.520	3	11.840	.547	.650
	Within Groups	16689.907	771	21.647		
	Total	16725.427	774			
Knowledge & Skills	Between Groups	152.976	3	50.992	2.109	.098
	Within Groups	18473.648	764	24.180		
	Total	18626.624	767			
Resources	Between Groups	53.834	3	17.945	.759	.517
	Within Groups	18102.583	766	23.633		
	Total	18156.417	769			
Time	Between Groups	38.929	3	12.976	.891	.446
	Within Groups	11043.339	758	14.569		
	Total	11082.268	761			
Rewards & Incentives	Between Groups	49.500	3	16.500	.611	.608
	Within Groups	20824.676	771	27.010		
	Total	20874.175	774			
Participation	Between Groups	47.225	3	15.742	.541	.655
	Within Groups	22420.508	770	29.118		
	Total	22467.733	773			
Commitment	Between Groups	40.651	3	13.550	.457	.713
	Within Groups	22672.329	764	29.676		
	Total	22712.979	767			
Leadership	Between Groups	17.407	3	5.802	.235	.872
	Within Groups	18706.391	759	24.646		
	Total	18723.798	762			

Table 4-51 presents the mean summed scale score for the eight conditions for the four PLT regions.

Table 4-51. Mean condition scores by PLT region

Condition		N	Mean (SD)
Status Quo	Northeast	68	20.84 (4.32)
	North Central	135	20.50 (4.52)

	South	403	21.01 (4.71)
	West	169	20.62 (4.75)
Knowledge & Skills	Northeast	68	19.38 (5.02)
	North Central	135	20.76 (5.10)
	South	398	20.54 (4.80)
	West	167	19.78 (5.00)
Resources	Northeast	68	20.26 (4.34)
	North Central	132	20.83 (4.66)
	South	402	20.23 (5.08)
	West	168	20.01 (4.67)
Time	Northeast	66	17.95 (3.77)
	North Central	131	18.57 (3.65)
	South	400	18.29 (3.83)
	West	165	17.91 (3.93)
Rewards & Incentives	Northeast	67	19.67 (5.54)
	North Central	134	18.82 (5.43)
	South	404	19.41 (5.19)
	West	170	19.12 (5.03)
Participation	Northeast	67	17.88 (5.68)
	North Central	134	16.90 (5.49)
	South	405	17.30 (5.45)
	West	168	17.10 (5.06)

Commitment	Northeast	65	17.11 (4.95)
	North Central	132	17.91 (5.37)
	South	402	17.46 (5.55)
	West	169	17.27 (5.46)
Leadership	Northeast	68	19.28 (4.53)
	North Central	133	19.11 (4.72)
	South	399	19.15 (5.10)
	West	163	18.80 (4.99)

The ANOVA for the mean level of use of technology tools by indicates significant differences exist between PLT Regions on four of the eight technology tools: Spreadsheet/Database, Presentation Software, Graphics Software, and Graphics Organizer Software. The results are presented in Table 4-52.

Table 4-52. ANOVA for mean level of use of technology tools by PLT region

Technology Tools		Sum of Squares	df	Mean Square	F	Sig.
Word Processing	Between Groups	15.281	3	5.094	2.586	.052
	Within Groups	1497.267	760	1.970		
	Total	1512.548	763			
Spreadsheet/Database Software	Between Groups	20.085	3	6.695	4.705	.003*
	Within Groups	1077.064	757	1.423		
	Total	1097.148	760			
Presentation Software	Between Groups	24.323	3	8.108	4.486	.004*
	Within Groups	1362.775	754	1.807		
	Total	1387.098	757			
Graphics Software	Between Groups	14.138	3	4.713	2.968	.031*
	Within Groups	1181.488	744	1.588		
	Total	1195.626	747			

Graphic Organizer Software	Between Groups	16.297	3	5.432	3.682	.012*
	Within Groups	1102.230	747	1.476		
	Total	1118.527	750			
Digital/Video Cameras	Between Groups	4.281	3	1.427	.814	.486
	Within Groups	1324.896	756	1.753		
	Total	1329.178	759			
Peripherals	Between Groups	6.381	3	2.127	1.558	.198
	Within Groups	1018.797	746	1.366		
	Total	1025.179	749			
Internet Resources	Between Groups	12.375	3	4.125	2.242	.082
	Within Groups	1388.995	755	1.840		
	Total	1401.370	758			

Note. *Significant at alpha = 0.05

Post hoc comparison of the mean level of use of technology tools by PLT Region (Table 4-53) indicate significant differences between the North Central and South PLT regions for each of the four technology tools (Table 4-54).

Table 4-53. Level of use of technology tools by PLT region

Technology Tools	PLT Region	N	Mean (SD)
Word Processing	Northeast	67	2.82 (1.60)
	North Central	133	2.62 (1.35)
	South	396	2.96 (1.40)
	West	168	2.71 (1.38)
Spreadsheet/Database Software	Northeast	67	2.37 (1.40)
	North Central	132	1.97 (1.04)
	South	394	2.40 (1.22)
	West	168	2.18 (1.16)
Presentation Software	Northeast	67	2.57 (1.43)
	North Central	131	2.40 (1.28)

	South	393	2.87 (1.35)
	West	167	2.72 (1.35)
Graphics Software	Northeast	66	2.23 (1.36)
	North Central	129	2.02 (1.15)
	South	386	2.40 (1.26)
	West	167	2.26 (1.30)
Graphic Organizer Software	Northeast	66	2.06 (1.28)
	North Central	131	1.93 (1.07)
	South	387	2.32 (1.24)
	West	167	2.14 (1.23)
Digital/Video Cameras	Northeast	67	2.58 (1.44)
	North Central	131	2.44 (1.29)
	South	395	2.59 (1.32)
	West	167	2.44 (1.30)
Peripherals	Northeast	66	2.05 (1.26)
	North Central	131	1.89 (1.09)
	South	388	2.14 (1.20)
	West	165	2.02 (1.12)
Internet Resources	Northeast	67	3.37 (1.37)
	North Central	132	3.13 (1.40)
	South	393	3.46 (1.33)
	West	167	3.27 (1.38)

Table 4-54. Significant post hoc comparisons of technology tool use by PLT region

Technology Tool	PLT Region[a]	Mean Diff.	SE	p-value	Effect Size[b]
Spreadsheet/Database software	2 – 3	0.426	0.109	.001	0.4
Presentation software	2 – 3	0.479	0.131	.002	0.4
Graphic software	2 – 3	0.379	0.120	.010	0.3
Graphic Organizer	2 – 3	0.384	0.113	.004	0.3

Note. [a]PLT Region where 2 = North Central and 3 = South
[b]Effect Size calculated using Cohen's d where small = 0.3, medium = 0.5, and large = 0.8

Summary

This purpose of this study was to investigate the conditions for implementation of technology in the context of environmental educators who use the Project Learning Tree (PLT) curriculum. This study collected self-report data using an Internet survey instrument. A total of 884 members of the PLT community completed the survey. The survey instrument contained eight constructs, each construct was comprised of four items, and each item response was based on a 7 point Likert-type scale, where 1 = Strongly Disagree and 7 = Strongly Agree. The construct reliability scores for seven of the eight constructs were above the 0.7 threshold, and only the Time construct (Cronbach's alpha = 0.4) was below the threshold.

The proportion of survey responses from PLT educators, facilitators, and state coordinators is consistent with the sample population, although, the number of educators responding may be small in relation to the total number recognized by the PLT national office. Regional representation may be skewed with the South representing over half of the responses. The PLT *PreK-8 Environmental Education Activity Guide* is the curriculum guide used most often, and grades PreK-12 were identified as the audience taught most often. Over two-thirds of those responding indicated they were either "somewhat familiar" (40%) or "not familiar" (27%) with the Technology Connections component of the PLT *PreK-8 Environmental Education*

Activity Guide. The mean level of use of the recommended technology tools ranged between "seldom (about 25% of the time)" and "about half the time", and only Internet Resources had a mean greater than "about half the time". Based on a 7-point scale, participants agreed that it is important to incorporate technology, and they felt somewhat confident in their ability to use technology tools. This study was guided by four research questions and a review of the results for each question follows.

Research Question 1: *Do the Implementation Profile Inventory scores for each of the eight conditions for implementing technology differ between Project Learning Tree educators, facilitators, and state coordinators?*

Significant differences were found for the IPI Condition scores between PLT educators and facilitators, and educators and state coordinators, but not between facilitators and state coordinators.

Research Question 2*: Is there a correlation between the eight conditions for implementation and the level of use of technology tools by PLT educators?*

Six of the eight conditions (predictor variables) were found to have significant Pearson Correlation Coefficients.

Research Question 3: *What is the effect of significantly correlated conditions on PLT educator's level of use of technology tools?*

Regression analysis identified a reduced model with four variables (Time, Rewards & Incentives, Participation, and Leadership).

Research Question 4: *What are the characteristics of a PLT educator who is most likely to implement technology?*

The characteristics of a PLT educator most likely to implement technology were identified based on self-reported data from this sample population. These significant findings are presented in Chapter 5.

CHAPTER 5

DISCUSSION

The concept for this study was born from my direct experience with Project Learning Tree. I was first introduced to the PLT curriculum in 1997 when I completed an educator workshop. Since that time, I was trained to be a facilitator and have been actively teaching educator workshops, serving as a member of the Georgia PLT state steering committee, and now function as a state coordinator for the Georgia PLT program. I have been recognized by the Georgia PLT program for my service, and as an outstanding educator and facilitator. I was recognized by the National PLT organization as a National Outstanding PLT Educator in 2002. I was invited by the national PLT office to provide technical review of curriculum content during the development of a new high school module – *Global Connections: Forests of the World*. My experience teaching with the PLT curriculum, training environmental educators to use the PLT curriculum, and providing technical review of new curriculum has afforded me the opportunity to observe other EE professionals teaching with the PLT materials, and how PLT facilitators conduct educator workshops. I have also discussed the instructional design of PLT materials with other state coordinators to develop a deeper understanding of others' views and ideas about ways to meet the needs of 21st century learners.

Participants in this study are my peers; they are environmental educators and use the Project Learning Tree (PLT) environmental education instructional materials. Project Learning Tree is considered a premiere international environmental education curriculum, and maintaining this status requires continuous improvement. Each year, the national PLT office works hard to ensure the content of all materials and recommended teaching strategies are current. Because of my commitment and devotion to support the Georgia PLT program, I was intrinsically motivated to learn if and how other PLT educators, facilitators, and state coordinators used the recommended technology tools as prescribed by the instructional design of the PLT curriculum. More importantly, I was interested to find out what conditions controlled the decision or capacity of my peers to use technology tools when teaching with the PLT curriculum.

In this chapter, I give my interpretation of the data collected from a nation-wide Internet survey of environmental educators trained to use the Project Learning Tree curriculum. First, a description of the participants will set the stage and provide a mental image of the population sampled. Next, the four research questions and associated data will be examined, synthesized, and connected to relevant literature. I will conclude with my recommendations for practice and research.

Description of Participants

The Internet survey used for this study was open for 56 days, from August 10, 2010 to October 5, 2010. During this time period a total of 1,306 participants opened the Internet survey, of which nearly 91 percent agreed to the consent form and started the survey, and around 8 percent declined to take the survey. Only 884 of the 1,194 participants who started the survey, completed the survey. Therefore, based on the number of people who opened the survey, the response rate to the Internet survey used in this study was nearly 68 percent. Considering the minimum number of possible participants receiving notification of the survey through the PLT email distribution list was 41,549 and the maximum was 44,785, this response rate may be viewed as very low. However, based on analytical statistics provided by the email service provider, the open rate for the survey used in this study was similar to that of the PLT newsletter, *The Branch*. The email distribution list is a database populated with email addresses voluntarily provided by individuals interested in receiving *The Branch*, and desire to be informed about national, regional, and state activities. The open rate for the email messages containing a link to the Internet survey is nearly the same when compared to email messages notifying recipients the latest copy of *The Branch* has arrived; the open rate for *The Branch* 2010 spring issue (12%); 2010 summer issue (11%); and 2010 fall issue (11%). These figures are not that much larger than the open rate for the first message announcing the study survey is open (10%) and the first reminder message (10%), but the open rate for the second reminder was lower (8%). It is difficult to know exactly why the total number completing the survey was not higher, but reasons may include the time required (15 minutes or less), interest in the topic, perceived relevance of the survey to the individual, or possibly it was just apathy toward completing an online survey.

The PLT organization recognizes three primary roles beyond the staff positions at the national office in Washington, DC. The three primary roles are educator, facilitator, and state coordinator. When participants were asked to identify their primary role, 87 percent responded: 513 (67%) identified as an educator, 211 (28%) identified as a facilitator, and 43 (5%) identified as a state coordinator (Table 4-1). The national PLT office recognizes there are over 500,000 PLT educators (AFF, 2009), around 1,200 facilitators and 80 state coordinators (R. Bayer, PLT Manager of Operations, personal communication, January 10, 2011). Based on these figures, study participants represented only 0.001 percent of the educators, nearly18 percent of the facilitators; and 54 percent of the state coordinators.

The number of educators participating in this study is relatively small compared the total number recognized by PLT, but overall, the 513 who did respond provides confidence in the data. The PLT educator is the person teaching with the PLT materials and observing student learning with the curriculum. The PLT educator is the practicing professional with knowledge and experience teaching PLT activities with students. The PLT educator is important to this study because they would have the greatest opportunity to use technology with PLT. Input from over 500 PLT educators was received, and is critical to this study. Having 18 percent of the PLT facilitators participate in the study is a solid representation of this primary role group. The role of the facilitator is to train PLT educators how to use the curriculum. The facilitator is the person whom has the responsibility of modeling best teaching practices for environmental education, and more specifically, describing Technology Connections and interpreting how to use technology tools. It is incumbent upon the PLT facilitator to design and deliver effective educator workshops so that new PLT educators come away feeling confident in their ability to integrate the PLT curriculum and technology into both their teaching philosophy and teaching environment. Without the input from the PLT facilitators, the data in this study would be incomplete. Input was received from 54 percent of the state coordinators – this is absolutely critical to this study. As the title implies, the state coordinator is responsible for managing the PLT program in their state. The state coordinator is guided by policy set by the national PLT office, and advised by a state steering committee. There may be more than one state coordinator for a given state. For example, Georgia has three state co-coordinators while California, the largest state PLT program has only one coordinator, but they have an office and staff. Nevertheless, the state coordinator is responsible for training facilitators, making sure PLT activity guides are delivered to facilitators so they can conduct educator workshops, and completing monthly and annual reporting required by the national PLT office. They are also the voice for their state PLT program, and provide feedback to the national PLT office regarding curriculum revisions, ideas for new curricula, grant administration, and training protocols. This study is interested in the level of use of technology tools as advised in the PLT curriculum and the state coordinator has the choice to either highlight or neglect the Technology Connections component during facilitator trainings. If state coordinators choose not to model the use of technology tools, their decision may influence new facilitator's approach to conducting their educator workshops in the same manner. In other words, the facilitator and state coordinator are responsible for increasing the technology, pedagogy, and content knowledge of respective training audiences (Koehler & Mishra, 2009). Participation from over half of the state coordinators in this study will support recommendations for practice, and forms the foundation for developing new training protocols at the national PLT office.

Females comprised 82 percent of the survey respondents in this study, and the remaining 18 percent were males. Based on 2007-08 national statistics from the U. S. Department of Education (2010), 76 percent of public school teachers are females, or a 3:1 (female: male) ratio. Interestingly, the ratio between female and male PLT state coordinators is the same: 60 female state coordinators to 20 male state coordinators. Why a greater number of females responded than males can not be explained by any of the data collected in this study.

Demographic data about participant age was collected using ordered response choices based on age ranges: less than 25, 25-34, 35-44, 45-54, and 55 or older. Nearly 39 percent of the 773 survey participants identified they were less than 45 years of age (Table 4-2). Based on 2007-08 national statistics from the U. S. Department of Education (2010), 44 percent of public school teachers in the U. S. were under the age of 40. The "less than 25" age group had the fewest (n = 35) responses. The "less than 25" age group includes students in teacher education programs, they represent the future of PLT, and the national PLT offices has made pre-service teacher training a priority. Grants have been provided to state PLT programs to conduct training for pre-service faculty in an attempt to increase the number of young teachers trained as PLT educators. Although it was not critical to know the exact age of participants for this study, age is one of several demographic variables used to answer Research Question 4.

This survey was designed to be nation-wide in scope, therefore, participants were asked to identify the state where they currently live. The data were then collapsed into the four PLT regions (Table 4-3). Over half (52%) identified as living in one of the thirteen states in the South PLT region; 22 percent were from the West PLT region; 17 percent were from the North Central PLT region; and only 9 percent were from the Northeast PLT region. Based on the strength and size of the PLT programs in the Northeast and West PLT regions, the response rates from these two regions is unexpectedly low.

The collection of PLT curricula are constructed with student-centered activities and designed for grades PreK-12. Nearly 74 percent of participants indicated they use PLT most often with students representing the PreK-12 target audience, and about 64 percent indicated they teach grades PreK-8 (Table 4-4). This is important because the focus of this study is implementation of Technology Connections which is a prominent component of the PLT *PreK-8 Environmental Education Activity Guide*. Participants were asked which PLT Activity Guide they used most often, and 650 (86%) identified the PLT *PreK-8 Environmental Education Activity Guide* as their guide of choice. This high percentage is critical to this study because predominant use of the PLT *PreK-8 Environmental Education Activity Guide* will increase exposure of the user to Technology Connections and the recommendations to use technology tools. Technology is included in the high school modules, but there is not a dedicated item in the sidebar identifying specific technologies to use, rather it is embedded in the text of the activity.

Participants in this study represent the three primary role groups recognized within the PLT community, but increased participation from PLT educators would have strengthened the study. All four PLT regions are represented, but the Northeast region had a very low participation rate when compared to the other three. Most of the participants in this study use PLT with students in the target grades (PreK-8). And the PLT *PreK-8 Environmental Education Activity Guide* is the guide used most by a clear majority of the participants in this study. These are all positive indicators that participants in this study represent the PLT community.

Research Question 1

Do the Implementation Profile Inventory scores for each of the eight conditions for implementation differ between PLT educators, facilitators, and state coordinators?

The primary roles recognized by the national PLT office are educator, facilitator, and state coordinator. The eight conditions for implementation identified by Ely (1990, 1999) and used later by Ensminger & Surry (2008) to create the Implementation Profile Inventory (IPI) are: Status Quo, Knowledge & Skills, Resources, Time, Rewards & Incentives, Participation, Commitment, and Leadership. This research question is aimed at discovering the level at which each of the primary role groups' rank the eight conditions for implementation of Technology Connections. The rankings by primary group in this study are based on mean summated scale scores where 1 = highest mean score and 8 = lowest mean score (Figure 5-1).

Rank	PLT Educators	PLT Facilitators	PLT State Coordinators
1	Status Quo	Status Quo	Status Quo
2	Resources	Knowledge & Skills	Knowledge & Skills
3	Knowledge & Skills	Resources	Resources
4	Reward & Incentives	Rewards & Incentives	Rewards & Incentives
5	Leadership	Leadership	Commitment
6	Time	Time	Participation
7	Commitment	Participation	Time
8	Participation	Commitment	Leadership

Figure 5-1. Ranking of the eight conditions for each group by mean score

The ANOVA identified significant mean differences between primary role groups for five conditions: resources, time, rewards & incentives, commitment, and leadership (Table 4-12).

Of particular interest is that mean differences were found between educators and facilitators, and educators and state coordinators, but no mean differences were found between facilitators and state coordinators (Table 4-14).

All three groups placed greatest value on the condition of dissatisfaction with status quo which means they all agreed that something must change before they use Technology Connections. None of the three occupational groups in a study by Ensminger and Surry (2008) ranked the status quo condition as the number one condition. Identifying what type of change or who is responsible for change was not within the scope of this study. However, based on the item responses it appears that the PLT educators, facilitators, and state coordinators who participated in this study are amenable to changing their views of using technology by simply observing other PLT educators using technology. This difference could also be attributed to differences between innovators and early adopters, and those considered as late adopters and laggards (Rogers, 2003).

The condition ranked second by educators was resources, while facilitators and state coordinators ranked knowledge and skills second in this study. A study by Ensminger and Surry (2008) using the same eight conditions found the K-12 group and higher education group ranked the resource condition first, as did the education group in a similar study by Surry and Ensminger (2002). Post hoc comparison for the resource condition indicated a significant difference between educators and facilitators ($p<.05$), but no difference between educators and state coordinators. Availability and access to technology hardware and software is paramount if Technology Connections is to be used. Similar results were reported by Rogers (2000) who identified access and availability to technology hardware and software as a barrier to adoption of technology by educators. Hew and Brush (2007) reported resources as one of six barriers to K-12 schools in the United States and other countries when integrating technology.

The knowledge and skills condition was ranked 3rd by educators, but facilitators and state coordinators ranked resources 3rd in this study. No significant differences between groups were found for the knowledge and skills condition; therefore, all groups value the importance of having the knowledge and skills to use technology tools equally. This third place ranking of knowledge and skills by educators in this study is the same result reported by Surry and Ensminger (2002). Knowledge and skills was also reported by Hew and Brush (2007) as a barrier to technology integration.

All three groups ranked the condition of rewards and incentives forth. Post hoc comparison indicated significant differences between educators and facilitators ($p<.01$) and educators and state coordinators ($p<.05$). In two separate studies (Ensminger & Surry, 2008; Surry & Ensminger, 2002) the condition dissatisfaction with status quo was ranked forth by K-12 and educator groups. The differences found in this study indicate educators may be more likely to use Technology Connections if they can be motivated to do so, either intrinsically or extrinsically. In a review of barriers that may influence technology adoption, Kopcha (2010) identified culture as a barrier and described culture as promoting “technology use and the adoption of new teaching practices” (p. 176). The characteristics of culture, as described by Kopcha, are very similar to what Ely (1990, 1999) identified for rewards and incentives. If the teacher or PLT educator knows that their efforts to use technology are desired by the supervisor or state PLT coordinator, the more likely they may be to implement technology.

Ranked fifth by educators and facilitators, the condition of leadership was found to be significantly different between educators and facilitators ($p<.01$), and educators and state coordinators ($p<.01$). Leadership was also ranked fifth by the education group in a study by Surry and Ensminger (2002), but it was ranked seventh by the K-12 group in a study by Ensminger and Surry (2008). The results of this study indicate educators' value receiving support from the PLT leadership to implement Technology Connections. In this study, leadership refers to the PLT facilitator and state coordinator, and it is the responsibility of the PLT leadership to model the use of technology when leading educator and facilitator trainings. A PLT educator is trained by a PLT facilitator to use the PLT curricula, and a PLT facilitator is trained by a PLT state coordinator to lead PLT educator workshops. If the PLT leadership is not using technology as part of educator or facilitator training, is it fair to assume that newly trained PLT educators and facilitators will use technology? It can not be assumed that the adult learners participating in the training will develop the knowledge about the technologies and pedagogical skills to implement technology when teaching with PLT to their respective audiences. In a study by Niess (2005), modeling instructional strategies that incorporate technology played a significant role toward helping preservice teachers develop new teaching ideas. Gopalakrishnan (2006) examined personal support factors important to educators that help them integrate technology into the teaching and learning process, and one of the models examined recommended the use of a translator. The translator is familiar with both domains of technology use and teaching. PLT facilitators and state coordinators must serve as the translator providing the support and demonstrating how to integrate technology with PLT activities.

The time condition was ranked sixth by educators and facilitators, while state coordinators ranked participation in this position. Time was found to be significantly different between educators and facilitators ($p<.001$), and between educators and state coordinators ($p<.01$). This indicates that educators in this study placed a higher value on having time to learn, adapt, integrate, and reflect on their use of Technology Connections. Time was ranked third by the K-12 group in one study (Ensminger & Surry, 2008), and ranked seventh in another study (Surry & Ensminger, 2002). Time has been identified as a barrier in other studies as well (Hew & Brush, 2007; Kopcha, 2010).

The seventh ranked condition differed for all three groups in this study; for educators it was commitment, for facilitators it was participation, and for state coordinators it was time. Leadership was ranked seventh by all three occupational groups in a study by Ensminger and Surry (2008). Post hoc comparison for the commitment condition found educators were significantly different from facilitators, but not different from state coordinators. This result indicates that educators' place a higher value on commitment than facilitators, even though it is the responsibility of facilitators and state coordinators to encourage and support use of Technology Connections and technology tools.

Educators ranked participation last, commitment was ranked last by facilitators, and state coordinators ranked leadership last. Post hoc comparisons found no differences for the condition of participation. What is interesting is that state coordinators, who provide support to educators and facilitators, placed the lowest value on the condition of leadership. Leadership was ranked fifth by the other two groups.

This research found that PLT educators, facilitators, and state coordinators ranked the conditions for implementation differently (Figure 5-1). The rank order of the conditions for implementation of technology innovations by PLT educators, facilitators, and state coordinators in this study are different from the results of similar research investigating other occupational groups (Ensminger & Surry, 2008; Nawawi et al., 2005; and Surry & Ensminger, 2002). The study conducted by Ensminger and Surry (2008) examined three different occupational groups

(K-12 schools, higher education, and business); Nawawi et al. (2005) examined the use of computers by mathematics teachers in secondary schools; and the study by Surry and Ensminger (2002) examined how the eight conditions influenced implementation of technology for individuals working in business and education.

The results of this study, and the three presented in Figure 5-2, are samples from the population of educators. Each study represents a different set of circumstances, personal and institutional constraints, support, and relationships which may explain the lack of continuity between the groups (Rogers, 2000). Every educator operates under a different set of conditions and these conditions influence their decision and ability to implement technology. This may also explain why PLT educators, facilitators, and state coordinators rank the conditions for implementation differently.

Rank	K-12 Group[a]	Secondary School Math Teachers[b]	Education Group[c]	Project Learning Tree Educators[d]
1	Resources	Commitment	Resources	Status Quo
2	Knowledge & Skills	Leadership	Participation	Knowledge & Skills
3	Time	Knowledge & Skills	Knowledge & Skills	Resources
4	Status Quo	Status Quo	Status Quo	Rewards & Incentives
5	Participation	Participation	Leadership	Leadership
6	Rewards & Incentives	Resources	Rewards & Incentives	Time
7	Leadership	Time	Time	Commitment
8	Commitment	Rewards & Incentives	Commitment	Participation

Figure 5-2. Ranking of conditions from three different studies
[a]Adapted from Ensminger & Surry, 2008; [b]Adapted from Nawawi et al., 2005; [c]Adapted from Surry & Ensminger, 2002; [d]Aggregate of Project Learning Tree educators (K-12)

Research Question 2

Is there a correlation between the eight conditions and the decision to implement technology?

This study used an Internet survey to collect self-reported data from PLT educators, facilitators, and state coordinators about their level of use of technology tools, and their level of agreement regarding the eight conditions for implementation. This study did not involve manipulation or intervention of any type. Using correlation to examine relationships between behaviors is an acceptable practice when none of the variables are manipulated (Field, 2009). This study found six of the eight IPI conditions significantly correlated to the level of use of technology tools. Significance is an indication that the relationship between the condition and the use of technology is not a chance result. All significantly correlated conditions are positive indicating that an increase on the condition score should result in an increase on the level of use of technology.

Although six of the conditions were found to be significant, the strength of these relationships is not large. To characterize the relationship between two variables, Cohen (1988) recommends Pearson r values between .010 and .29 be considered as an indication of a small, positive correlation; Pearson r values between .30 and .49 indicate a medium, positive correlation; and Pearson r values between 0.5 and 1.0 indicate large, positive correlations. Based on these guidelines, the Pearson r values found in this study indicate small to less than small, positive correlations for Status Quo, r (756) = .140, Time, r (721) = .08, Rewards & Incentives, r (731) = .265, Commitment, r (716) = .249; and Leadership, r (708) = .262. The only condition found to have a medium, positive correlation was Participation, r (723) = .313. Positive correlations to the conditions have been found by others (Bauder, 1993; Nawawi, M. H., Ayub, A. M., Ali, W. W., Yunus, A. M., & Tarmizi, R. A. 2005). However, the strength of the correlations found in this study are not as strong as those found by Porter, Surry, & Ensminger (2003) who ran test/retest correlations which resulted in a mean correlation for the eight conditions of r (39) = .747. This strong correlation may be the result of the format of the survey, which was a 56-item instrument where each item presented a statement and participants had to select from two conditions the one that influenced their decision to implement an innovation. This study did not follow the same method as Porter et al. (2003), but both studies used the same eight conditions for implementation. For this study, determination of significantly correlated conditions to implementation is a prerequisite for research question 3 which applies regression analysis.

Research Question 3

What is the effect of significantly correlated conditions on PLT educator's decision to implement technology?

Regression analysis was used to evaluate the linear association between the level of use of technology tools (dependent variable) by PLT educators, facilitators and state coordinators, and the conditions for implementation (independent variables). The full regression model used the six correlated conditions and was found to be significant $F(6, 668) = 13.72$, $p<.001$ and explained 11 percent of the variability in the dependent variable. Using the backward entry method, a reduced model with four variables was found to be significant $F(4,670) = 20.350$, $p<.001$ and explained nearly 11 percent of the variability in the dependent variable too. The four variable regression model included the conditions of time (T), rewards and incentives (R&I), participation (P), and leadership (L).

Level of Use of Technology = -.302(T) + .195(R&I) + .346 (P) + .237(L) + 11.416

Time has a negative coefficient (-.302), thus there is a negative relationship with the level of use. Therefore, reducing the condition of time will increase the level of use of technology. As adopters of the innovation, PLT educators, facilitators, and state coordinators do not expect the PLT organization to train them to use technology tools, but they agree it should be part of the educator workshops. They discount the idea that the amount of time it takes to implement technology will make them less likely to use it. Ebersole and Vorndam (2003) recognize time as an important condition for implementation.

Rewards & Incentives is the next variable in the equation with a value of .195. This variable indicates that some type of reward or incentive will increase use of technology by PLT members. Determining the type of reward or incentive is beyond the scope of this study. According to Stockdill and Morehouse (1992), rewards are a significant factor in building the capacity of an organization. Therefore, given the organizational structure and goals of PLT and the personality of the stereotypical environmental educator, it may be useful to intrinsically motivate the innovators. For example, highlight stories of successful use of technology in the PLT newsletter and post photos and stories on the PLT website and Facebook page.

Participation was found to have the strongest coefficient (.346), which means the more the innovator is involved in the decision-making process that involves using technology, the more likely technology will be implemented (Ely, 1999). In this study, PLT educators, facilitators, and state coordinators are the innovators. Therefore, the actions of the national PLT office and state coordinators will be critical to creating ownership of the innovation (Ensminger et al., 2004). Actions that can increase the leadership condition score include a clear demonstration of support and encouragement for the use of technology, and increased use of technology during PLT educator workshops by facilitators.

Leadership is the last variable with a value of .237. The leadership condition indicates the need for the PLT organization to actively promote the use of Technology Connections and the associated technology tools. In this study, PLT leadership refers to national staff, but also includes state coordinators and active facilitators. Other studies stress the importance of supervisors and managers communicating to workers that they support use of the innovation (Ebersole & Vorndam, 2003; Kotter, 1996). The correlation coefficients for both status quo and time are less than .1, and have very weak coefficients of determination. However, they are significant.

This study was conducted with members of the Project Learning Tree organization representing the primary role groups of PLT: educators, facilitators, and state coordinators. This is important because the regression analysis conducted in this study addressed a gap in the adoption and diffusion literature identified by Surry and Brennan (2009), who recommended the investigation of the relationships between sub-groups of an organization and their decision to implement technology. This might be the first time Ely's eight conditions for implementation have been applied to three groups within one organization. The regression analysis can be used to guide decisions about national and state level program management strategies.

Research Question 4

What are the characteristics of a PLT educator who is most likely to implement technology?

Is it possible to look at a PLT educator and determine if they are likely to use technology to teach environmental education? No, more specific information must be obtained before coming to a conclusion about their use of technology. Using self-report data collected in this study, this is an attempt to quantify the characteristics of a PLT educator who is most likely to use technology tools recommended in the Technology Connections section of the PLT *PreK-8 Environmental Education Activity Guide*. To clarify, the use of the term PLT educator is a person who has completed the PLT educator training, or has moved on to become a PLT facilitator or is a state coordinator. In this portion of the discussion, I will create a profile that describes the characteristics of a PLT educator who is most likely to implement technology based on when the person was trained, their primary role within the PLT organization, their sex (gender), age, and region. These demographic data will be examined by self-reported level of familiarity with Technology Connections, level of importance to incorporate technology tools, level of confidence to use technology tools, and level of use of technology tools. The final item to characterize a PLT educator and their use of technology is the regression equation from research question 3.

Comparing participants who attended PLT training before December, 2006 with those who completed training after January 1, 2007, the latter group had a higher level of familiarity with Technology Connections. This group also demonstrated a greater level of concern for the importance of incorporating technology tools, and reported a higher level of use of all eight technology tools. The level of confidence to use technology tools was not affected by the date an individual completed PLT training. Technology Connections was introduced as part of the instructional design of the 2006 edition of the PLT *PreK-8 Environmental Education Activity Guide*, and was available in 2007. State coordinators were informed of the changes to the activity guide and were requested to bring this change to the attention of participants of educator and facilitator workshops. For this reason, a person completing PLT training after January 1, 2007 is expected to be more familiar with Technology Connections, and possibly feel more strongly that it is important to incorporate technology tools. However, the verbal introduction of Technology Connections during an educator workshop alone can not account for the higher level of use by educators, and a higher level of confidence to use technology is tied to a much larger issue than just the date a person completed a PLT educator workshop.

When comparing educators, facilitators, and state coordinators (primary role), facilitators where the most familiar with Technology Connections, followed by state coordinators and then educators. Educators had the highest level of agreement that it is important to incorporate technology. Facilitators had the greatest confidence using technology tools. Educators exhibited a greater affinity for using technology by reporting the highest level of use for seven of the eight technologies. The level of use was not different between facilitators and state coordinators. Facilitators are responsible for leading educator workshops and for this reason alone, they should be highest level of familiarity with Technology Connections. It is their responsibility to explain and demonstrate how to use the recommended technology tools. It is interesting to find that educators viewed the importance to incorporate technology more strongly than facilitators or state coordinators. It is possible, but not confirmed by this study, that this is a result of facilitators supporting the use of technology during educator workshops. Facilitators reported a higher level of confidence to use technology tools, but educators reported they use technology more than facilitators. This is possible because PLT educators are actively teaching more often in a classroom or nature center, compared to facilitators who may teach 1-3 PLT educator workshops in a year. Or, the survey could have introduced an element of confusion when asking participants to indicate their level of use of the eight technologies when recommended in the PLT PreK-8 Activity Guide. Participants may have indicated their level of use of technology that reflected the cumulative use when teaching with and without PLT materials.

Males and females demonstrated no difference in their level of familiarity with Technology Connections, level of importance to use technology tools, and their confidence to use technology tools. However, females demonstrated greater use of graphic software, graphic organizer software, and digital/video cameras. Based on the data, it is hard to say whether male or female PLT educators are more likely to use technology. If the question was aimed at use of specific technologies, then a distinction between the two is possible. Suffice it to say, the term PLT educator will have to be gender-neutral.

The age of a PLT educator made no difference in their level of familiarity with Technology Connections or their rating on the level of importance to incorporate technology tools. The youngest age group (less than 25 years) displayed the greatest level of confidence to use technology, and they demonstrated the greatest level of use for six of the eight technology tools (word processing, spreadsheet/database software, presentation software, graphic organizer software, digital/video cameras, and peripherals). Based on this data, the age of the PLT educator most likely to use technology is less than 25 years old. It is a little surprising that the 25-34 age group did not demonstrate higher level of use because this age group could be considered from the computer generation.

The last item used to characterize the PLT educator most likely to use technology is PLT region. The South region showed a greater level of familiarity than the West, but it was not different when compared against the levels for the Northeast and North Central regions. All regions agreed equally that it is important to incorporate technology tools when teaching PLT. The South region reported the highest level of confidence to use technology tools; significantly higher than North Central, but not from the Northeast and West regions. The South region reported significantly more use for four of the eight technology tools compared to the North Central region, but not more than the other two regions. Overall, scores of participants from the North Central region were lower compared to those from the other three regions.

Using data collected in this study, the characteristics of a PLT educator most likely to use technology tools are presented in the list below:

1. Completed a PLT workshop after January 1, 2007 where the PLT facilitator emphasized the Technology Connections component and modeled the use of technology tools.

2. They are trained PLT educators (not facilitators or state coordinators) who believe it is important to use technology tools when appropriate.
3. They use technology tools and encourage student learning with technology.
4. They tend to be younger.
5. They likely live in the Northeast, South, and West PLT regions.

The level of use of technology of a person possessing the characteristics above can be predicted when the condition scores for time (T), rewards and incentives (R&I), participation (P), and leadership (L) are used in the regression equation below:

$$\text{Level of Use of Technology} = -.302(T) + .195(R\&I) + .346(P) + .237(L) + 11.416$$

The negative coefficient associated with the time condition score has the potential to significantly reduce the predicted level of use, particularly if the time condition score is larger than any of the other three condition scores. To offset the negative effect of the time coefficient, the condition score for rewards and incentives would need to be at least one-third larger than the time condition score; participation would have to be at least equal to the time condition score; and the condition score for leadership would need to be at least 25 percent larger than the time condition score.

Recommendations for Practice

The following recommendations are based on the results of this study and my practical experience working with the PLT program for nearly 15 years. These recommendations address national and state level programming for the Project Learning Tree program, and if implemented, have the potential to increase the use of technology by all PLT educators.

1. The national PLT office should form a committee comprised of state coordinators, facilitators, and educators to develop a technology implementation plan (TIP). This plan

should articulate the goals, actions, responsibilities, and resources required to effectively integrate technology. The TIP will clearly communicate that the PLT leadership supports using technology.

2. The PLT community of practice must increase their technology, pedagogy, and content knowledge (TPACK). Therefore, it is recommended that a supplemental TPACK manual for PLT be created specifically for the users of the PLT curricula. Also, TPACK should be a permanent item on the agenda at the annual National PLT Coordinators Conference, and be the substance for writing a special article (Teaching Tips for Technology) in the quarterly PLT newsletter, *The Branch*.
3. State coordinators, facilitators, and educators must be confident using technology and develop new ideas about how technology can be used with PLT. Therefore, the current training protocols for facilitators and educators should be revised to reflect TPACK. TPACK should be modeled during facilitator and educator trainings to reinforce the use of technology and Technology Connections.
4. The Technology Connections section and list of recommended technology tools in the PLT PreK-8 Activity Guide should be revised to reflect best practices for technology in the classroom.
5. Peer to peer mentoring should be encouraged between the state coordinators. The PLT listserv can serve as the communication platform to support this effort.

Recommendations for Research

This study was guided by previous research investigating the conditions for implementation of technology. In 1998, Surry and Brennan identified five important, unexplored questions associated with use of instructional innovations. They suggested an examination of different groups within one organization. Therefore, this study examined the three primary role groups (educators, facilitators, and state coordinators) recognized as part of the Project Learning Tree organization.

The field of environmental education research with a focus on implementation of technology lacks adequate coverage in the literature. The following are recommended topics for research that can help fill the void in the EE literature:

1. A comparative study of Implementation Profile Inventory scores for educators, facilitators, and state coordinators among Project Learning Tree, Project WILD, and Project WET.
2. Identify best practices to incorporate technology, pedagogy, and content knowledge into environmental education training; specifically addressing the non-formal learning environment experience.
3. Guided by the work of Schmidt, Baran, Thompson, Mishra, Koehler, and Shin (2009), measure the technological pedagogical content knowledge of PLT educators, facilitators, and state coordinators and their related knowledge domains. The data will identify strengths and weaknesses, and guide the design of instructional materials and training activities.

My Thoughts

The results of this study may be useful for the Project Learning Tree organization as we continually strive to make high quality environmental education materials and programs available to students in grades PreK-12. As environmental educators, we must embrace the affordances of technology. After all, technology is in every classroom in some form, at least most classrooms have Internet access (National Center for Educational Statistics, 2001).

If PLT is serious about incorporating technology, the technology implementation plan will provide the road map necessary to achieve success. Serious effort must be put forth to gather input from all stakeholders who use PLT in various learning environments – classrooms, nature centers, and scout groups – to learn more about how the conditions for implementation affect their use of technology. Then, PLT leadership must be committed to support the use of technology. State coordinators must be willing to reach out to their network to find the best people who possess the skills and knowledge to train facilitators, both new and old, how to use technology tools and how to incorporate the use of technology in educator workshops. Facilitators must embrace technology and be made aware they have the opportunity to influence new PLT educators by the simple act of modeling technology during educator workshops. Lastly, I want this study to influence new research and stimulate the growth of environmental education as a practice and field. I want researchers interested in environmental education, to refocus their research agendas and design studies that are rigorous and ask the difficult questions that can lead to finding better ways to teach and improve the field and practice of environmental education.

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APPENDICES

Appendix A. Original Implementation Profile Inventory Questions

Dissatisfaction with the status quo:

1. It is important for me to feel that the current way we do things is not working before I consider a change.
2. Before accepting an innovation I like to be sure the old methods are not working well.
3. I am more willing to accept innovations if I feel the old ways are not working very well.
4. If the management of my organization did nothing else but demonstrate how an innovation would be an improvement over the current way things are done, that would significantly increase the likelihood that I would use the innovation.

Knowledge and Skills:

1. Innovations typically fail because people do not know how to use the innovation correctly.
2. If the management of my organization did nothing else but give me the training I need to know how to use an innovation properly, that would significantly increase the likelihood that I would use the innovation.
3. I am more likely to use an innovation if I already have the skills and knowledge related to the innovation.
4. I am comfortable using innovations as long as I know training will be provided.

Resources:

1. Without enough of the needed materials, supplies, and tools an innovation will fail.
2. Change requires not only having enough resources for everyone but also everyone having access to the resources.
3. Without proper support personnel, an innovation will fail.
4. If the management of my organization did nothing else but ensure I had easy access to support personnel and materials related to an innovation that would significantly increase the likelihood that I would use the innovation.

Time:

1. If management did nothing else but provide me with the time I need to become familiar with an innovation, that would significantly increase the likelihood that I would use the innovation.
2. Organizations usually underestimate the amount of time it will take to implement an innovation.
3. It is important to me that I do not have to spend my free time becoming familiar with an innovation.
4. You can not expect an innovation to work unless you give time on the job for people to become familiar and comfortable with it.

Rewards and Incentives:

1. I want to know that the innovation will help me in some way before I consider using it.
2. I am more likely to accept a change if I know I will gain something from it.
3. Achieving a sense of personal satisfaction will make me more likely to use an innovation.
4. If the management of my organization did nothing else but provide meaningful incentives or rewards for using an innovation, that would significantly increase the likelihood that I would use the innovation.

Participation:

1. Most front line users are more likely to accept an innovation if they have had some say in the process.
2. If management did nothing else but actively involve me and my co-workers in the decision making process about an innovation, that would significantly increase the likelihood that I would use the innovation.
3. The more everyone participates in the innovation process, the more successful the innovation will be.
4. It is important that my ideas and thoughts are considered when the organization is considering implementing an innovation.

Commitment:

1. I want tangible commitment not just basic lip service from the top level executives before I consider using an innovation.
2. If the senior management (for example, CEO, President, etc.) of my organization did nothing else but actively support and champion an innovation, that would significantly increase the likelihood that I would use the innovation.
3. Senior management’s actions are pivotal in fostering the implementation of an innovation.
4. Upper management support is not necessary for an innovation to be effective.

Leadership:

1. If my immediate supervisor did nothing else but actively support my use on an innovation on a day-to-day basis, that would significantly increase the likelihood that I would use the innovation.
2. For an innovation to succeed, direct supervisors must also use the innovation and serve as role models to others.
3. Personal encouragement from my direct supervisor would make me more willing to use an innovation.
4. Low and mid level mangers who are opposed to an innovation can kill the innovation easily, even if upper level managers support it.

Appendix B. Institutional Review Board Approval

RECEIVED 27 May 10 R. Branch

The University of Georgia

Office of The Vice President for Research
DHHS Assurance ID No.: FWA00003901

Institutional Review Board
Human Subjects Office
612 Boyd GSRC
Athens, Georgia 30602-7411
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APPROVAL FORM

Date Proposal Received: 2010-04-20 **Project Number:** 2010-10805-0

Name	Title	Dept/Phone	Address	Email
Dr. Robert Maribe Branch	PI	Educational Psychology and Instructional Technology 630 Aderhold Hall +4410 706-542-4110	706-389-6359	rbranch@uga.edu
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Title of Study: Conditions for Implementation of Instructional Technology in the Context of Environmental Education

45 CFR 46 Category: Administrative 2
Parameters:
None;

Change(s) Required for Approval:
Revised Recruitment Email;
Revised Application;
Revised Consent Document(s);

Approved : 2010-05-17 **Begin date : 2010-05-17** **Expiration date :** 2015-05-16

NOTE: Any research conducted before the approval date or after the end data collection date shown above is not covered by IRB approval, and cannot be retroactively approved.

Number Assigned by Sponsored Programs: **Funding Agency:**

Your human subjects study has been approved.

Please be aware that it is your responsibility to inform the IRB:
. . . of any adverse events or unanticipated risks to the subjects or others within 24 to 72 hours;
. . . of any significant changes or additions to your study and obtain approval of them before they are put into effect;
. . . that you need to extend the approval period beyond the expiration date shown above;
. . . that you have completed your data collection as approved, within the approval period shown above, so that your file may be closed.

For additional information regarding your responsibilities as an investigator refer to the IRB Guidelines.
Use the attached Researcher Request Form for requesting renewals, changes, or closures.
Keep this original approval form for your records.

Chairperson or Designee,
Institutional Review Board

Appendix C. Original PLT IPI Survey used to collect data for pilot study

Technology Connections Implementation Survey for PLT

Consent Form

You are invited to participate in a research study examining use of Technology Connections, a component of most activities found in the Project Learning Tree PreK-8 Environmental Education Activity Guide. Technology Connections has been integrated into every edition of the instructional design of the PLT PreK-8 Activity Guide starting in 2006. Technology Connections provides suggestions for using different computer hardware and software applications. Technology Connections is a section located in the sidebar of most activities in the PLT PreK-8 Activity Guide and is indicated by an arrow-shaped icon.

This study serves two purposes. The first purpose is to help the National PLT office understand, from a practical standpoint, how PLT educators, facilitators, and state coordinators are using Technology Connections. The second purpose of this study is to provide data that will be used by Kris Irwin (Georgia PLT Co-Coordinator) as part of the requirements for his PhD in the Department of Educational Psychology and Instructional Technology at the University of Georgia. Participation in this study will ultimately lead to benefits for you and the PLT organization through improved curriculum and programming support.

This survey should take 20 minutes or less to complete. It is broken into 12 sections and contains a total of 50 questions. Section 1 seeks to understand your familiarity with Technology Connections; Section 2 seeks to understand your level of innovativeness; Sections 3-11 seek to understand how different conditions effect your use of Technology Connections by asking you to rate your response from "Strongly Disagree" to "Strongly Agree"; and Section 12 asks for demographic data.

Your participation in this survey is anonymous, and all data is confidential. Only the researcher will have access to the raw data. You will not be asked to provide information that can be used to identify who you are, therefore participation in this study posses no risk to you. SurveyMonkey does not link internet protocol addresses, internet service provider, clickstream data, or other automatically collected data to personally identifiable information. However, if you are not comfortable with the level of confidentiality provided by the internet, please feel free to print a copy of the survey, fill it out by hand, and mail it to me at the address given below with no return address on the envelope. The results of this study may be used for teaching, research, publications, or presentations at scientific meetings.

Kris Irwin
Warnell School
University of Georgia
Athens, GA 30602-2152

Thank you very much for taking time to help PLT. Your participation in this study is strictly voluntary and you are free to withdraw at any time. Any questions you may have about this study may be directed to Dr. Rob Branch at 706-542-4110 or rbranch@uga.edu. Additional questions or problems regarding your rights as a research participant should be addressed to The Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199; E-Mail Address IRB@uga.edu

Technology Connections Implementation Survey for PLT

By selecting "I accept, start the survey" and clicking the "Next" button, you acknowledge that you have read the information presented in the consent form above and agree to participate in this study, with the full knowledge that you are free to refuse to participate or withdraw your participation at any time.

- ◯ I accept, start the survey.
- ◯ I do not wish to participate in this survey.

Technology Connections Implementation Survey for PLT

Section 1: What is Technology Connections?

Since 2006, all editions of the PLT PreK-8 Environmental Education Activity Guide have had Technology Connections incorporated into the instructional design for the purpose of providing support for teaching lesson objectives, to help students master those objectives, and to formulate a product that can be used for assessment.

Technology Connections is a section located in the sidebar of most activities in the PreK-8 PLT Activity Guide. The information in the sidebar is a brief description of how to integrate technology tools with the activity.

Technology tools suggested for use with PLT activities include software such as word processing, spreadsheet/database, presentation/graphics and graphic organizer, and internet resources; and hardware such as digital cameras. Technology Connections provides suggestions for tools commonly available to most PLT educators.

Technology Connections has been part of the instructional design of every edition of the PLT PreK-8 Activity Guide since 2006.

	Not familiar	Somewhat familiar	Familiar	Very familiar
How familiar are you with Technology Connections as it is presented in the PLT PreK-8 Activity Guide?	○	○	○	○

Technology Connections highlights the use of technology as part of most of the activities in the PLT PreK-8 Activity Guide. However, suggestions for using technology with activities in the high school modules is often embedded in the "Enrichment" section of most activities.

	Not helpful	Slightly helpful	Fairly helpful	Very helpful
How helpful would it be to add Technology Connections as a prominent section in the sidebar of the PLT high school modules?	○	○	○	○

The use of technology tools is supported by the inclusion of Technology Connections in the PLT PreK-8 Activity Guide.

	Very uncomfortable	Uncomfortable	Comfortable	Very comfortable
How comfortable are you at using technology tools (software and hardware) with PLT?	○	○	○	○

Technology Connections Implementation Survey for PLT

Technology Connections provides suggestions for integrating different technology tools as part of the learning experience of activities in the PLT PreK-8 Activity Guide.

	I do not integrate technology	I seldom integrate technology	I often integrate technology	I always integrate technology
How often do you integrate Technology Connections as part of the learning experience when teaching a PLT activity?	○	○	○	○

Technology Connections Implementation Survey for PLT

Section 2. Level of Innovativeness

Using PLT and using technology in education asks educators to do something new and different. Consider how you tend to approach situations in which you are asked to do something new.

Please respond by indicating your level of agreement with each statement.

Statement 1

	Strongly Disagree						Strongly Agree
As a general rule, I consider myself to be an innovative PLT educator.	○	○	○	○	○	○	○

Statement 2

	Strongly Disagree						Strongly Agree
Others expect me to be innovative.	○	○	○	○	○	○	○

Statement 3

	Strongly Disagree						Strongly Agree
It is necessary to use technology tools when using the PLT curriculum.	○	○	○	○	○	○	○

Statement 4

	Strongly Disagree						Strongly Agree
I am confident in my ability to use technology tools when teaching with the PLT curriculum.	○	○	○	○	○	○	○

Statement 5

	Strongly Disagree						Strongly Agree
I am motivated by others to use technology tools when teaching with PLT.	○	○	○	○	○	○	○

Statement 6

	Strongly Disagree						Strongly Agree
I must see others successfully use Technology Connections before I use it.	○	○	○	○	○	○	○

Technology Connections Implementation Survey for PLT

Section 3: Dissatisfaction with the Status Quo

Think about your use of the PLT curriculum and the effect of including Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

Before I use Technology Connections, I must be certain it is more effective than leading PLT without technology.

Strongly Disagree ○ ○ ○ ○ ○ ○ ○ Strongly Agree

Statement 2

Before I use Technology Connections, I must see that using Technology Connections will achieve the desired learning outcomes.

Strongly Disagree ○ ○ ○ ○ ○ ○ ○ Strongly Agree

Statement 3

I must confirm for myself that using Technology Connections will achieve the desired learning outcomes.

Strongly Disagree ○ ○ ○ ○ ○ ○ ○ Strongly Agree

Statement 4

Seeing others use Technology Connections will influence me to use it too.

Strongly Disagree ○ ○ ○ ○ ○ ○ ○ Strongly Agree

Technology Connections Implementation Survey for PLT

Section 4: Knowledge and Skills

Think about the knowledge and skills required to implement Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

	Strongly Disagree						Strongly Agree
I will not use Technology Connections if I do not know how to use the suggested technologies.	○	○	○	○	○	○	○

Statement 2

	Strongly Disagree						Strongly Agree
I find it necessary to have Technology Connections demonstrated during a PLT educator workshop.	○	○	○	○	○	○	○

Statement 3

	Strongly Disagree						Strongly Agree
I am more likely to use Technology Connections if I already have the skills and knowledge.	○	○	○	○	○	○	○

Statement 4

	Strongly Disagree						Strongly Agree
I am comfortable using Technology Connections as long as I know training will be provided that will increase my knowledge and skills.	○	○	○	○	○	○	○

Technology Connections Implementation Survey for PLT

Section 5: Resources

Think about the issues of accessibility and supply of hardware, software, support personnel, and materials necessary to implement Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

	Strongly Disagree						Strongly Agree
I must have a sufficient supply of technology tools and materials before I will use Technology Connections.	◯	◯	◯	◯	◯	◯	◯

Statement 2

	Strongly Disagree						Strongly Agree
I must have access to technology tools and materials before I will use Technology Connections.	◯	◯	◯	◯	◯	◯	◯

Statement 3

	Strongly Disagree						Strongly Agree
I must have access to technical support personnel before I will use Technology Connections.	◯	◯	◯	◯	◯	◯	◯

Statement 4

	Strongly Disagree						Strongly Agree
I would use Technology Connections if I were provided an adequate supply of technology resources and access to technical support personnel.	◯	◯	◯	◯	◯	◯	◯

Technology Connections Implementation Survey for PLT

Section 6: Time

Think about the time you have to learn, adapt, integrate, and reflect on what you are doing to implement Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

I would use Technology Connections if the PLT organization provided me with time to become familiar with new technology tools I do not know how to use.

	Strongly Disagree						Strongly Agree
	○	○	○	○	○	○	○

Statement 2

The amount of time it takes to implement Technology Connections makes me less likely to use it.

	Strongly Disagree						Strongly Agree
	○	○	○	○	○	○	○

Statement 3

I should use my free time to become familiar with Technology Connections, and to learn how to use the suggested technology tools.

	Strongly Disagree						Strongly Agree
	○	○	○	○	○	○	○

Statement 4

Time should be allocated during PLT educator workshops to learn how to use Technology Connections and technology tools.

	Strongly Disagree						Strongly Agree
	○	○	○	○	○	○	○

Technology Connections Implementation Survey for PLT

Section 7: Rewards and Incentives

Think about the incentives or rewards that motivate you to implement Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

	Strongly Disagree						Strongly Agree
I would use Technology Connections if I knew it would help me be a better educator.	◯	◯	◯	◯	◯	◯	◯

Statement 2

	Strongly Disagree						Strongly Agree
I would use Technology Connections if I can personally gain something from doing so.	◯	◯	◯	◯	◯	◯	◯

Statement 3

	Strongly Disagree						Strongly Agree
I would use Technology Connections if I will receive a sense of personal satisfaction by doing so.	◯	◯	◯	◯	◯	◯	◯

Statement 4

	Strongly Disagree						Strongly Agree
I would use Technology Connections if the PLT organization provided meaningful incentives or rewards for doing so.	◯	◯	◯	◯	◯	◯	◯

Technology Connections Implementation Survey for PLT

Section 8: Participation

Think about the importance of being involved in the decision-making process with regards to implementing Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

	Strongly Disagree						Strongly Agree
I am more likely to use Technology Connections if I have the opportunity to share my ideas about implementing Technology Connections.	○	○	○	○	○	○	○

Statement 2

	Strongly Disagree						Strongly Agree
I am more likely to use Technology Connections if I have more opportunity to provide input into the decision making process about how technology is to be implemented.	○	○	○	○	○	○	○

Statement 3

	Strongly Disagree						Strongly Agree
The more everyone has meaningful input into the development of PLT materials, the more successful Technology Connections will be.	○	○	○	○	○	○	○

Statement 4

	Strongly Disagree						Strongly Agree
It is important that my ideas and thoughts are considered when changes to the PLT curriculum guides are being considered that involve implementation of Technology Connections.	○	○	○	○	○	○	○

Technology Connections Implementation Survey for PLT

Section 9: Commitment

Think about the PLT organization and its influence on your willingness and ability to implement Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

Commitment to support the use of Technology Connections from the PLT organization is important before I consider using it.

Strongly Disagree ○ ○ ○ ○ ○ ○ ○ Strongly Agree

Statement 2

I will use Technology Connections if the PLT organization actively campaigns for its use.

Strongly Disagree ○ ○ ○ ○ ○ ○ ○ Strongly Agree

Statement 3

Actions of the PLT organization are pivotal in fostering my use of Technology Connections.

Strongly Disagree ○ ○ ○ ○ ○ ○ ○ Strongly Agree

Statement 4

As an organization, PLT needs to demonstrate support and champion the use of Technology Connections.

Strongly Disagree ○ ○ ○ ○ ○ ○ ○ Strongly Agree

Technology Connections Implementation Survey for PLT

Section 10: Leadership

Think about implementation of Technology Connections, and your interactions with the PLT organization.

Please respond by indicating your level of agreement with each statement.

Statement 1

I would use Technology Connections if the PLT organization actively supported my use of it on a day-to-day basis.

Strongly Disagree ○ ○ ○ ○ ○ ○ ○ Strongly Agree

Statement 2

PLT workshop facilitators must use and model Technology Connections for it to be implemented successfully.

Strongly Disagree ○ ○ ○ ○ ○ ○ ○ Strongly Agree

Statement 3

I would use Technology Connections if personal encouragement was provided by the PLT organization.

Strongly Disagree ○ ○ ○ ○ ○ ○ ○ Strongly Agree

Statement 4

PLT workshop facilitators who oppose using Technology Connections can stifle its use, even if the PLT organization supports it.

Strongly Disagree ○ ○ ○ ○ ○ ○ ○ Strongly Agree

Technology Connections Implementation Survey for PLT

Section 11: Demographic Information

Please provide the following information.

I completed a PLT training where I received a copy of the PreK-8 PLT Activity Guide...

- ◯ Prior to December 2006
- ◯ After January 1, 2007

What do you consider to be your primary role with Project Learning Tree?

- ◯ PLT Educator = You have completed the PLT Professional Development Workshop
- ◯ PLT Facilitator = You are certified to lead PLT Professional Development Workshops (i.e. training PLT Educators)
- ◯ PLT State Coordinator = You are responsible for organizing and facilitating the PLT programming in your state

Select the educational setting where you use PLT most often.

- ◯ Early Childhood (Ages 3-6)
- ◯ Preschool (Grades PreK-2)
- ◯ Primary School (Grades 3-5)
- ◯ Middle School (Grades 6-8)
- ◯ High School (Grades 9-12)
- ◯ College
- ◯ Nature Center (All ages)
- ◯ Museum (All ages)
- ◯ Community Youth Program (Grades PreK-12)
- ◯ Scouts

Other (please specify)

[ ]

Technology Connections Implementation Survey for PLT

Which PLT Activity Guide do you use most often?

- ◯ PreK-8 Activity Guide
- ◯ Focus on Forests (High school module)
- ◯ Municipal Solid Waste (High school module)
- ◯ Places We Live (High school module)
- ◯ Focus on Risk (High school module)
- ◯ The Changing Forest: Forest Ecology (High school module)
- ◯ Global Connections: Forests of the World (High school module)

What is your sex?

- ◯ Male
- ◯ Female

What is your age?

- ◯ Less than 25
- ◯ 25-34
- ◯ 35-44
- ◯ 45-54
- ◯ 55 or more

If you live in the United States, select the state or territory where you currently live.

State: [ ]

If you live outside of the United States, please select the country where you live.

Country

Select the Country [ ]

Technology Connections Implementation Survey for PLT

Thank you!

Thank you for completing our survey! Your participation and input is greatly appreciated. The data you have provided will help improve the PLT program.

Appendix D. Implementation Profile Inventory Modified Questions

Dissatisfaction with the status quo: the perception or feeling that the current process or system is not working and improvements must be made.

Original Generic Questions

1. It is important for me to feel that the current way we do things is not working before I consider a change.
2. Before accepting an innovation I like to be sure the old methods are not working well.
3. I am more willing to accept innovations if I feel the old ways are not working very well.
4. If the management of my organization did nothing else but demonstrate how an innovation would be an improvement over the current way things are done, that would significantly increase the likelihood that I would use the innovation.

Modified Questions for PLT

1. Before I use Technology Connections, I must be certain it is more effective than leading PLT without technology.
2. Before I use Technology Connections, I must see that using Technology Connections will achieve the desired learning outcomes.
3. I must confirm for myself that using Technology Connections will achieve the desired learning outcomes.
4. Seeing others use Technology Connections will influence me to use it too.

Knowledge and Skills: the persons expected to implement the innovation have the required knowledge and skills.

Original Generic Questions

1. Innovations typically fail because people do not know how to use the innovation correctly.
2. If the management of my organization did nothing else but give me the training I need to know how to use an innovation properly, that would significantly increase the likelihood that I would use the innovation.
3. I am more likely to use an innovation if I already have the skills and knowledge related to the innovation.
4. I am comfortable using innovations as long as I know training will be provided.

Modified Questions for PLT

1. I will not use Technology Connections if I do not know how to use the suggested technologies.
2. I find it necessary to have Technology Connections demonstrated during a PLT educator workshop.
3. I am more likely to use Technology Connections if I already have the skills and knowledge.
4. I am comfortable using Technology Connections as long as I know training will be provided that will increase my knowledge and skills.

Resources: the necessary hardware, software, finances, personnel, and materials are accessible and in sufficient supply.

Original Generic Questions

1. Without enough of the needed materials, supplies, and tools an innovation will fail.
2. Change requires not only having enough resources for everyone but also everyone having access to the resources.
3. Without proper support personnel, an innovation will fail.
4. If the management of my organization did nothing else but ensure I had easy access to support personnel and materials related to an innovation that would significantly increase the likelihood that I would use the innovation.

Modified Questions for PLT

1. I must have a sufficient supply of technology tools and materials before I will use Technology Connections.
2. I must have access to technology tools and materials before I will use Technology Connections.
3. I must have access to technical support personnel before I will use Technology Connections.
4. I would use Technology Connections if I were provided an adequate supply of technology resources and access to technical support personnel.

Time: adequate time to learn, adapt, integrate, and reflect on what they are doing to implement the innovation is provided and the personnel are willing to devote time for implementation.

Original Generic Questions

1. If management did nothing else but provide me with the time I need to become familiar with an innovation, that would significantly increase the likelihood that I would use the innovation.
2. Organizations usually underestimate the amount of time it will take to implement an innovation.
3. It is important to me that I do not have to spend my free time becoming familiar with an innovation.
4. You can not expect an innovation to work unless you give time on the job for people to become familiar and comfortable with it.

Modified Questions for PLT

1. I would use Technology Connections if the PLT organization provided me with time to become familiar with new technology tools I do not know how to use.
2. The amount of time it takes to implement Technology Connections makes me less likely to use it.
3. I should use my free time to become familiar with Technology Connections, and to learn how to use the suggested technology tools.
4. Time should be allocated during PLT educator workshops to learn how to use Technology Connections and technology tools.

Rewards and Incentives: incentives or rewards exist that motivate implementation of the innovation.

Original Generic Questions

1. I want to know that the innovation will help me in some way before I consider using it.
2. I am more likely to accept a change if I know I will gain something from it.
3. Achieving a sense of personal satisfaction will make me more likely to use an innovation.
4. If the management of my organization did nothing else but provide meaningful incentives or rewards for using an innovation, that would significantly increase the likelihood that I would use the innovation.

Modified Questions for PLT

1. I would use Technology Connections if I knew it would help me be a better educator.
2. I would use Technology Connections if I can personally gain something from doing so.
3. I would use Technology Connections if I will receive a sense of personal satisfaction by doing so.
4. I would use Technology Connections if the PLT organization provided meaningful incentives or rewards for doing so.

Participation: the users are involved in some part of the decision-making process with regards to how to implement the innovation.

Original Generic Questions

1. Most front line users are more likely to accept an innovation if they have had some say in the process.
2. If management did nothing else but actively involve me and my co-workers in the decision making process about an innovation, that would significantly increase the likelihood that I would use the innovation.
3. The more everyone participates in the innovation process, the more successful the innovation will be.
4. It is important that my ideas and thoughts are considered when the organization is considering implementing an innovation.

Modified Questions for PLT

1. I am more likely to use Technology Connections if I have the opportunity to share my ideas about implementing Technology Connections.
2. I am more likely to use Technology Connections if I have more opportunity to provide input into the decision making process about how technology is to be implemented.
3. The more everyone has meaningful input into the development of the PLT materials, the more successful Technology Connections will be.
4. It is important that my ideas and thoughts are considered when changes to the PLT curriculum guides are being considered that involve implementation of Technology Connections.

Commitment: the perception that the senior level administrators actively support the implementation of the innovation.

Original Generic Questions

1. I want tangible commitment not just basic lip service from the top level executives before I consider using an innovation.
2. If the senior management (for example, CEO, President, etc.) of my organization did nothing else but actively support and champion an innovation, that would significantly increase the likelihood that I would use the innovation.
3. Senior management's actions are pivotal in fostering the implementation of an innovation.
4. Upper management support is not necessary for an innovation to be effective.

Modified Questions for PLT

1. Commitment to support Technology Connections from the PLT organization is important before I consider using it.
2. I will use Technology Connections if the PLT organization actively campaigns for its use.
3. Actions of the PLT organization are pivotal in fostering my use of Technology Connections.
4. As an organization, PLT needs to demonstrate support and champion the use of Technology Connections.

Leadership: there is active involvement of user's direct supervisors in the implementation of the innovation.

Original Generic Questions

1. If my immediate supervisor did nothing else but actively support my use on an innovation on a day-to-day basis, that would significantly increase the likelihood that I would use the innovation.
2. For an innovation to succeed, direct supervisors must also use the innovation and serve as role models to others.
3. Personal encouragement from my direct supervisor would make me more willing to use an innovation.
4. Low and mid level mangers who are opposed to an innovation can kill the innovation easily, even if upper level managers support it.

Modified Questions for PLT

1. I would use Technology Connections if the PLT organization actively supported my use of it on a day-to-day basis.
2. PLT workshop facilitators must use and model Technology Connections for it to be implemented successfully.
3. I would use Technology Connections if personal encouragement was provided by the PLT organization.
4. PLT workshop facilitators who oppose using Technology Connections can stifle its use, even if the PLT organization supports it.

Appendix E. Modified PLT IPI Survey Instrument

PLT Technology Connections National Survey

Consent Form

You are invited to participate in a research study examining use of Technology Connections, a component of most activities found in the Project Learning Tree PreK-8 Environmental Education Activity Guide. Technology Connections has been integrated into every edition of the instructional design of the PLT PreK-8 Activity Guide starting in 2006. Technology Connections provides suggestions for using different computer hardware and software applications. Technology Connections is a section located in the sidebar of most activities in the PLT PreK-8 Activity Guide and is indicated by an arrow-shaped icon.

This study serves two purposes. The first purpose is to help the National PLT office understand, from a practical standpoint, how PLT educators, facilitators, and state coordinators are using Technology Connections. The second purpose of this study is to provide data that will be used by Kris Irwin (Georgia PLT Co-Coordinator) as part of the requirements for his PhD in the Department of Educational Psychology and Instructional Technology at the University of Georgia. Participation in this study will ultimately lead to benefits for you and the PLT organization through improved curriculum and programming support.

This survey should take 20 minutes or less to complete. It is broken into 10 sections and contains a total of 44 questions. Section 1 seeks to understand your familiarity and use of Technology Connections; Sections 2-9 seek to understand how different conditions effect your use of Technology Connections by asking you to rate your response from "Strongly Disagree" to "Strongly Agree"; and Section 10 asks for demographic data.

Your participation in this survey is anonymous, and all data is confidential. Only the researcher will have access to the raw data. You will not be asked to provide information that can be used to identify who you are, therefore participation in this study posses no risk to you. SurveyMonkey does not link internet protocol addresses, internet service provider, clickstream data, or other automatically collected data to personally identifiable information. However, if you are not comfortable with the level of confidentiality provided by the internet, please feel free to print a copy of the survey, fill it out by hand, and mail it to me at the address given below with no return address on the envelope. The results of this study may be used for teaching, research, publications, or presentations at scientific meetings.

Kris Irwin
Warnell School
University of Georgia
Athens, GA 30602-2152

Thank you very much for taking time to help PLT. Your participation in this study is strictly voluntary and you are free to withdraw at any time. Any questions you may have about this study may be directed to Dr. Rob Branch at 706-542-4110 or rbranch@uga.edu. Additional questions or problems regarding your rights as a research participant should be addressed to The Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199; E-Mail Address IRB@uga.edu

By selecting "I accept, start the survey" and clicking the "Next" button, you acknowledge that you have read the information presented in the consent form above and agree to participate in this study, with the full knowledge that you are free to refuse to participate or withdraw your participation at any time.

- ◯ I accept, start the survey.
- ◯ I do not wish to participate in this survey.

PLT Technology Connections National Survey

Section 1: Using Technology Connections

PLT recognizes the importance of utilizing technology to enhance student learning. Technology Connections is a section located in the sidebar of most activities in the PreK-8 PLT Activity Guide.

The information in the sidebar is a list of the technology tools suggested for use with the activity. Information about how to integrate the suggested technology is provided in the activity description.

Technology Connections has been part of the instructional design of every edition of the PLT PreK-8 Activity Guide since 2006.

	Not familiar	Somewhat familiar	Familiar	Very familiar
How familiar are you with Technology Connections as it is presented in the PLT PreK-8 Activity Guide?	◯	◯	◯	◯

Appendix 8 of the current PLT PreK-8 Activity Guide provides a description of technology tools that can be used with activities in the guide.

For each technology listed, please indicate your level of use of each technology when it is recommended in the PLT PreK-8 Activity Guide.

	Never (0% of the time)	Seldom (about 25% of the time)	About half the time	Usually (about 75% of the time)	Always (100% of the time)
Word Processing Software	◯	◯	◯	◯	◯
Spreadsheet/Database Software	◯	◯	◯	◯	◯
Presentation Software	◯	◯	◯	◯	◯
Graphics Software	◯	◯	◯	◯	◯
Graphic Organizer Software	◯	◯	◯	◯	◯
Digital/Video Cameras	◯	◯	◯	◯	◯
Peripherals	◯	◯	◯	◯	◯
Internet Resources	◯	◯	◯	◯	◯

Please indicate your level of agreement with the following statement.

	Strongly Disagree						Strongly Agree
It is important to incorporate technology tools when it is recommended in the PLT PreK-8 Activity Guide.	◯	◯	◯	◯	◯	◯	◯

Please indicate your level of agreement with the following statement.

	Strongly Disagree						Strongly Agree
I am confident in my ability to use technology tools when teaching with the PLT curriculum.	◯	◯	◯	◯	◯	◯	◯

PLT Technology Connections National Survey

Section 2: Dissatisfaction with the Status Quo

Think about your use of the PLT curriculum and the effect of including Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

	Strongly Disagree						Strongly Agree
Before I use Technology Connections, I must be certain it is more effective than leading PLT without technology.	○	○	○	○	○	○	○

Statement 2

	Strongly Disagree						Strongly Agree
Before I use Technology Connections, I must see that using Technology Connections will achieve the desired learning outcomes.	○	○	○	○	○	○	○

Statement 3

	Strongly Disagree						Strongly Agree
I must confirm for myself that using Technology Connections will achieve the desired learning outcomes.	○	○	○	○	○	○	○

Statement 4

	Strongly Disagree						Strongly Agree
Seeing others use Technology Connections will influence me to use it too.	○	○	○	○	○	○	○

PLT Technology Connections National Survey

Section 3: Knowledge and Skills

Think about the knowledge and skills required to use the technology tools recommended in Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

	Strongly Disagree						Strongly Agree
I will not use Technology Connections if I do not know how to use the suggested technologies.	○	○	○	○	○	○	○

Statement 2

	Strongly Disagree						Strongly Agree
I find it necessary to have Technology Connections demonstrated during a PLT educator workshop.	○	○	○	○	○	○	○

Statement 3

	Strongly Disagree						Strongly Agree
I am more likely to use Technology Connections if I already have the skills and knowledge.	○	○	○	○	○	○	○

Statement 4

	Strongly Disagree						Strongly Agree
I am comfortable using Technology Connections as long as I know training will be provided that will increase my knowledge and skills.	○	○	○	○	○	○	○

PLT Technology Connections National Survey

Section 4: Resources

Think about the issues of accessibility and supply of hardware, software, support personnel, and materials necessary to implement Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

	Strongly Disagree						Strongly Agree
I must have a sufficient supply of technology tools and materials before I will use Technology Connections.	○	○	○	○	○	○	○

Statement 2

	Strongly Disagree						Strongly Agree
I must have access to technology tools and materials before I will use Technology Connections.	○	○	○	○	○	○	○

Statement 3

	Strongly Disagree						Strongly Agree
I must have access to technical support personnel before I will use Technology Connections.	○	○	○	○	○	○	○

Statement 4

	Strongly Disagree						Strongly Agree
I would use Technology Connections if I were provided an adequate supply of technology resources and access to technical support personnel.	○	○	○	○	○	○	○

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Section 5: Time

Think about the time you have to learn, adapt, integrate, and reflect on using Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

	Strongly Disagree						Strongly Agree
I would use Technology Connections if the PLT organization provided me with time to become familiar with new technology tools I do not know how to use.	○	○	○	○	○	○	○

Statement 2

	Strongly Disagree						Strongly Agree
The amount of time it takes to implement Technology Connections makes me less likely to use it.	○	○	○	○	○	○	○

Statement 3

	Strongly Disagree						Strongly Agree
I should use my free time to become familiar with Technology Connections, and to learn how to use the suggested technology tools.	○	○	○	○	○	○	○

Statement 4

	Strongly Disagree						Strongly Agree
Time should be allocated during PLT educator workshops to learn how to use Technology Connections and technology tools.	○	○	○	○	○	○	○

PLT Technology Connections National Survey

Section 6: Rewards and Incentives

Think about the rewards or incentives that will motivate you to implement Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

	Strongly Disagree						Strongly Agree
I would use Technology Connections if I knew it would help me be a better educator.	○	○	○	○	○	○	○

Statement 2

	Strongly Disagree						Strongly Agree
I would use Technology Connections if I can personally gain something from doing so.	○	○	○	○	○	○	○

Statement 3

	Strongly Disagree						Strongly Agree
I would use Technology Connections if I will receive a sense of personal satisfaction by doing so.	○	○	○	○	○	○	○

Statement 4

	Strongly Disagree						Strongly Agree
I would use Technology Connections if the PLT organization provided meaningful incentives or rewards for doing so.	○	○	○	○	○	○	○

PLT Technology Connections National Survey

Section 7: Participation

Think about the importance of being involved in the decision-making process with regards to implementing Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

	Strongly Disagree						Strongly Agree
I am more likely to use Technology Connections if I have the opportunity to share my ideas about implementing Technology Connections.	○	○	○	○	○	○	○

Statement 2

	Strongly Disagree						Strongly Agree
I am more likely to use Technology Connections if I have more opportunity to provide input into the decision making process about how technology is to be implemented.	○	○	○	○	○	○	○

Statement 3

	Strongly Disagree						Strongly Agree
The more everyone has meaningful input into the development of PLT materials, the more successful Technology Connections will be.	○	○	○	○	○	○	○

Statement 4

	Strongly Disagree						Strongly Agree
It is important that my ideas and thoughts are considered when changes to the PLT curriculum guides are being made that involve implementation of Technology Connections.	○	○	○	○	○	○	○

PLT Technology Connections National Survey

Section 8: Commitment

Think about the PLT organization and its influence on your willingness and ability to implement Technology Connections.

Please respond by indicating your level of agreement with each statement.

Statement 1

	Strongly Disagree						Strongly Agree
Commitment to support the use of Technology Connections from the PLT organization is important before I consider using it.	○	○	○	○	○	○	○

Statement 2

	Strongly Disagree						Strongly Agree
I will use Technology Connections if the PLT organization actively campaigns for its use.	○	○	○	○	○	○	○

Statement 3

	Strongly Disagree						Strongly Agree
Actions of the PLT organization are pivotal in fostering my use of Technology Connections.	○	○	○	○	○	○	○

Statement 4

	Strongly Disagree						Strongly Agree
As an organization, PLT needs to demonstrate support and champion the use of Technology Connections.	○	○	○	○	○	○	○

PLT Technology Connections National Survey

Section 9: Leadership

Think about implementation of Technology Connections, and your interactions with the PLT organization.

Please respond by indicating your level of agreement with each statement.

Statement 1

	Strongly Disagree						Strongly Agree
I would use Technology Connections if the PLT organization actively supported my use of it on a day-to-day basis.	○	○	○	○	○	○	○

Statement 2

	Strongly Disagree						Strongly Agree
PLT workshop facilitators must use and model Technology Connections for it to be implemented successfully.	○	○	○	○	○	○	○

Statement 3

	Strongly Disagree						Strongly Agree
I would use Technology Connections if encouragement was provided by the PLT organization.	○	○	○	○	○	○	○

Statement 4

	Strongly Disagree						Strongly Agree
PLT workshop facilitators who oppose using Technology Connections can stifle its use, even if the PLT organization supports it.	○	○	○	○	○	○	○

PLT Technology Connections National Survey

Section 10: Demographic Information

Please provide the following information.

I completed a PLT training where I received a copy of the most recently published PreK-8 PLT Activity Guide...

- ◯ Prior to December 2006
- ◯ After January 1, 2007

What do you consider to be your primary role with Project Learning Tree?

- ◯ PLT Educator = You have completed the PLT Professional Development Workshop
- ◯ PLT Facilitator = You are certified to lead PLT Professional Development Workshops (i.e. training PLT Educators)
- ◯ PLT State Coordinator = You are responsible for organizing and facilitating the PLT programming in your state

Select the educational setting where you use PLT most often.

- ◯ Early Childhood (Ages 3-6)
- ◯ Preschool (Grades PreK-2)
- ◯ Primary School (Grades 3-5)
- ◯ Middle School (Grades 6-8)
- ◯ High School (Grades 9-12)
- ◯ College
- ◯ Nature Center (All ages)
- ◯ Museum (All ages)
- ◯ Community Youth Program (Grades PreK-12)
- ◯ Scouts

Other (please specify)

[ ]

PLT Technology Connections National Survey

Which PLT Activity Guide do you use most often?

- ◯ PreK-8 Activity Guide
- ◯ Focus on Forests (High school module)
- ◯ Municipal Solid Waste (High school module)
- ◯ Places We Live (High school module)
- ◯ Focus on Risk (High school module)
- ◯ The Changing Forest: Forest Ecology (High school module)
- ◯ Global Connections: Forests of the World (High school module)

What is your sex?

- ◯ Male
- ◯ Female

What is your age?

- ◯ Less than 25
- ◯ 25-34
- ◯ 35-44
- ◯ 45-54
- ◯ 55 or more

If you live in the United States, select the state or territory where you currently live.

State: [ ]

If you live outside of the United States, please select the country where you live.

	Country
Select the Country	[ ]

PLT Technology Connections National Survey

Thank you!

Thank you for completing our survey! Your participation and input is greatly appreciated. The data you have provided will help improve the PLT program.