THE EFFECT OF AN ETHNOBOTANICAL ENVIRONMENTAL EDUCATION WORKSHOP ON TEACHER'S ENVIRONMENTAL KNOWLEDGE

By

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(Under the Direction of Gary T. Green)

ABSTRACT

Environmental Education (EE) plays a vital role in the development of an environmentally-literate global society. Evaluation of EE workshops impacts on teacher's environmental knowledge is critical. This study described the development and implementation of an efficient, reliable, and valid survey instrument that measured teacher's environmental knowledge during an Ethnobotanical EE Workshop. Teachers' environmental knowledge increased in primary areas of the workshop. Teacher interviews indicated that environmental knowledge increases were recognized by more confidence introducing and teaching new environmental topics in their classrooms.

Based on these results, it appeared that most teachers derived general benefits from the Ethnobotanical EE workshop. EE workshops that promote positive interactions with EE strengthen teacher's environmental knowledge and may facilitate more EE instruction in the classroom. Further research is needed to identify additional factors that affect teacher's environmental knowledge and to determine methods for improving the delivery and functional utility of EE workshops for teachers.

INDEX WORDS: Environmental Education, Environmental Knowledge, Ethnobotany, Teacher Professional Development

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INTRODUCTION

In 2006, Louv coined the phrase “nature-deficit disorder” in his book *Last Child in the Woods* (p. 34). Nature-deficit disorder relates to the decline in outdoor experiences and understanding of the environment by children. The author describes how a lack of authentic outdoor experiences helps to make children become more disconnected from the world of nature; a world where humans are a vital part of the fragile ecosystem (Kahn & Kellert, 2002; Loughland, Reid, Walker, & Petocz, 2003; Louv, 2006).

Recent researchers have also reported on the growing disconnect between children and the environment is not a new concern (Louv, 2006). In fact, despite nearly a century of propaganda, conservation literacy and environmental awareness still proceed at an alarmingly slow pace. Aldo Leopold, the “father” of wildlife management, suggested that the future of the natural world lies within the hands of an environmentally literate society (Leopold, 1949). Although Louv and Leopold lived decades apart, their idea that environmental education (EE) needs to exist to help promote sustainable relationships between humans and the natural world continues to transcend time. Hence, both the historical and present answer to people’s lack of environmental awareness continues to remain focused on the need for “more conservation education” (Leopold, 1949; Louv, 2006).

Environmental education in teacher education has been a priority since the end of the twentieth century (UNESCO-UNEP, 1990). Despite the emphasis, an introduction of programs attempting to educate teachers about the environment also proceeds at a remarkably slow pace

(McKoewn-Ice, 2000; Van Petegem, Blieck, & Pauw, 2007). However, teachers are becoming more sensitive to the vital roles they play in conceptualizing environmental issues and in developing cognitive environmental frameworks for children (Ballantyne, 1995; McKoewn-Ice, 2000; Van Petegem, et al., 2007). Furthermore, many studies indicate the importance of having teachers with a strong base knowledge of environmental issues to properly teach students about the natural world (Kapyla & Wahlstrom, 2000; Michail, Stamou, & Stamou, 2006; Summers et al., 2001).

In the past, the inclusion of environmental education within school curricula was inconsistent at best and mostly unstructured in regards to preparing teachers to assimilate and teach environmental material (Ballantyne, 1995). Many teachers still disregard or fail to appreciate the importance of actually being able to understand environmental concepts or issues before being able to properly teach environmental ideas and concepts to students. Teachers also remain somewhat reluctant as to how or what EE provides or contributes to student learning (Cross, 1998; Summers, Kruger, & Childs, 2000).

To date, limited research has been conducted on the actual impact of EE curricula on teacher's environmental knowledge, and the possible impacts of EE curricula still remain somewhat unknown (Arvai, Campbell, Baird, & Rivers, 2004; Smith-Sebasto & Cavern, 2006; Volk & Cheak, 2003). Revised curricula could help to fully integrate EE into school curricula, and hence help to address current disconnects between teachers and the environmental curriculum. Furthermore, in the future, by having environmentally informed and aware teachers, schools may be better able to offer more EE programs or curricula for children, so helping to reconnect children with the environment.

Problem Statement

Current literature reports a growing disconnect between children and the natural environment. Schools are attempting to address this problem by implementing environmental education curricula. Unfortunately, the implementation of many EE curricula has been inconsistent and unstructured, thus providing little instruction for teachers on how to teach a curriculum with environmental education components. Furthermore, limited research has examined the actual impacts of EE curricula on teacher's environmental knowledge.

Statement of Purpose and Research Objectives

The purpose of this study was to investigate the effect of an EE workshop on the environmental knowledge of elementary teachers in a two-step process. This process involved two objectives: (1) the development of a reliable and valid metric to quantify the environmental knowledge of elementary teachers; and (2) the examination of the impact of a three-day EE teacher workshop on the environmental knowledge of primary teachers.

Research Justification

Global conservation depends on the quality and delivery of environmental educational curricula that generate a positive impact on teacher's environmental knowledge. Resources are often allocated to curricula that find quantifiable results, hence research is necessary to identify "proven" and "promising" environmental education efforts (NEEAC, 2005). Environmental education teacher training workshops can create unique vehicles for teacher learning that may also provide quantifiable results. This idea became recognized very recently when the U.S. House of Representatives passed the No Child Left Inside (NCLI) Act in September 2008.

Support for NCLI signifies the growing recognition of the importance of EE in today's society. This act created an environmental education grant curriculum for teacher's professional development and student curricula (CBF, 2008). “The purpose of this grant curriculum is to ensure the academic achievement of students in environmental literacy through the professional development of teachers and educators and outdoor learning experiences for students” (CBF, p.1, 2008). One hundred million dollars will be allocated to NCLI and the state environmental literacy plans. The new funding sources for EE allow for the development, improvement, and advancement of EE through educational models and studies of national significance for teachers and students to expand their classroom learning to include EE. This study will address the need for improved teacher education in the EE arena specified by NCLI.

The expansion of new curricula in the classroom also coincides with the expansion of classroom cultural diversity. By 2050, the Anglo-American proportions of the U.S. population will decline from the current 70% to 50% as the African-American and Hispanic proportions rise (Cordell, Green, & Betz, 2002). Traditional EE curricula typically target homogenous populations (Larson, Green & Castleberry, in review). However, as America’s population continues to grow more ethnically diverse, there will be a greater need for EE curricula that reaches more culturally diverse groups. Environmental education efforts could help facilitate these changes in cultural diversity within school curricula.

Environmental education efforts should be adapted to respond to these population changes. Georgia is not unique to these changes in cultural diversity. Many organizations have joined together in an attempt to improve the lack of environmental education occurring in the state of Georgia. Environmental Education in Georgia is an organization that promotes EE, and its goal is to build statewide capacity for environmental education by providing: EE lesson plans based on Georgia’s curriculum standards, a searchable directory of Georgia's EE organizations and the resources they offer, a statewide calendar of EE events, EE news, and easy-to-access facts about Georgia's environment (EEG, 2009). The Environmental Education Alliance of Georgia is another organization that promotes EE and its goals are: (1) “To increase the content knowledge and skill level of environmental educators through professional development and continuing education. To promote the design, implementation, and evaluation of environmental education teaching and learning strategies that increase awareness, knowledge, and informed responses to environmental topics and issues that impact Georgia citizens. (2) To build capacity for environmental education through partnerships with governmental and non-governmental organizations to achieve comprehensive statewide environmental education programs. (3) To support inclusion, values of diversity, and multiculturalism in environmental education; and (4) To highlight emerging trends in environmental education and protection, and provide our members with cutting edge information and innovative initiatives” (EEA, 2009).

In Athens-Clarke County, Georgia, the population is very diverse and near an urban area in the southern United States, and is located in a region with low environmental literacy rates relative to the rest of the country (Coyle, 2005). One out of every four Athens-Clarke County children lives in poverty, and suboptimal socioeconomic situations prevent many African-American and Hispanic families from accessing nature-based recreation opportunities in and around Athens (Partners for a Prosperous Athens, 2006). School EE programs expose teachers to different curricula that could introduce children to unfamiliar environmental objects and concepts in an exciting context, which may induce knowledge and attitude shifts in children regardless of their ethnic, economic, or cultural circumstances. The State Botanical Gardens of Georgia (SBG) provides a gateway for children, parents, and teachers to learn more about the environment through many different opportunities.

Specifically, the SBG provides many opportunities for teachers to learn how to better implement environmental information and EE curricula into their classrooms. This study evaluates the impact of an Ethnobotanical Environmental Education Workshop on teacher's environmental knowledge. The ethnobotanical curriculum, in part, has been created to help address the cultural challenges presented by changes in diversity within United States' classrooms. The definition of ethnobotanic is broken down into "ethno," meaning cultural group or people, and "botanic," meaning scientific study of plants. Ethnobotany is the study of how people of a particular culture and region make use of indigenous plants. Ethnobotanists explore how plants are used for such things as food, shelter, medicine, clothing, hunting, and religious ceremonies.

Hence, one goal of the EE workshop is to provide interdisciplinary connections from the EE curricula which can include social studies, language arts, science, and math skills. These additional aspects of the environment provide teachers with greater environmental knowledge that can help them provide more holistic environmental curricula in their classrooms. The EE curriculum also brings diverse aspects of cultures to the classroom by the sharing of stories about various plants' histories and current uses. Showing students where plants originate helps illustrate cultural connections and common plant uses. Animal and human uses of plants also can be discussed in terms of ecology and nutritional needs, once again connecting students to the natural world and influencing critical thinking. Hence, there are multiple learning possibilities pertaining to ethnobotany. Therefore, this ethnobotanical specific EE curriculum may also help improve teacher understanding and knowledge of the environment.

CHAPTER 2

LITERATURE REVIEW

The impact of an EE workshop on teacher's environmental knowledge was assessed in a two-step process. This process involved: (1) the development of a reliable and valid metric to quantify the environmental knowledge of primary teachers; and (2) the examination of the impact of a three-day EE teacher workshop on the environmental knowledge of primary teachers. Literature related to this study is reviewed in this chapter. Relevant research includes an overview of the benefits of environmental education, teacher's environmental knowledge, building environmental knowledge in teachers, measuring teacher's environmental knowledge, the role of professional development workshops, and the ethnobotanical EE workshop.

Benefits of Environmental Education

Environmental Education was not recognized as a global conservation tool until the 1970s when the United Nations Educational, Scientific, and Cultural Organization made global environmental education a high priority. According to the Belgrade Charter:

> The goal of environmental education is to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones (UNESCO, pg. 34, 1975).

In the 1977 Tbilisi Declaration that followed, the United Nations called for programs to embrace environmental knowledge and awareness, provide opportunities and skills for environmental protection, and create new patterns of behavior (UNESCO, 1977). The Declaration's primary objectives—building knowledge, increasing awareness, changing attitudes, and encouraging participation in pro-environmental behaviors—continue to remain important goals of environmental education efforts around the world. The 1990 National Environmental Education Act stressed the importance of environmental programs within the American educational system (EPA, 1990). Traditional reforms have since targeted science knowledge through classroom activities (Mahadeva, 1989), but classroom instruction rarely induces students to change their attitudes and ideas about the environment. These shortcomings may extend into the realm of environmental literacy.

According to the National Environmental Education and Training Foundation (NEETF), very few Americans in general have an adequate understanding of the natural world and how to cope with future environmental issues (Coyle, 2005). One way to help improve people's environmental knowledge is by using EE curricula to help revitalize the school systems with a comprehensive approach to environmental learning. Education is one of the most critical factors for addressing the growth of environmental issues occurring in the world, and this education can start with children as young as six years old (Tilbury, 1995). The North American Association for Environmental Education (NAAEE) produces guidelines for excellence in K-12 education. These guidelines create a framework to establish the development of balanced, scientifically accurate, and comprehensive environmental education curricula. Quality environmental education curricula can lead to an environmentally literate society that can compete in our global economy (NEEAC, 2005). The NAAEE curriculum identifies four strands that reflect environmental literacy—Strand1: Questioning, Analysis and Interpretation Skills; Strand 2: Knowledge of Environmental Processes and Systems; Strand 3: Skills for Understanding and

Addressing Environmental Issues; and Strand 4: Personal and Civic Responsibility. Although each strand is important, Strand 2 relates directly to the knowledge component that this study seeks to identify. The Knowledge of Environmental Processes and Systems (KEPS) component is subdivided into four categories: (1) the earth as a physical system, (2) the living environment, (3) humans and their societies, and (4) environment and society (Shepardson, 2005). These guidelines help to mold specific curriculum topics for teachers and allow them to present the natural environment in a manner that provides students with a better understanding from different scientific perspectives.

Unfortunately, in much of the United States, children's achievement in core subject areas remains remarkably low despite many years of state and national attention, legislation, and discussion (Ernst & Monroe, 2004). In fact, well-researched reform models and other curriculum pertaining to environmental education are currently being implemented in many school's to help address this problem (Barraza & Cuaron, 2004). For instance, one study on what children think of the environment indicates that their conception of the environment is limited to just an ecological perspective (i.e., nature is the only natural environment). In fact, when asked about human-managed or built landscapes, children did not perceive them as environments, nor did they see humans as part of the environment (Shepardson, 2005). Subsequently, research alludes to the fact that current EE curricula need to be reoriented and reevaluated to provide children with more than just terminology, as children need to be able to understand key environmental concepts (Loughland et al., 2003).

Some researchers report that environmental education curricula within school systems greatly increase student's science knowledge (Arvai et al., 2004; Shepardson, 2005; Volk & Cheak, 2003). This achievement is often measured by standardized test scores (Coyle, 2005;

Ernst & Monroe, 2004; Smith-Sebasto & Cavern, 2006). In fact, one benefit of EE curricula includes improved standardized achievement test scores for science (Ernst & Monroe, 2004; Smith-Sebasto & Cavern, 2006). Additional benefits associated with EE include reduced classroom management problems and increased enthusiasm for learning (Lieberman & Hoody, 1998). Researchers also suggest that EE curricula within school systems reconnect children to the environment while bettering their environmental literacy skills (NEEAC, 2005). Furthermore, children exposed to environment-based curricula become more skilled in critical thinking than children in traditional science classes (Arvai et al., 2004; Ernst & Monroe, 2004). Ernst and Monroe (2004) data also indicated that the teacher's role in providing environmental education is crucial for the future success of our children.

Teacher's Environmental Knowledge

Robottom, Malone, & Walker (2000) claimed "behind every successful environmental education curriculum is a committed teacher" (p.157). Committed or successful teachers possess a special knowledge base of skill, understanding, and technology, of ethics and disposition, of collective responsibility in order to communicate with students (Kapyla & Wahlstrom, 2000; Palonsky, 1993; Summers et al. 2000). Shulman (1987) explored these ideas and established seven categories of teacher knowledge: (1) content knowledge; (2) general pedagogical knowledge; (3) curriculum knowledge; (4) pedagogical content knowledge; (5) knowledge of the learners and their characteristics; (6) knowledge of educational contexts; and (7) knowledge of educational ends, purposes, and values and their philosophical and historical grounds.

Shulman (1987) indicated that 'pedagogical content of knowledge' or 'the art or science of being a teacher' is found at the heart of teaching because it represents the ways in which teachers fuse academic content with teaching methods, organize instruction, and unites all these elements in the classroom with the interests and abilities of the students. Grossman (1995) expanded the conceptualization of content knowledge to include and affect what and how teachers actually teach. Teachers were more likely to emphasize areas that they had a basis of knowledge in and avoided or de-emphasized areas in which they lacked content knowledge. Hence, teachers avoided or de-emphasized environmental education if they had less content knowledge about environmental topics.

Environmental education in teacher education has been a priority since the end of the twentieth century (UNESCO-UNEP, 1990). However, the attempt to educate teachers about the environment proceeds at a “snail’s pace” (McKoewn-Ice, 2000; Van Petegem et al., 2007). Furthermore, the impact of environmental education curricula on teachers is also a new and uncharted area of research. The link between teachers and environmental education has been said to be vital to achieve the desired outcome of increased environmental awareness in children (Mastrilli, 2005). The lack of change in student’s attitudes may be linked to their teacher’s lack of environmental knowledge (Gruver & Luloff, 2008; Mastrilli, 2005; Van Petegem et al., 2007). In fact, Van Petegem et al. (2007) indicated very little has been done to enhance or change teacher’s knowledge and attitudes toward environmental education. The authors also found teachers generally lacked environmental knowledge and were reluctant to implement uncertain fields and to go beyond their existing lesson plans. Stronger staff organization, involvement, and training in EE curricula were also mentioned as potential strategies for teachers seeking to better educate their students (Van Petegem et al., 2007). Furthermore, providing teachers with professional development and connecting EE curricula with opportunities and resources can only heighten teacher and student knowledge and involvement (Ernst & Monroe, 2004).

Additionally, new theories and teaching techniques have recently emerged that help to transform EE concepts into practical teaching terms through the use of applied skills and strategies (Van Petegem et al., 2007). However, despite these new theories and teaching techniques, coordination and cohesion between different EE curricula are often missing (Ballantyne, 1995). Furthermore, many teachers often lack insight into the complexity of EE issues and fail to see how their teaching methods may alter the effect of EE on children (Van Petegem et al., 2007).

Some researchers also report that most teachers are unaware of the theoretical issues and concepts associated with environmental issues (Cross, 1998; Dove, 1996; Summers, Kruger, Childs, & Mant, 2000). Hence, teachers, themselves, also need to have a better understanding of environmental issues to more fully educate their students. Van Petegem et al. (2007) found that some teachers only see EE as an instrument for a predetermined goal and not as an ongoing process for developmental learning within children. In contrast, other studies report that teachers recognized the importance of environmental education as a learning area; however, the teachers seemed to lack the skills and knowledge to successfully teach environmental education (Cutter & Smith, 2003; Spork, 1992). In many cases, teachers of non-science disciplines have had little or no effective training on how to teach EE in the classroom (Mastrilli, 2005). With no existing connection between teachers and EE curricula, the promotion and conceptualization of environmental education for children does not often occur in many school systems (Mastrilli, 2005). Unfortunately, the popular media is often a major environmental information source for teachers; however, within this medium, environmental issues are frequently constructed as risks and are not properly described (Michail et al., 2006). Hence, teachers are being environmentally educated in laymen’s terms and are not being educated about the proper scientific terms, which just continue to create further miscommunications and disconnections (Gruver & Luloff, 2008).

In examining the use of EE, Mastrilli (2005) found that EE has been inconsistently used and not thoroughly integrated within schools in a manner that fully prepares teachers to teach environmental concepts. Furthermore, even fewer studies have been conducted on what factors influence teacher’s ability to gain EE knowledge and on how teachers strive to teach EE material (Mastrilli, 2005; Van Petegem et al., 2007).

Building Environmental Knowledge in Teachers

Many researchers have aimed to equip teachers with ‘state-of-the-art’ instructional knowledge (Reynolds, 1989; Good, 1990). However, the researchers were unable to report any one technique that identified what relates to the ‘state-of-the-art’ instructional knowledge and how was used to benefit teachers. This has lead other researchers to argue that ‘knowledge’ is only the ‘being’ of being able to fully understand and teach environmental ideas (Cutter-Mackenzie & Smith, 2003). In fact, knowledge is viewed as only a building block that leads to ‘environmental literacy.’

Orr (1994) established the concept of ‘ecological literacy’ or ‘environmental literacy,’ which refers to knowing, caring, and the practical competence encompassing understanding of how people and societies relate to each other and the natural systems, and how they might do so sustainably. The term ‘environmental literacy’ builds upon pedagogical content knowledge, evokes ideas and approaches that are fundamental in EE, and provides a set of criteria to gauge teacher’s environmental literacy. Orr (1994) argues that education is the most powerful mechanism to address the world’s environmental problems and for a sustainable future. The concept ‘environmental literacy’ encourages the educator to internalize environmental issues, and most EE researchers would hope all teachers achieve this idea.

However, environmental literacy does not just occur; most literature still examines the topics of environmental education through ‘environmental knowledge’ because the status of EE is only beginning to gravitate toward more than just knowledge (Summers et al., 2001). Environmental literacy or any other term may be irrelevant unless a system-wide commitment to EE knowledge is embraced by the government, education departments, pre-service teacher education providers, and teachers themselves (Cutter-Mackenzie & Smith, 2003). Before the information is truly internalized, knowledge must be established.

Measuring Teacher’s Environmental Knowledge

Several studies concerning teacher’s knowledge about the environment have revealed a general failure on the part of the teachers to distinguish between the causes and consequences of different environmental issues, and even between environmental issues themselves (Khalid, 2003; Michail et al., 2006; Summers et al., 2000). However, each of these studies used different instruments to measure teacher’s environmental knowledge. No one instrument has been developed to measure general environmental knowledge. Hence, most researchers collect both quantitative and qualitative data to provide more in-depth information. Although researchers have used different methods and instruments, most concluded that more teacher preparation about the environmental is necessary to (1) emphasize the critical role teachers play in EE; (2) enhance teacher’s environmental content knowledge; (3) emphasize the importance EE in the classroom; and (4) enhance environmental knowledge transmitted to the students (Khalid, 2003; Michail et al., 2006; Summers et al., 2000). Hence, future studies should strive to identify the critical elements of EE training programs that increase teacher’s environmental knowledge.

The Role of Professional Development Workshops

Teachers are provided professional opportunities to develop and expand their knowledge for teaching language arts, math, science, social studies, physical education, etc., (Grossman, 1990), so why should environmental education be any different? Environmental education among teachers remains the weakest area in pre-service teachers in many countries (McKeown-Ice, 2000). Researchers have recognized the vital importance of teacher's knowledge of the environment in relation to their ability to effectively teach their students about the natural world (Gruver & Luloff, 2008; Mastrilli, 2005; Van Petegem et al., 2007). Therefore, environmental education workshops are a necessity to expose teachers to EE curricula, and to instill the confidence in teachers to implement EE material successfully into their classrooms (Gruver & Luloff, 2008; Van Petegem et al., 2007). With greater confidence and content knowledge of environmental topics, teachers will be more likely to incorporate within their classrooms material that could lead children to become better stewards of the environment. Therefore, a greater emphasis should be placed on teacher workshops that integrate ecological concepts into educational structures (Gruver & Luloff, 2008).

Environmental education workshops can provide interdisciplinary connections and diverse aspects of cultures to the classroom, which may be implemented into social studies, language arts, science, and math skills. These aspects of the environment would provide teachers with more environmental knowledge that could help them provide more holistic environmental curricula in their classrooms. Ethnobotany, for instance, provides multiple learning possibilities pertaining to environmental knowledge and related issues. Therefore, diverse programs of this nature may also help improve teacher's understanding and knowledge of the environment.

However, the extent to which any EE workshops may impact the environmental knowledge of teachers still remains largely unknown. Thus, there is a critical need for research that assesses the effect of EE teacher training or workshops on teacher's environmental knowledge. This is especially true as national support for EE initiatives, manifested by legislative measures for example the No Child Left Inside Act, continues to grow (CBF, 2008). The EE teacher workshops embrace positive steps to ensure that the natural world is respected and appreciated through education. Efforts to evaluate EE teacher workshops could lead to a more environmentally literate society that will enhance future conservation efforts. Therefore, the purpose of this study is to measure the impact of The State Botanical Garden of Georgia's Ethnobotanical Environmental Education teacher workshop on teacher's environmental knowledge.

The Ethnobotanical Environmental Education Workshop

Globalization and immigration are rapidly changing societies and cultures around the world. Many areas are becoming melting pots for many ethnic groups with varying cultures. Georgia is not unique to these changes and the demographics and cultures of Georgia's classrooms are rapidly changing. More than ever teachers are seeking resources to engage students from different backgrounds and abilities in classroom activities (McShane, 2003). To address these issues the State Botanical Garden of Georgia (SBG) worked with a University of Georgia team representing the SBG, the College of Education, the College of Environment & Design and the Latin American & Caribbean Studies Institute to create the Ethnobotanical Gardens for Georgia Schools project. This project focused on ethnobotanical gardens as a way of describing distinct human and plant relationships throughout history. "Ethno-botanic," meaning humans' relationship with plants, brings a unique concept to the classroom by encouraging students in cross-cultural learning while increasing science inquiry. This topic gives rise to many key learning objectives in life science, physical, earth, and environmental sciences, such as plant growth, water, rocks, soils, insects, disease, weather, growing zones, composting, ecosystems, and interdependent relationships among living things. This topic can be presented in a formal classroom setting or outdoors during the creation of an ethnobotanical school garden. School gardens enhance the material and provide hands-on and real-world experiences that enable students to participate in the discovery processes of environmental science.

Ethnobotanical Environmental Education Teacher Workshops address teacher's lack of environmental education training. Programs described human and animal uses, ecosystems, and cultural or historical information to teachers for incorporation into their school's curriculum along with a "how to" on school gardening. These curriculum focused on five regions of the world—Africa, Asia, Latin America, the Southeastern United States and the Mediterranean—and five plants that originate in each region. Presentations cover the five regions of the world with five plants per region and the information is customized for teaching third through fifth graders. Presentations emphasize geographic location, ecology, and human and animal related plant utilization. Teachers received additional information and more detailed descriptions of the plants to answer possible student questions when presenting the information in a formal setting. Five science-related activities relevant to each region were developed to encourage hands-on-learning for the students.

The Workshops discussed environmental education materials and procedures from multiple perspectives to broaden teacher's knowledge of the environment. Materials are modeled to meet various pedagogical and learning styles of teachers and their students. Teachers also have the opportunity to share their own teaching experiences and to practice inquiry questions in these programs.

CHAPTER 3

METHODS

Statement of Purpose, Research Objectives and Hypotheses

The purpose of this study was to investigate the effect of an EE workshop on the environmental knowledge of elementary teachers in a two-step process. This process involved two objectives: (1) the development of a reliable and valid metric to quantify the environmental knowledge of elementary teachers; and (2) the examination of the impact of a three-day EE teacher workshop on the environmental knowledge of primary teachers.

Research Objective 1.

To develop a reliable and valid metric to quantify the environmental knowledge of primary teachers.

Alternative Hypothesis ($H1_a$). Statistical analyses provided evidence that data from the environmental knowledge survey revealed statistically significantly reliable responses for teacher's environmental knowledge.

Null Hypothesis ($H1_0$). Statistical analyses failed to provide evidence that data from the environmental knowledge survey revealed statistically significantly reliable and valid responses for teacher's environmental knowledge.

Research Objective 2.

To examine the impact of a three-day EE teacher workshop on the environmental knowledge of primary teachers.

Alternative Hypothesis ($H2_a$). Teachers in the treatment group exhibited statistically significantly greater self-reported environmental knowledge on their posttest scores compared to their pretest scores.

Null Hypothesis ($H2_0$). Teachers in the treatment group did not exhibit statistically significantly greater self-reported environmental knowledge on their posttest scores compared to their pretest scores.

Alternative Hypothesis ($H3_a$). Teachers in the control group exhibited statistically significantly greater self-reported environmental knowledge on their posttest scores compared to their pretest scores.

Null Hypothesis ($H3_0$). Teachers in the control group did not exhibit statistically significantly greater self-reported environmental knowledge on their posttest scores compared to their pretest scores.

Alternative Hypothesis ($H4_a$). Teachers in the treatment group exhibited statistically significantly greater self-reported environmental knowledge between their pre- and posttest scores than teachers in the control group after controlling for pretest scores.

Null Hypothesis ($H4_0$). Teachers in the treatment group did not exhibit statistically significantly greater self-reported environmental knowledge between their pre- and posttest scores than teachers in the control group after controlling for pretest scores.

Study Context

This study used a mixed-method, quasi-experimental approach involving a treatment group (teachers who participated in a three-day teacher ethnobotanical environmental education workshop) and a control group (teachers who did not participate in a three-day teacher ethnobotanical environmental education workshop).

Constructing the Survey Instrument

The environmental knowledge (EK) of teachers was measured using a survey consisting of thirty-seven Likert-type responses items. The EK instrument was created and modified through a multi-step process that included an in-depth literature review, initial scale construction, scale revision and reduction, pilot testing, and refinement. Items from existing scales (Shepardson, 2005) were adapted to cover general concepts and specific facts related to the EE and Ethnobotanical EE curriculum, creating a modified evaluation tool suitable for teachers in the workshop.

Likert-type response items were designed to measure several important components of environmental knowledge including geographic location, ecology, and human and animal related plant utilization. Based on prior research and scale-specific item content, common factors related to knowledge components were expected to emerge (Shepardson, 2005). These factors were the earth as a physical system, the living environment, humans and their societies, and environment and society.

Statements related to each distinct component were randomly arranged within the survey, and teachers were asked to indicate the extent to which they disagreed or agreed with a statement by circling the appropriate number. The Likert-type knowledge scale ranged from one = "strongly disagree" to five = "strongly agree." An additional option, "don't know or refuse," was also included. Please refer to appendix A for a copy of the survey.

Pilot Test

A pilot test of the initial survey was conducted with a group of elementary teachers from Athens-Clarke County, GA schools who matched the characteristics of the larger population of interest during the month of February 2008. A volunteer sample of teachers from one school

(N=36) agreed to complete the survey at their schools. Once completed the surveys were collected. Problematic items on the pilot test were identified and modified based on observations, participant questions, and Cronbach's Alpha reliability estimates. Based on the results of the pilot test, revisions were made to the wording and clarity of some questions so that they more effectively measured the constructs of interest. The modified survey was then administered at the SBG's Ethnobotanical workshop.

The Ethnobotanical EE Workshop

The workshop was sponsored by the State Botanical Garden through a teacher quality grant on February 28 to March 1, 2008 from 8:00am to 3:00pm each day. The workshop was advertised through the SBG, Athens-Clarke County School District, and other school districts in the surrounding area. Attending teachers viewed ethnobotanical EE presentations, demonstrations, and activities to enhance their environmental knowledge. For a detailed schedule of all the activities, please refer to Appendix B. The curriculum meets Georgia Performance Standards (GPS) requirements and the needs formulated from the planning surveys of teachers from two high-needs elementary schools. The teachers received all ethnobotanical materials and presentations free of charge plus two Professional Learning Units (PLUs). Random sampling was not feasible for the treatment group given the workshop's structure and relatively small size (twenty-four maximum teachers), so each registered participant who completed the three-day workshop was included in the study.

Participants

The treatment group consisted of participants in Ethnobotanical EE workshop on February 28 to March 1, 2008 (N=23). The control group consisted of primary teachers in three Clarke-County Schools during the 2007-2008 academic year (N=38) during March to June of

2008. The principal of each school held a staff meeting where the researcher introduced the survey. Teachers who agreed to participate in the research formed the control group.

Study Design

Baseline environmental knowledge of the teachers had to be established before the Ethnobotanical EE workshop began to measure the effects of the workshop. A pre-test and post-test were administered on the first and last day of the three-day workshop, respectively. The surveys were administered by the primary researcher at 08:00am on the first day of the workshop and at 02:45pm on the last day of the workshop and collected at completion. The survey took approximately ten to fifteen minutes to complete.

The control group’s pre- and post-test surveys were administered during March to June of 2008. A three-day period occurred between pre- and posttest surveys. The pre-test surveys were administered by the primary researcher and collected after completion on day one. The post-test surveys were distributed by the school’s principal to the teachers on day three. The principal was instructed on how to distribute the survey. Completed surveys were left by teachers in a collection box at each school and then collected by the primary researcher. Random allocation of subjects to the treatment group was not possible because the workshop participants elected to attend the workshop.

The Effects of the EE Workshop

Effects of the EE program on teacher’s environmental knowledge were assessed using a pre-test, post-test approach. Initial differences in environmental knowledge scores for teachers in the treatment and control groups were examined. Data from the pre-tests were used to examine any potential pre-existing differences in the EE workshop treatment group and the teacher control group. After controlling for pre-test score differences, data from the post-tests were then used to examine pre-test, post-test score changes on environmental knowledge of teachers in the treatment and control groups. Of the 62 participants in the EE treatment and control group, 61 completed the pre-test and post-test EK at the beginning and end of a three-day period. The pre- and post-test survey contained the same identical Likert-type items, except the pretest survey provided to the control group asked one additional question. This question asked whether or not the teachers had participated in an ethnobotanical workshop in the last year.

Analysis

Reliability and Validity Analysis

Reliability estimates of internal consistency were measured for the survey using the Cronbach's alpha coefficient. An exploratory factor analysis (EFA) was also used to identify constructs within the thirty-seven-item knowledge survey.

Factor analysis is framed to reflect the purpose underlying the survey. A principal components analysis (PCA) was used to identify constructs that existed in the survey to better identify what the survey was measuring. A Verimax rotation helped to clarify the data structure. Items with factor loadings of 0.40 and greater were retained (Huck & Cormier, 1996). Items that did not meet this criterion were removed.

Program Effects

Two-way analyses of covariance (ANCOVA) were used to evaluate program-mediated effects on post-test score means after controlling for initial pre-test differences. Preliminary checks were conducted to ensure that the assumptions of reliable covariate measurement, normality, linearity, homogeneity of variances, and homogeneity of regression slopes were not violated. An ANCOVA was used to control for extraneous variation and to increase the power of the statistical test (Huck & Cormier, 1996). Separate tests were run with post-test scores on each of the different constructs (ethnobotany, Georgia and its plants, ecosystems, and knowledge based questions) as the dependent variable. Pre-test scores on respective subscales served as the covariate.

Only teachers who completed both the pre-test and post-test were included in the analysis. A statistically significant score increase over the three-day period for teachers in the treatment group would suggest that the Ethnobotanical EE workshop had a positive impact on environmental knowledge.

Qualitative Data Collection

Although quantitative survey data provides a solid base for assessment, qualitative data may yield more comprehensive and holistic views of teacher's background and ideas (Patton, 1990). Additional data regarding the teacher's personal experience and program-related changes in environmental knowledge were obtained through a seven question short personal interview. Please refer to Appendix C for the interview questions. Brief personal interviews were conducted by the principal investigator and trained volunteers to supplement survey data and provide an opportunity for criterion-based validity analysis of the survey constructs. Small groups of three to five teachers (N = 14) were interviewed together on day one and day three of the workshop during the lunch break from 12:00pm to 01:30pm by the primary researcher or trained volunteers. Each set of interviews took ten to fifteen minutes. The teachers were asked seven questions designed to provide a more detailed look at individual interaction with the environment and EE. Due to time constraints, no interviews were conducted with teachers in the control group. An inductive analysis was used to identify emerging patterns and classify responses into a set of ordered categories that could be used to supplement and support trends in the quantitative data (For more information regarding qualitative data analysis, see Patton, 1990). The inclusion of these components helped to highlight the any pre-existing experience the teachers had with plants and the environment to better explain the quantitative data collected. Results from the qualitative analysis that were relevant to the research objectives were incorporated into the final chapter of this document.

Limitations

Population-level inferences based on the sample statistics should be cautiously interpreted. Data were collected from a relatively small sample of participants ($N = 61$) in Athens-Clarke County, Georgia, and survey responses from teachers in other geographical regions may vary. Random selection of participants was not possible because groups consisted of participants who either chose to participate in the workshop or volunteered to complete the survey. Hence, inherent bias associated with self-selected, non-random group structure may impact generalizations (Huck & Cormier, 1996; Leeming et al., 1993). However, in social science research, non-randomized allocation of treatments to groups is not uncommon (Tabachnick & Fidell, 2001). Pre-existing differences in subjects can be somewhat addressed through statistical analysis. All survey scores were self-reported with the expectation that every teacher answered each item honestly and without external influences. A substantial effort was made to recognize these limitations and reduce confounding variation as much as possible.

CHAPTER 4

RESULTS

The results of the data analysis associated with each research objective and corresponding hypotheses are described in this chapter. Results for each distinct project phase (the development of a reliable and valid metric to quantify the environmental knowledge of primary teachers; and the examination of the impact of a three-day EE teacher workshop on the environmental knowledge of primary teachers) are presented in chronological order. All tests were conducted using SPSS (SPSS, Inc., Version 17.0).

Constructing the Survey Instrument

Pilot Test

The reliability of the survey was measured using Cronbach's alpha. The Cronbach's alpha of the forty-one item pilot test was 0.78. In the exploratory factor analysis of the pilot test, the Scree Plot indicated four factors that accounted for 47.3% of the total variance (See Figure 1). An attempt to extract the factors terminated after twelve iterations. After examining the results of the pilot test, multiple items were altered to reduce confusion, reduce redundancy, and improve the internal consistency of responses on the version of the survey used in the empirical investigation. These adjustments resulted in a thirty-seven item survey being adopted for the workshop evaluation.

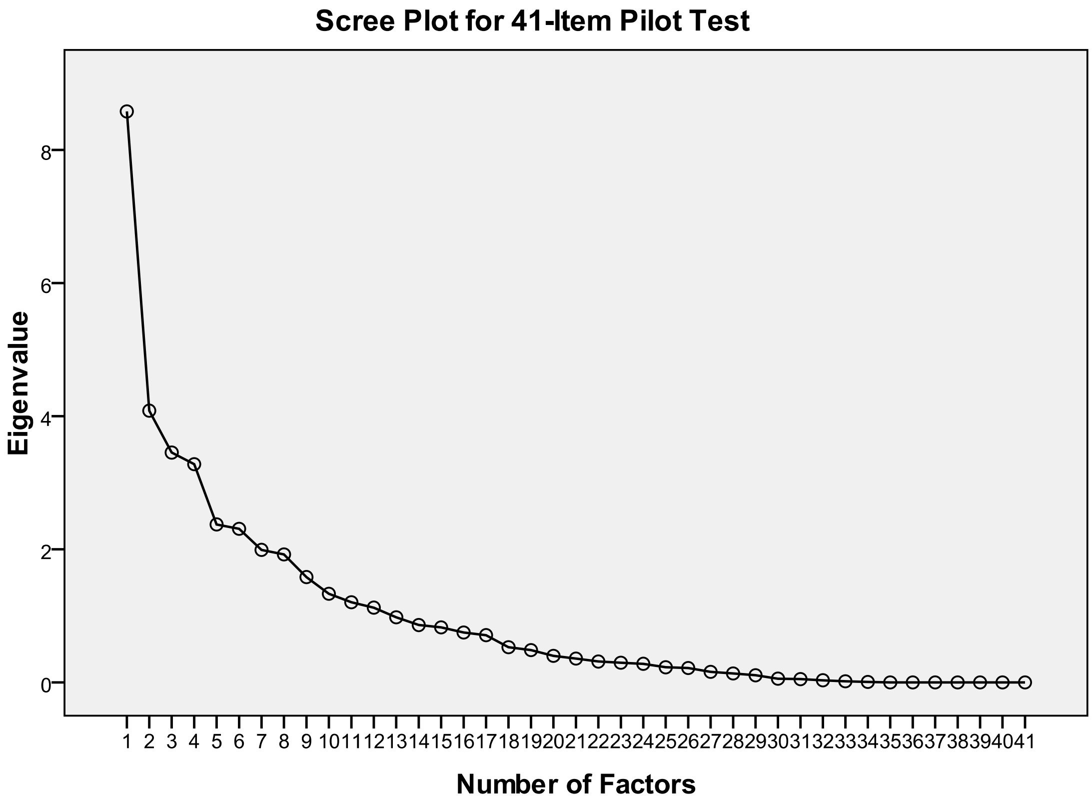

Figure 1. Principle Component Factor Analysis Scree Plot with Extracted Factors and Corresponding Eigenvalues for 41-Item Pilot Test.

Ethnobotanical EE Workshop

The Cronbach's alpha coefficient for the thirty-seven item pre-test was 0.82. Dimensionality of the survey items was analyzed using principle components factor analysis. The subject item ratio of the thirty-seven items of the environmental knowledge survey was examined. The subject item ratio typically sought after is 10:1 (Costello & Osborne, 2005). However, the subject item ratio for this study was 2:1. The subject item ratio is the ratio between sample size and the number of items in the survey. It should be noted that factor analysis is a "large-sample" procedure; however, many researchers use the process to examine smaller data sets with the understanding that generalizable or replicable results are unlikely when the sample size is too small (Costello & Osborne, 2005).

Only diagonals of the anti-image correlation matrix above 0.4 were focused on to strengthen the survey's reliability. Therefore, the communalities were all above 0.4, and each item shared some common variance with other items. During several steps, a total of eleven items were eliminated because they did not contribute to a simple factor structure and failed to meet a minimum criteria of having a primary factor loading of 0.4 or above, and no cross-loading of 0.3 or above. Given these overall indicators, principle component factor analysis was conducted with a twenty-six item survey.

Principle components analysis was used because the primary purpose was to identify and compute composite coping scores for the factors underlying the environmental knowledge survey. The principle component initially revealed a three factor solution, where the initial eigenvalues showed that the first factor explained 26.80%, the second factor 11.47%, and the third factor 10.98% of the variance. However, a forth factor emerged after examining eigenvalues and item content and was included in the analysis. The forth factor explained 7.35% of the variance. The four factor solutions were examined, using the varimax rotations of the factor loading matrix. The four factor solution, which explained 56.60% of the variance, was preferred because of the 'leveling off' of eigenvalues on the scree plot after four factors, and the insufficient number of primary loadings and difficulty of interpreting subsequent factors shown in both Figure 1 and Figure 2.

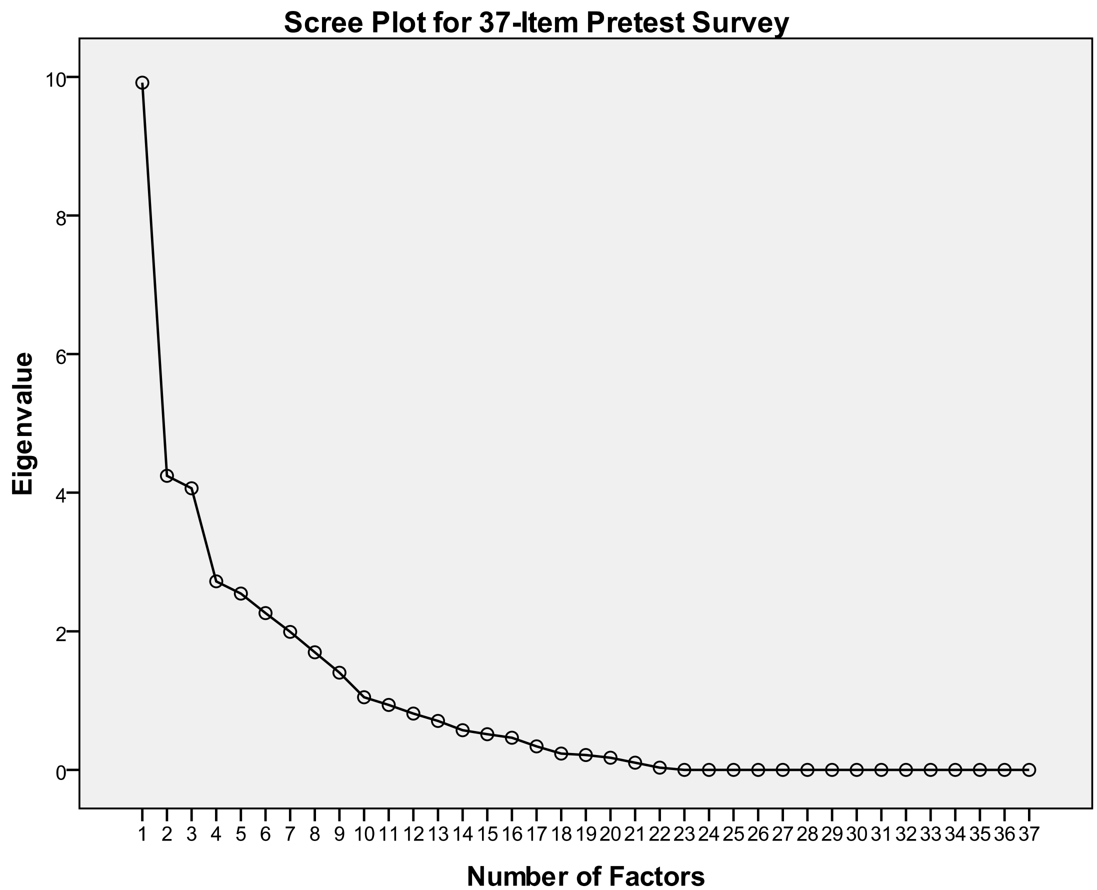

Figure 2. Principle Component Factor Analysis Scree Plot with Extracted Factors and Corresponding Eigenvalues for 37-Item PreTest Survey.

Internal consistency for each of the factor scales were examined using Cronbach's alpha. The alpha's were moderate—0.85 for Ethnobotany (8 items), 0.82 for Georgia's Environment (6 items), 0.72 for Ecosystem Concepts (5 items), and 0.63 for Fact-based Knowledge (5 items). The factor labels appeared to explain the extracted factors and hence, were retained. However, Items 12 and 35 were removed to increase the reliability of the survey resulting in a final twenty-four item survey. The factor loading matrix for this final solution is presented in Table 1. Based on these results, the *Null Hypothesis ($H1_0$). Statistical analyses failed to provide evidence that data from the environmental knowledge survey revealed statistically significantly reliable and valid responses for teacher's environmental knowledge* was rejected.

Table 1. Factor Loadings Based on a Principle Components Analysis with a Varimax Rotation for 24-Item Environmental Knowledge Survey (N = 61)

Item	Construct			
	1	2	3	4
1. Georgia's climate is similar to certain parts of Africa.		0.780		
3. Temperature changes have dramatic affects on ecosystems.			0.705	
4. Some plants are used for a variety of different uses by different cultures in the world.	0.620			
6. Georgia's climate enables peanuts from Africa and peaches from Asia to be grown here.		0.636		
9. Different parts of a county may hold several different ecosystems.	0.719			
10. Some plants are valued by people for their cultural significance.	0.614			
11. Some Mediterranean cultures use pomegranates for medicine, while pomegranates are used as food in the US.				0.617
14. One ecosystem may hold many different types of plant communities.			0.632	0.330
15. White oaks are native to GA.				0.650
16. Herbivores such as buffalo help manage ecosystem landscapes by disturbing the communities.				0.560
17. Many plants have other uses associated with them by other cultures around the world.	0.683			
19. Georgia's climate enables many plants from Africa and Asia to be grown here.		0.709		
20. Plants help to keep their ecosystems stable and healthy.			0.666	
21. The interaction between plants, animals, and people is critical for our survival.	0.781			
22. Many plants that we rely on in GA are not originally from GA.		0.637	0.315	
23. Georgia's climate is similar to certain parts of Asia.		0.727		
24. Both people and animals have an affect on plant communities.	0.559		0.363	
25. Herbivores such as buffalo help manage ecosystem landscapes by grazing on plant communities.				0.677
27. Climate changes have dramatic affects on ecosystems.	0.301		0.633	
28. Some plants are valued very highly in certain cultures as part of their ritual ceremonies.	0.398		0.523	
29. Beyond merely simple food consumption some plants are regarded very highly by certain cultures for their medicinal purposes.	0.710		0.320	
31. River Cane material is used by the Native Americans for weaving.		0.566		0.326
32. Plant communities help stabilize soil erosion in ecosystems.	0.755			
33. Plants may be used to educate people about different cultures and societies.	0.406	0.382		0.551
% Variance Explained	26.80	11.47	10.98	7.35

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
N.B. Rotation converged in 6 iterations.

The Effect of the Ethnobotanical EE Workshop

Analysis of Covariance

Using the revised twenty-four item survey instrument, a one-way analysis of covariance (ANCOVA) was conducted to measure the effects of the EE workshop on teachers' overall environmental knowledge. The dependent variable was totaled averaged posttest scores and the covariate was the totaled averaged pretest scores. The independent variable was group—either treatment or control. The within-group relationship between the covariate and the dependent variable was linear for each level of the independent factor. A preliminary analysis evaluating the homogeneity-of-slopes assumption did not reveal a significant interaction between the covariate and the treatment groups $F(1, 57) = 2.425$, $p = 0.125$, effect size = 0.041 (See Table 2). When the interaction term was removed from the ANCOVA for the total score, the group variable had a statistically significant effect on the posttest scores ($F(1, 58) = 57.016$, $p = 0.000$, effect size = 0.496; see Table 3). The adjusted mean post-test scores were higher in the treatment group than the control group (See Figure 3).

Table 2. The ANCOVA of Average Pre- and Posttest Scores for the Surveys.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2.743[a]	3	.914	27.262	.000	.589
Intercept	.541	1	.541	16.123	.000	.220
group	.105	1	.105	3.145	.082	.052
AVEPRETEST	1.188	1	1.188	35.414	.000	.383
group * AVEPRETEST	.081	1	.081	2.425	.125	.041
Error	1.911	57	.034			
Total	1078.929	61				
Corrected Total	4.654	60				

N.B. R Squared = .589 (Adjusted R Squared = .568)

Table 3. The ANCOVA of Average Total Pre- and Posttest Scores without the Interaction Term.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2.661[a]	2	1.331	38.729	.000	.572
Intercept	.466	1	.466	13.564	.001	.190
group	.491	1	.491	14.295	.000	.198
AVEPRETEST	1.959	1	1.959	57.016	.000	.496
Error	1.993	58	.034			
Total	1078.929	61				
Corrected Total	4.654	60				

N.B. R Squared = .572 (Adjusted R Squared = .557)

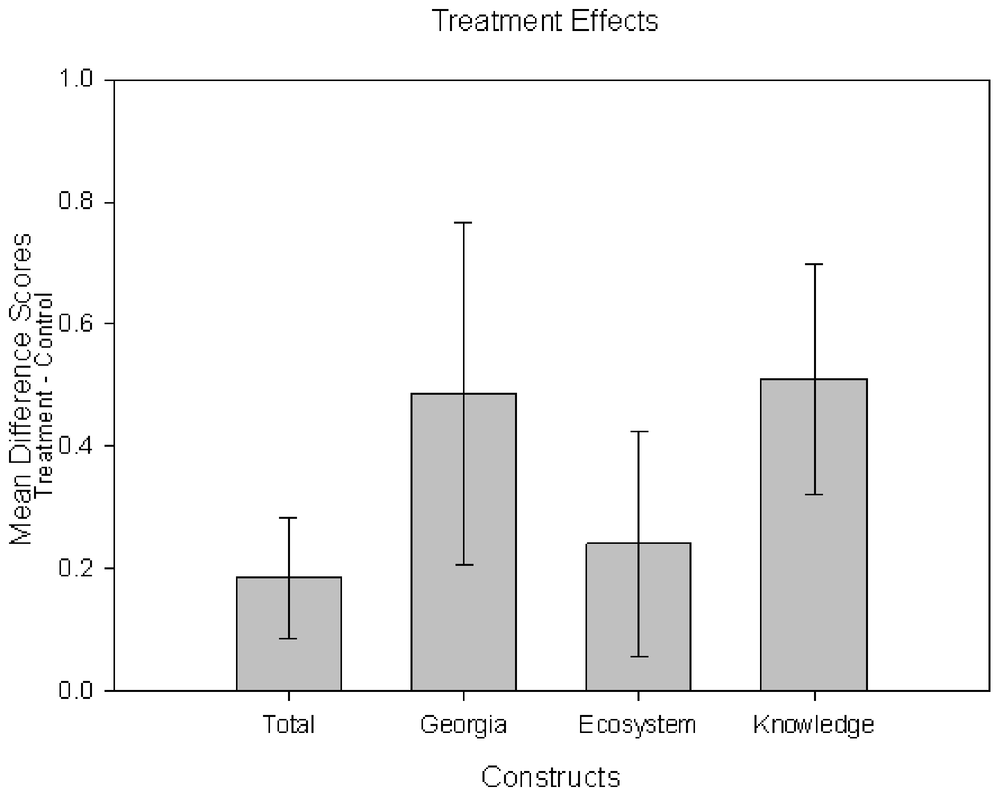

Figure 3. Adjusted Mean Posttest Score Differences after Controlling for the Pretest Score for the Treatment Group Minus the Control Group with 95% CI (n = 61).

The ANCOVA assumption of homogeneous regression slopes were not satisfied when comparing group effects for each of the specific factors. Mean differences in post-test scores among the groups varied as a function of pre-test scores. When the linear relationships between the mean adjusted average posttest and the average pretest scores were graphically examined, an ordinal interaction was evident. However, despite different regression slopes, the treatment group consistently displayed higher adjusted mean post-test scores than the control group creating an ordinal relationship (See Figure 4). Because of the consistent ordinal nature of the relationship, the interaction term was dropped from the ANCOVA models (See Table 4).

Table 4. The ANCOVA of Each Construct without the Interaction Term.

Constructs	**F-value**	**p-value**	**effect-size**
Georgia	(1, 56) = 29.875	0.000	0.285
Ecosystems	(1, 58) = 6.787	0.012	0.105
Knowledge	(1, 57) = 29.197	0.000	0.339

The graphic representation of the mean differences between the pre- and posttest scores also indicated a statistically significant treatment effect for Georgia's Environment, Ecosystem Concepts, and Specific Knowledge constructs (See Figure 3). Each construct—Georgia's Environment, Ecosystem Concepts, and Fact-based Knowledge—indicated the same ordinal interaction except for the Ethnobotany

For the Ethnobotany construct, members of the control group actually displayed higher post-test scores than members of treatment group with comparable scores on the pre-test (See Figure 4). The Johnson-Neyman Procedure was employed to identify points on the Ethnobotany scale where the differences between the groups were statistically significant. This test is generally of interest because it finds critical points where differences have occurred. The Johnson-Neyman Procedure in comparing the treatment and control group in the Ethnobotany construct identified a lower limit of 4.516 ($F(1,57) = 4.02$, p-value = 0.05). For individuals with average pre-test scores below 4.516 the workshop appeared to be effective, but for individuals above 4.516 statistically significant differences were not evident (See Figure 5). For individuals having averaged pre-test scores above 4.516 there was insufficient evidence to conclude that the workshop was either helpful or harmful.

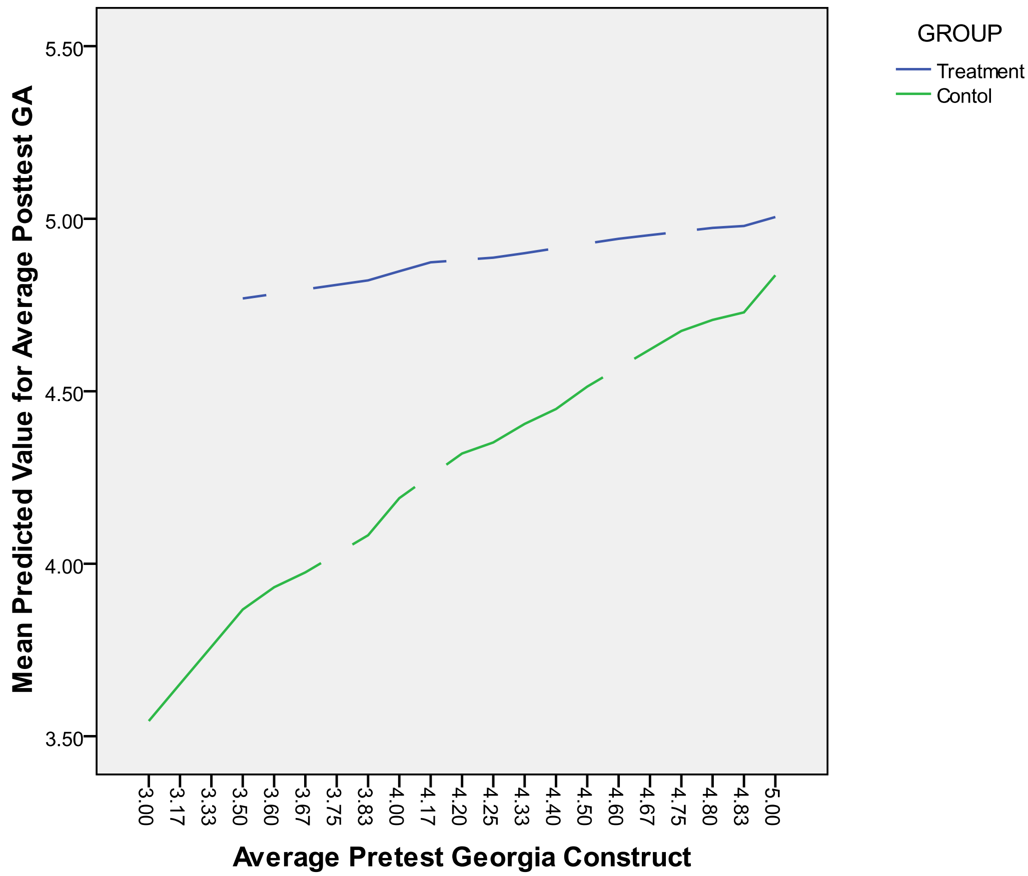

Figure 4. Linear Relationship between Mean Predicted Value for the Average Posttest Score and the Average Pretest Score for the Georgia's Environment Construct.

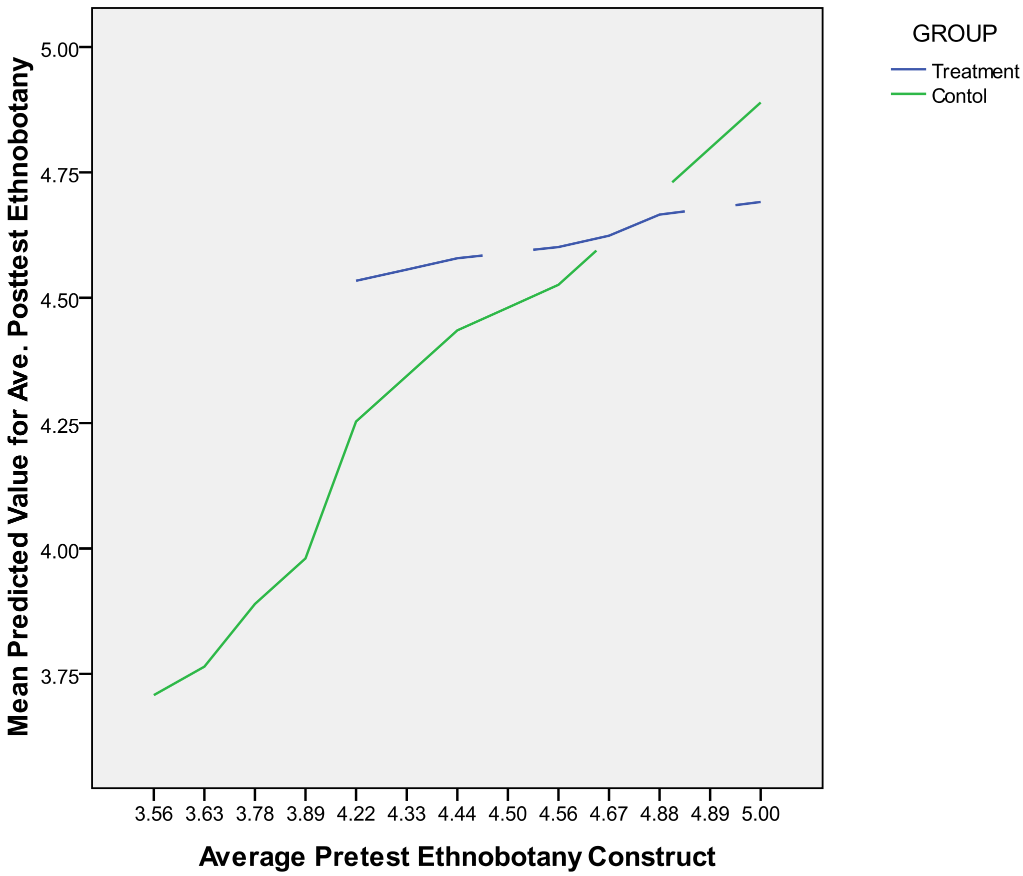

Figure 5. Relationship between Mean Predicted Posttest Score and Pretest Score for Ethnobotany Construct.

In summary, statistically significant differences existed within the treatment group's pretest and posttest scores. Therefore, the *Null Hypothesis ($H2_0$): Teachers in the treatment group did not exhibit statistically significantly greater self-reported environmental knowledge on their posttest scores compared to their pretest scores* was rejected. Significant differences were not evident within the control groups' pre- and posttest. Therefore, the *Null Hypothesis ($H3_0$): Teachers in the control group did not exhibit statistically significantly greater self-reported environmental knowledge on their posttest scores compared to their pretest scores* was rejected.

After controlling for pre-test scores, teachers in the treatment group exhibited statistically significantly greater adjusted mean post-test self-reported environmental knowledge scores than teachers in the control group. Therefore, the *Null Hypothesis* ($H4_0$)*: Teachers in the treatment group did not exhibit statistically significantly greater self-reported environmental knowledge between their pre- and posttest scores than teachers in the control group after controlling for pretest scores* was rejected.

Teacher Interviews

Interview of teachers from the treatment group indicated a very wide variety of ethnobotanical knowledge that contributed to their environmental knowledge ($N = 14$) (Refer to Appendix D). Almost all of the interviewees had some experience with gardening at some point in their lives. Participant 12 indicated that her mother and grandmother landscaped and gardened. She is very interested in plants and planting her own garden with her kids. Participants 14 and 15 had years of experience with their own gardens and enjoy it as a hobby and teaching tool. The pre-interviews indicated that the teachers were not entirely comfortable presenting the ethnobotanical environmental education (EBEE) topics in their classrooms. The post-interviews indicated a stark change in confidence relating to the ethnobotany topics. Nearly all of the teachers changed their confidence levels in their ability to teach different EBEE topics. Participant 10 stated, “All of the materials here will enhance and give connections (the resources explain how plants are used in other areas) explains to students the debate between space and resources. Still trying to process all the materials for taking back to school.” Participant 18 indicated the after this workshop he gained knowledge and confidence about teaching materials presented in the workshop. After the workshop, teachers said they were prepared to bring many knew EBEE topics into their classrooms. Participant 21 stated, “We teach habitats. The workshop enriched this knowledge-gave new knowledge to extend what I know. The workshop introduced new cultures to incorporate into class, made it so I am not just limited to GA information.” In summary, the workshop participants already had an interest in plants; however, the teachers as a whole were relatively unsure how to integrate the information into the classroom. After the workshop, the teachers gained more knowledge about ethnobotany in general, but more importantly they gained knowledge about how to integrate the material into the classroom.

CHAPTER 5

DISCUSSION & IMPLICATIONS

This study investigated the effect of an EE workshop on the environmental knowledge of elementary teachers using a two-step process that involved: (1) the development of a reliable and valid metric to quantify the environmental knowledge of primary teachers; and (2) the examination of the impact of a three-day EE teacher workshop on the environmental knowledge of elementary teachers. A discussion of research results and implications for each stage of the project are described in this chapter. Interview excerpts have also been incorporated to support important issues and trends.

Constructing the Survey Instrument

In this study, a pilot test of the Environmental Knowledge Survey (EKS) indicated that the survey appeared to be a psychometrically-sound evaluation instrument suitable for use with elementary teachers. Analysis of EKS pre-test data showed statistically significant reliability and validity among the teachers. The Likert-type EKS items appeared to measure four important components of the EKS: Ethnobotany, Georgia's Environment, Ecosystem Concepts, and Fact based Knowledge. Ethnobotany items reflected the relationship people have with plants (i.e. food, necessity, culture, etc.). Georgia's Environment items reflected more specific information relating to Georgia's environment its effect on climate and plants. Ecosystem Concept items reflected a systematic approach to how plants, animals, people, and the environment interact. Fact-based Knowledge items were related to specific topics that were covered in the workshop. Personal interviews supplemented the quantitative data and supported the four factor structure.

Overall, the items grouped under the four categories seemed to represent distinct components of teacher's environmental knowledge.

This instrument was a preliminary attempt to create a short survey specifically designed for teachers, and continued efforts to refine and revise the evaluation tool will enhance its utility. The instrument used in this study was comparable in item structure, length, and time requirement to other researcher's instruments (Dove, 1996; Gruver & Luloff, 2008). Reliability and validity tests throughout the survey design process highlighted the need for rigorous psychometric assessment throughout the evaluation process (Gray, Borden, & Weigel, 1985). Future use of the EKS will continue to generate feedback and revisions, which could reveal more information about the validity of survey constructs. Although the EKS has limited applicability in the general education sector due to specific content related to the Ethnobotanical EE workshop, it could serve as a model for future research efforts.

The Effect of the Ethnobotanical EE Workshop

As the importance of holistic educational approaches grow, authorities have issued a call for rigorous EE programs and curricula that help teachers reconnect children to environmental concepts (Coyle, 2005; Louv, 2005). The No Child Left Behind Act has placed a growing emphasis on reading, writing, and mathematics testing. Thus, environmental education has often become regarded as a lower priority. A 2000 study by the North American Association for Environmental Education and the Environmental Literacy Council showed that although 61% of public school teachers claim to include environmental topics in their curricula, most devote fewer than 50 hours to it throughout the course of an entire year (Coyle, 2005). These alarming figures have stimulated a push for program evaluation and assessment. The current study addressed this need by investigating the effect of an EE workshop on teacher's environmental knowledge.

The Ethnobotanical EE workshop appeared to have a positive effect on the EKS scores for the treatment group. The benefits of the EE workshop on teachers' content knowledge were obvious for Georgia's Environment, Ecosystem Concepts, and Fact-based Knowledge constructs. The Ethnobotany construct, which contained the most items directly related to workshop theme, was not found to be statistically significant for participants with high pretest scores. Although, this surprising finding could reflect a ceiling effect, it may also result from a disjunction between the workshop objectives and the survey content. Equal emphasis was placed on workshop material and instruction in each specific construct area. Although, the Georgia's Environment, Ecosystem Concepts, and Fact Based Knowledge constructs included statements that likely drew from previous knowledge from the teacher, the Ethnobotany construct may have presented unfamiliar connections and information. As a result, items referencing this new information may have become overshadowed by previous knowledge or familiar content in other constructs.

Future researchers interested in measuring the effects of workshops on environmental knowledge should work very closely with the program instructors to create instruments that appropriately match curricular goals and objectives. This supports the idea that workshop materials and the evaluation content must coincide in order to produce sound, relevant data. The workshop also covered multiple topics and multiple activities over a very short period of time. Although this type of agenda is effective for introducing many different topics to teachers, such an accelerated pace may not be the best way to facilitate knowledge retention.

In this study, pre-test survey scores revealed several interesting trends. After comparing the treatment and control pre- and posttests scores, it became clear that the two groups' pretest scores were significantly different. The treatment group pre-test data were clustered around the high end of the scale. The Ethnobotanical EE Workshop was advertised at multiple locations in the teaching community, and participation in the workshop was strictly voluntary. Thus, pretest differences could be attributed to workshop participants' inherent interest in the EE topics. Teachers who registered for the EE workshops may have possessed a predisposition for environmentally-oriented programs, creating the possibility of self-selection bias (Leeming et al., 1993).

Limited variability may have decreased the potential to observe treatment effects. An expanded scale with a broader range of response options might help to alleviate this ceiling effect problem. The five-point scale also could be extended to seven or nine categories—an adjustment that would increase variation in the response variables and help reduce any possible centralized distribution. A larger sample size also may have revealed different trends in the data. Finally, although a three-day workshop could be sufficient to expose teachers to different EE methods, more time is likely necessary to help teachers understand important EE concepts that could be used in the classroom (Mastrilli, 2005; Van Petegem et al., 2007). Although this workshop's immediate influence on environmental knowledge is encouraging, long-lasting effects of the EE treatment could not be measured because the study was limited to a three-day period. A delayed posttest, longitudinal-type study would have provided insight into long-term program effects and the degree to which the ethnobotany curricula were incorporated into classroom instruction.

The EE facilitated-knowledge gains were encouraging because knowledge is a critical component of environmental literacy (Coyle, 2005; Robottom, 2000). Additional research is needed to understand the long-term effects of increased environmental knowledge of teachers and how it is utilized in the classroom. Environmental Knowledge is a precursor to creating awareness, attitudinal, and behavioral changes regarding environmental topics and issues (Boyles et al., 1995; Pe'er, Goldman, & Yavetz, 2008). By encouraging environmental stewardship, a change in teachers' attitude and behavior could be transferred to students (Leopold, 1949; Louv, 2006). Further research should focus on how EE workshops affect teachers' knowledge, attitudes, and behaviors and how this change affects their students. If the teacher training approach successfully transmits knowledge to children, increased environmental awareness releases benefits that stretch across the entire globe and could help protect the planet for future generations.

The teacher interviews demonstrated that workshop benefits extended beyond cognitive gains. The teachers experienced affective growth and elevated teaching confidence after attending the workshop, supporting the theory that teachers' environmental knowledge gains from workshops produced increased confidence teaching the material in the classroom (Gruver & Luloff, 2008). Interview excerpts in the result section highlighted some significant differences in the environmental and ethnobotanical experiences of teachers prior to the EE workshop. Many participants gardened as a child, adult, or teacher. Though levels of experience varied, the majority of the teachers had a passion for plants. Despite this experience, the participants' confidence in teaching the ethnobotany topics was generally very low. Teachers often expressed uncertainty when asked if they would feel comfortable teaching certain environmental topics in the classroom. Once the material was presented in the workshop, posttest interviews revealed a huge confidence boost. Many teachers expressed gratitude and appreciation for the information and materials presented in the workshop which has been observed in similar studies (Kapyla & Wahlstrom, 2000. If the qualitative interview data were not collected, these confidence levels of the teachers would not have been known nor would the change in confidence levels by exposure to the environmental knowledge presented in the workshop be revealed. Therefore, the interview responses were vital to better understand the impacts of the workshop and could provide a critical addition to future quantitative evaluation efforts in other areas (Patton, 1990).

Summary

If EE is going to play a vital role in the development of an environmentally-literate global society, an evaluation of EE workshop impacts on teacher's environmental knowledge will be critical. This study described the development and implementation of an efficient, reliable, and valid survey instrument that measured four important components of a teacher's environmental knowledge during an Ethnobotanical EE Workshop: Ethnobotany, Georgia's Environment, Ecosystem Concepts, and Fact-based Knowledge. Two important trends emerged. Teachers' environmental knowledge increased in three of the four primary areas—Georgia's Environment, Ecosystem Concepts, and Fact-based Knowledge—after attending the workshop. Teacher interviews indicated that environmental knowledge increases were recognized by more confidence introducing and teaching new environmental topics in their classrooms.

Based on these results, it appeared that most teachers derived some general benefits from the Ethnobotanical environmental education workshop. Environmental education workshops that promote positive interactions with environmental education strengthen teacher's environmental knowledge and may facilitate more EE instruction in the classroom. However, to improve assessment strategies evaluation tools should be directly related to workshop objectives. Further research is needed to identify additional factors that affect teacher's environmental knowledge and to determine methods for improving the delivery and functional utility of EE workshops for teachers.

REFERENCES

Arvai, J. L., Campbell, V. E. A., Baird, A., & Rivers, L. (2004). Teaching students to make better decisions about the environment: lessons from the decision sciences. *Journal of Environmental Education, 36*(1), 33-44.

Ballantyne, R. (1995). Environmental teacher education: constraints, approaches and course design. *International Journal of Environmental Education and Information, 14*(2), 115-128.

Barraza, L., & Cuaron, A. D. (2004). How values in education affect children's environmental knowledge. *Journal of Biological Education, 39*(1), 18-23.

Boyles, E., Chambers, W., & Stanisstreet, M. (1995). Trainee primary teachers' ideas about the ozone layer. *Environmental Education Research, 1*(2), 133-146.

Brown, P. A. (2005). Cultivating community from the classroom. *American Forests, 111*(2), 34-39.

Chesapeake Bay Foundation (CBF). (2008). Retrieved September 24, 2008 from No Child Left Inside website: www.cbf.org.

Cordell, H. K., Betz, C. J., & Green, G. T. (2002). Recreation and the environment as cultural dimensions in contemporary American society. *Leisure Sciences, 24*, 13-41.

Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation, 10*(7), 1-9.

Coyle, K. (2005). *Environmental Literacy in America: What ten years of NEEFT/Roper research and related studies say about environmental literacy in the U.S.* Washington, D.C.: The National Environmental Education and Training Foundation.

Cross, R. T. (1998). Teachers' view about what to do about sustainable development. *Environmental Education Research, 4*(1), 41-53.

Cutter-Mackenzie, A. & Smith, R. (2003). Ecological literacy: the ‘missing paradigm’ in environmental education (part one). *Environmental Education Research, 9*(4), 497-524.

Dillman, D. A. (2007). *Mail and internet surveys: The tailored design method* (2nd ed.). Hoboken, NJ: John Wiley & Sons, Inc.

Dove, J. (1996). Student teacher understanding of the greenhouse effect, ozone depletion and acid rain. *Environmental Education Research, 2*, 89-100.

Environmental Education Alliance of Georgia (EEA). (2009). Mission and Strategic Plans. Accessed May 20, 2009. Retrieved from http://www.eealliance.org.

Environmental Education in Georgia (EEG). (2009). Accessed May 20, 2009. Retrieved from http://www.eeingeorgia.com.

Environmental Protection Agency. (1990). *National Environmental Education Act of 1990*. Retrieved from http://www.epa.gov/enviroed/whatis.html.

Ernst, J., & Monroe, M. (2004). The effects of environment-based education on students' critical thinking skills and disposition toward critical thinking. *Environmental Education Research, 10*(4), 507-522.

Good, T. (1990). Building the knowledge base for teaching, in: D. Dill (Ed.) *What Teachers Need to know* (San Fancisco, Jossey-Bass).

Gray, D. B., Borden, R. J., & Weigel, R. H. (1985). *Ecological beliefs and behaviors: Assessment and change*. Westport, CT: Greenwood Press.

Grossman, P. L. (1990). *The Making of a Teacher: Teacher Knowledge and Teacher Education (Professional Development and Practice Series)*. Teachers College Press.

Grossman, P. L. (1995). Teachers knowledge, in L. W. Anderson (Ed.) *International Encyclopedia of Teaching and Teacher Education* (New York, Pergamon).

Gruver, J. & Luloff, A. E. (2008). Engaging Pennsylvania teachers in watershed education. *Journal of Environmental Education, 40*(1), 43-54.

Huck, S. W., & Cormier, W. H. (1996). *Reading statistics and research* (2nd ed.). New York, NY: Addison Wesley Longman.

Kapyla, M. & Wahlstrom, R. (2000). An environmental education curriculum for teacher trainers in Finland. *Journal of Environmental Education, 31*(2), 31-37.

Khalid, T. (2003). Pre-service high school teachers' perceptions of three environmental phenomena. *Environmental Education Research, 9*(1), 35-50.

Larson, L., Green, G., & Castleberry, S. (in review). Environmental education and ethnicity: the impact of a summer education program on the environmental attitudes and awareness of minority children. University of Georgia, Master's Thesis.

Leeming, F. C., Dwyer, W. O., Porter, B. E., & Cobern, M. K. (1993). Outcome research in environmental education: A critical review. *Journal of Environmental Education, 24*(4), 8-21.

Leeming, F. C., & Dwyer, W. O. (1995). Children's environmental attitude and knowledge scale: Construction and validation. *Journal of Environmental Education, 26*(3), 22.

Leopold, A. (1949). *A Sand County almanac, and Sketches here and there*. New York,: Oxford Univ. Press.

Lieberman, G., & Hoody, L. (Eds.). (1998). *Closing the achievement gap: Using the environment as an integrating context for learning.* San Diego, CA: Paper Presented at the State Education and Environment Roundtable.

Loughland, T., Reid, A., Walker, K., & Petocz, P. (2003). Factors Influencing Young People's Conceptions of Environment. *Environmental Education Research, 9*(1), 3.

Louv, R. (2006). *Last child in the woods: saving our children from nature-deficit disorder*. Chapel Hill, N.C.: Algonquin Books of Chapel Hill.

Mahadeva, M. N. (1989). From misinterpretations to myths. *Science Teacher, 56*(4), 33-35.

Mastrilli, T. (2005). Environmental education in Pennsylvania's elementary teacher education curricula: A Statewide Report. *Journal of Environmental Education, 36*(3), 22-30.

McKeown-Ice, R. (2000). Environmental education in the United States: a survey of preservice teacher education programs. *Journal of Environmental Education, 32*(1), 4-11.

McShane, J. (2003). Science and Children: Editor's Note. National Science Teacher Association.

Michail, S., Stamou, A. G., & Stamou, G. P. (2006). Greek primary school teachers' understanding of current environmental issues: an exploration of their environmental knowledge and images of nature. *Science Education, 1,* 244-259.

Myers Jr, O. E., Saunders, C. D., & Garrett, E. (2004). What do children think animals need? Developmental trends. *Environmental Education Research, 10*(4), 545-562.

National Environmental Education Advisory Council (NEEAC) (2005). *Setting the standard, measuring results, celebrating successes: A report to Congress on the status of environmental education in the United States.* Retrieved May 6, 2006 from http://epa.gov/enviroed/pdf/reporttocongress2005.pdf

Orr, D. W. (1994). *Earth in Mind: on education, environment, and the human prospect* (Washington, DC, Island Press).

Palonsky, S. B. (1993). A knowledge base for social studies teachers. *The International Journal of Social Education*, *7*, 7-23.

Partners for a Prosperous Athens. (2006). Poverty in Athens: What we have learned. Retrieved March 20, 2009, from http://www.prosperousathens.org

Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Newbury Park, CA: Sage.

Pe'er, S., Goldman, D., & Yavetz, B. (2008). Environmental literacy in teacher training: attitudes, knowledge, and environmental behavior of beginning students. *The Journal of Environmental Education, 39*(1), 45-59.

Reynolds, M. (1989). *Knowledge Base for Beginning Teachers* (New York, Pergamon).

Robottom, I., Malone, K., & Walker, R. (2000). *Case Studies in Environmental Education: policy and practice*. Geelong, Deakin University Press.

Shepardson, D. P. (2005). Student Ideas: What Is an Environment? *Journal of Environmental Education*, *36*(4), 49-58.

Shulman, L. S. (1987). Knowledge and teaching: foundations for educational reform. *Harvard Educational Review*, *57*, 1-22.

Smith-Sebasto, N. J., & Cavern, L. (2006). Effects of Pre- and Posttrip Activities Associated With a Residential Environmental Education Experience on Students' Attitudes Toward the Environment. *Journal of Environmental Education, 37*(4), 3-17.

Smith-Sebasto, N. J., & Semrau, H. J. (2004). Evaluation of the Environmental Education Curriculum at the New Jersey School of Conservation. *Journal of Environmental Education, 36*(1), 3-18.

Spork, H. (1992). Environmental education: a mismatch between theory and practice. *Australian Journal of Environmental Education, 8*, 147-166.

Summers, M., Kruger, C., Childs, A., & Mant, J. (2000). Primary school teachers' understanding of environmental issues: an interview study. *Environmental Education Research, 6*(4), 293-312.

Summers, M., Kruger, C., Childs, A., & Mant, J. (2001). Understanding the science of environmental issues: development of a subject knowledge guide for primary teacher education. *International Journal of Science Education, 23*(1), 33-53.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using Multivariate Statistics* (4th ed.). Boston: Allyn and Bacon.

The State Botanical Gardens of Georgia (SBG). (2007). Retrieved March 17, 2009 from http://www.uga.edu/botgarden/teacherworkshops.html.

Tilbury, D. (1995). Environmental education for sustainability: Defining the new focus of environmental education in. *Environmental Education Research, 1*(2), 195.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (1975, October 13-22). *The Belgrade Charter.* Paper presented at the International Workshop on Environmental Education, Belgrade, Yugoslavia.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (1977, October 14-26). *Intergovernmental conference on environmental education*, Tbilisi, Georgia (USSR).

United Nations Educational, Scientific and Cultural Organization (UNESCO-UNEP). (1990). Environmentally educated teachers: the priority of priorities? *Connect, XV*(1), 1-3.

Van Petegem, P., Blieck, A., & Pauw, J. B.-D. (2007). Evaluating the Implementation Process of Environmental Education in Preservice Teacher Education: Two Case Studies. *Journal of Environmental Education, 38*(2), 47-54.

Volk, T. L., & Cheak, M. J. (2003). The effects of an environmental education curriculum on students, parents, and community. *Journal of Environmental Education*, *34*(4), 12-25.

APPENDIX A

Ethnobotanical Environmental Education Survey

The State Botanical Garden of Georgia
In conjunction with

University of Georgia
Warnell School of Forestry & Natural Resources

Dear Participant:

This survey concerns an important research project being conducted by the University of Georgia's Warnell School of Forestry and Natural Resources. The survey helps to measure the impact of an environmental education workshop on participating teacher's environmental knowledge. The results from this study will be used to help improve future teacher workshops. Furthermore, it is hoped that a more effective way of using a variety of teaching tools maybe identified, which could help teachers more fully meet Georgia Performance Standards in terms of environmental education.

This research can only be successful with the generous help of teachers like you! Thank you for your time and consideration.

Sincerely,

Rachel Small
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Teacher Survey

Instructions:

Based upon your knowledge, please indicate whether you strongly disagree, slightly disagree, neither disagree or agree, slightly agree, strongly agree, (or do not know or refuse to answer) with the following statements:

Question	Strongly Disagree	Slightly Disagree	Neither Disagree or Agree	Slightly Agree	Strongly Agree	Do Not Know or Refuse
1. Georgia's climate is similar to certain parts of Africa.	1	2	3	4	5	99
2. Some tropical plants may be grown in ecosystems found in GA.	**1**	**2**	**3**	**4**	**5**	**99**
3. Temperature changes have dramatic affects on ecosystems.	1	2	3	4	5	99
4. Some plants are used for a variety of different uses by different cultures in the world.	**1**	**2**	**3**	**4**	**5**	**99**
5. Removing plants from an ecosystem may have positive or negative effects.	1	2	3	4	5	99
6. Georgia's climate enables peanuts from Africa and peaches from Asia to be grown here.	**1**	**2**	**3**	**4**	**5**	**99**
7. Latin America relies heavily on cacao for economic stability.	1	2	3	4	5	99
8. People and animals may share similar interests in certain plants.	**1**	**2**	**3**	**4**	**5**	**99**
9. Different parts of a country may have several different ecosystems.	1	2	3	4	5	99
10. Some plants are valued by people for their cultural significance.	**1**	**2**	**3**	**4**	**5**	**99**
11. Some Mediterranean cultures use pomegranates for medicine, while pomegranates are used as food in the	1	2	3	4	5	99

USA.						
12. Temperature changes <u>do not</u> affect ecosystems.	**1**	**2**	**3**	**4**	**5**	**99**
13. Without animals many plants would struggle to survive.	1	2	3	4	5	99
14. One ecosystem may hold many different types of plant communities.	**1**	**2**	**3**	**4**	**5**	**99**
15. White oaks are native to GA.	1	2	3	4	5	99
16. Herbivores such as buffalo help manage ecosystem landscapes by disturbing plant communities.	**1**	**2**	**3**	**4**	**5**	**99**
17. Many plants have other uses associated with them by other cultures around the world.	1	2	3	4	5	99
18. Specific regions of the world heavily rely on plants for economic stability.	**1**	**2**	**3**	**4**	**5**	**99**
19. Georgia's climate enables many plants from Africa and Asia to be grown here.	1	2	3	4	5	99
20. Plants help to keep their ecosystems stable and healthy.	**1**	**2**	**3**	**4**	**5**	**99**
21. The interaction between plants, animals, and people is critical for our survival.	1	2	3	4	5	99
22. Many plants that we rely on in GA <u>are not</u> originally from GA.	**1**	**2**	**3**	**4**	**5**	**99**
23. Georgia's climate is similar to certain parts of Asia.	1	2	3	4	5	99
24. Both people and animals have an affect on plant communities.	**1**	**2**	**3**	**4**	**5**	**99**
25. Herbivores such as buffalo help manage ecosystem landscapes by grazing on plant communities.	1	2	3	4	5	99

26. Plants <u>cannot</u> be used to educate people about different cultures and societies.	**1**	**2**	**3**	**4**	**5**	**99**
27. Climate changes have dramatic affects on ecosystems.	1	2	3	4	5	99
28. Some plants are valued very highly in certain cultures as part of their ritual ceremonies.	**1**	**2**	**3**	**4**	**5**	**99**
29. Beyond merely simple food consumption some plants are regarded very highly by certain cultures for their medicinal purposes.	1	2	3	4	5	99
30. Herbivores such as rodents <u>have no</u> affect on plant communities.	**1**	**2**	**3**	**4**	**5**	**99**
31. River Cane material is used by Native Americans for weaving.	1	2	3	4	5	99
32. Plant communities help to stabilize soil erosion in ecosystems.	**1**	**2**	**3**	**4**	**5**	**99**
33. Plants may be used to educate people about different cultures and societies.	1	2	3	4	5	99
34. Climate changes have <u>do not</u> affect ecosystems.	**1**	**2**	**3**	**4**	**5**	**99**
35. Herbivores such as deer <u>have no</u> affect on plant communities.	1	2	3	4	5	99
36. Peanuts are native to GA.	**1**	**2**	**3**	**4**	**5**	**99**
37. Chocolate has very important ceremonial qualities in Latin America.	1	2	3	4	5	99

For Statistical Purposes, I Need To Ask You A Few Questions About Yourself. Please Remember That All Information Is Confidential.

Name______________________________________ Age____ Gender F / M

What Race or Ethnicity do you consider yourself to be?________________

Which School Do You Teach At?____

Grades Taught____

Subjects Taught____

Teaching Experience________years

APPENDIX B

The Ethnobotanical EE Workshop Agenda

The Ethnobotanical Garden for Georgia Schools

Design, Plant Selection and Teaching Activities
Funded by "No Child Left Behind" Title II
Improving Teacher Quality Higher Education Program
February 28 & 29, March 1 2008

AGENDA

Day One (7 hours): Thursday February 28, 2008

8:15 Registration, Distribution of Course Materials, and Pre-Test

8:30 Welcome, Project Overview and Course requirements
Find your NUTRITION Partner Game & Participant Introductions

9:00 Ethnobotanical Plants: A multi-cultural learning resource for GA Students
Latin America, the Caribbean and Mediterranean plants that grow in Drought
Paul Duncan

10:00 Alternative Water Sources for School Gardens - Frank Henning

10:55 Break

11:05 Circle Gardens for Success – Bobby Wilson

12:00 Lunch at Café Trump- Conduct interviews

1:00 Designing the Ethnobotanical Gardens & Container Plantings - Ashley Calabria

2:00 Recipe for a Forest: Shade Grown Coffee & Cocoa and Oaks – Anne Shenk

2:45 Break

2:55 Recipe for a Forest

4:00 Review and ask Questions

4:15 Adjourn

Day Two (7 hours): Friday February 29, 2008

8:30 Sowing Seeds for Success – Anne Shenk

9:30 Bamboo, Rice and Pine: the Spirit of the Japanese Landscape - Shelley Cannady

10:30 Break

10:40 Japanese Children's Festival

10:50 Natural Products and Processes in Fabric Design: Nigeria and Ghana
Dr. Patricia Hunt-Hurst

11:50 Ashanti Cloth, Kente Colors and other Symbols of Ghana – Barbara Payne

12:00 Lunch at Café Trump

1:00 "Yesterday's Ways, Tomorrow's Treasures: Heirloom Plants and Memory Banking," Southern Seed Legacy Project – Jim Veteto and Kristine Skarbo

2:00 Victory Gardens – Remembering the Gardens of World War II
A garden interview with a treasure, Lois Haywood and Barbara Payne

- Victory for Vitamins
- A Treasure Trove - Farmers and Consumers Market Bulletin
- A Treasure Hunt – The Almanac for Farmers and City Folk

2:35 Break

2:45 Four Foot Square Gardens

3:00 Cultural Uses of Plants from Africa, PowerPoint presentation for Students - Rachel Small

3:15 Cooking up Chemistry - Making Sense of Food
Barbara Payne, Rachel Small, Anne Shenk, Paul Duncan

4:00 Cultural Uses of Plants from Asia, PowerPoint presentation for Students - Rachel Small

4:15 Review and Questions & Answers

4:30 Adjourn

Day Three (6 hours): Saturday March 1, 2008

8:30 Adventures in the Tropical Rain Forest: A Shaman's Apprentice
Dr. Norm Thomson and Rachel Wilson

10:30 Break

10:50 Continuing with School Garden Designs – Ashley Calabria
& rotating through the ABC 's of Ethnobotanical Garden activities

- Seeds of Change
- Georgia's Agriculture and Ambassadors for Change
- It's All about Relationships!
- Positive Multicultural Experiences through Children's Literature

12:00 Lunch at Café Trump- Conduct interviews

1:00 Cherokee Ethnobotany: Past, Present, and Future
Dr. David Cozzo

3:15 Questions and Answers

3:30 Post-Test and Course Evaluation
Adjourn

Course Requirements for 2 PLUs:

- Attend and actively participate in all workshop sessions.
- Complete Post-Test and Course Evaluation
- Develop three student activities (interdisciplinary) for use in your Ethnobotanical Garden, correlate them to the Georgia Performance Standards, and share with other teachers.

APPENDIX C

Teacher Interview Questions

1. What experiences have you had with plants?
   Which ones do you like in Georgia, either to grow or look at?

2. Name 3 of the most important plants that contribute to Georgia's economy? Are these plants native to Georgia or have they been introduced?

3. How much do you feel you could teach students about plants used in other countries?

4. Georgia's climate enables many foreign plants to be grown here. Do you know how this can occur? Do feel confident explaining it to students?

5. How fully do you feel you could explain about plant, animal, and human interactions in different ecosystems—for example pond verse stream ecosystems— to students?

6. Some ecosystems, for example animal habitats—woodlands, grasslands, etc. are more fragile than others. How confident would you feel in explaining to students how humans have made positive and negative impacts to some traditional ways of life?

7. Many plants have different cultural uses in other countries. Can you name 2 plants you could use to teach your students with about these different cultural uses?

APPENDIX D

Teacher Interview Responses

07 Pre-Interview

1. Container plants in yard. Gardenias, tulip trees, flowering plants.
2. Peanuts-native, cotton-native, pines-native
3. Learning about new resources raises confidence about ability to students
4. Understanding temperature ranges and the zones that they are categorized into
5. Runoff and contaminants entering system. Rivers effect greater area, while pond is isolated system
6. Encourages RRR and understands that the system will take a while to catch up after being overused. The given route is not always the best route
7. aloe- West Indies used for massages or lubrication; orange-spices in Japan, recycle for compost, only eaten as fruit here

07 Post-Interview

1. Flowers, tulip trees, gardenias- plants in containers because of soil.
2. peanuts-nonnative, cotton- nonnative, pine and white oak-native
3. aloe vera- Indies, different countries medicinal/ceremonial
4. yes, learned zones-comparable to other continents
5. fish ponds-animals, turtles, fish. Good stewardship.
6. positive-DNR replanting; negative-spotted owl in nest, cut down trees, rainforest, invasive varieties.
7. aloe vera, yellow root-Native American, medicinal

09 Pre-Interview

1. have a garden with just flowers and vegetables growing. Azaleas, Selvia, Iris.
2. corn and soybeans- both introduced; peanuts-native
3. not much
4. good rain-good temperature-not harsh winter. Confident with Pre-K
5. not comfortable
6. small
7. aloe vera

09 Post Interview

1. different colors and textures for plants

2. cotton and soybeans- imported
3. much more now- not thought about the topic before about other countries. Workshop introduced me to them.
4. Humidity and temperature. Much more confident with pre-K.
5. Think about the topic now, had not thought about it before.
6. Single out areas and talk about it. Construction site disruption and urban impacts. Confident.
7. Medicinal purpose, coffee, aloe and verbena, indigo-dye

10 Pre-Interview

1. tried gardening-North Georgia. Oranges, daylilies, live oak, jonquils.
2. peanuts, peaches, pecan-not native
3. 7th grade-Asia, Africa, Middle East Units are very beneficial.
4. Same climate zones within world-Asia
5. Teach geography . I love the outdoors and my husband is a hunter.
6. 5 human environmental interactions- great deal of time
7. yams-africa, rubber trees

10 Post-Interview

1. Schools don't do plants, remember 4H camps and plant collection! Large family that loves plants and exchange-hates crabgrass in garden so that makes difficult to work. Love to garden.
2. pecans-native thought they were not, peaches-not native, peanuts-not native
3. middle school social studies is Latin America, Asia, etc. in middle school. Can do interdisciplinary unit, connections of technology. All subjects in all areas could be taught by creating a school garden.
4. I do this through geography-teach vegetation zones. Pangaea and why things are similar on different continents.
5. All of the materials here will enhance and give connections (the resources explain how plants are used in other areas) explains to students the debate between space and resources. Still trying to process all the materials for taking back to school.
6. Human, environment, interaction- Seed legacy will fall into that, need to pass (individual knowledge) to future generations- how older generations have information that new people will not know if they do not ask.
7. Indigo-dye within Africa, many different cultures use rice, bamboo-fabric. Mythology as well.

12 Pre-Interview

1. Mom and grandmother landscaped/garden. Interest in plants-own garden with kids, grow own herbs. Cherokee Rose.
2. peanuts; cotton, peaches, pecan-maybe native
3. a lot- mango tree growing in classroom.
4. yes, kudzu brought in and beneficial- teach about invasive qualities.

5. Very well, different cycle-seeds not growing if not gone through digestive tracts of animals.
6. not as much detail in K. take away habitat from animals and how affects water from negative develop. Bear and deer in city.
7. Agave-many Hispanic children, different herbs-tea out of flower

12 Post-Interview

1. Grandmother had plants, mother grew lots. I would wander in woods, brought plants back- have a wildflower garden and have herb garden.
2. Peanuts, cotton, peaches- all not native
3. Lots because ties into all areas of the curriculum-food, clothing, housing materials; writing, reading, comparison.
4. Because on globe same distance from equator. Weather, landforms, dirt, humidity are alike. Confident.
5. Pretty well and I can access resources if I am unsure-people and published.
6. Pretty good-now we have pictures to go along with what we saw. Look at school with out yard and impact thing. Bear setting and talk about native habitat.
7. Chocolate- has meaning in other countries, tea-ceremonial uses

13 Pre-Interview

1. Rose garden, vegetable garden. Husband does yard work.
2. corn, wheat, hay-all introduced
3. not confident, but hope to learn more from seminar
4. Understand zones for planting and hopes to gain a better understanding from seminar.
5. Water runoff into rivers with low, little filtering ability. Ponds hold contaminants for longer periods.
6. Negatively- overused resources and not given time to rejuvenate system.
7. Lavendar-spice traditionally, here used for scent only. Agave-used for foods, here only used for tequila

13 Post-Interview

1. Not much experience at all. Some with my garden at home-ban peppers, roses, strawberries, love to look at flowers.
2. Peanuts-introduced, hay-native, peaches-introduced
3. With my resources quite a bit, not from memory right now but could do lots with resources.
4. We are similar to parts of Africa. Know what growing zone we are in but does not feel confident about teaching it.
5. Semi-confident. Could explain at pre-k but would need to go over resources more to teach higher grades.

6. Pretty confident-rainforest destruction, animals, and our land in local countries. How we are affecting our animals here.
7. Aloe-our use and different uses by other countries; gourd-use it for carving and stamping, here for bird houses.

14 Pre-Interview

1. Home garden-some herbs-mostly flowers. Irises, roses, butterfly bush, hydrangea, camilia, herbs, pianees.
2. Peanut, peach, cotton-all introduced.
3. Very little.
4. Similar sun and temperature. Mountains and coast. Confident.
5. Superficially.
6. Superficially
7. Red onion, tobacco, fox glove.

14 Post-Interview

1. Home garden, school garden
2. pine-much more important, native; peanuts, cotton, peaches-all introduced
3. More now from workshop curriculum.
4. Temperate climate based on distance from equator. More confident.
5. Pretty fully-different habitats taught.
6. Rain forests and tundra. Confident. Urban Impacts, pollution, and top soil.
7. Cacao- money, indigo-dye, bamboo-fabrics, flower arrangements.

15 Pre-Interview

1. Flower graden-30 years-hobby. Azalea, hydrangea, dogwoods, grass
2. Peanuts, cotton, soy-all introduced
3. Very limited.
4. No
5. Confident-elementary science
6. Pretty Confident
7. No

15 Post-Interview

1. Personally-our hobby; we experiment with azaleas and live in a rural area-have to know about plants
2. Soy bean, cotton, peanuts-not native
3. After this workshop a lot more. The resources have helped me tremendously. I have something to take away to help remember.
4. Because we have similar situations and I can look at reference material.

5. One of our standards-very comfortable. I have been teaching for 26 yrs.
6. Goes along with #5. I feel confident. I learn more everyday about how to do/ teach these things.
7. Indigo-dye, cassava-tapioca and cyanide

16 Pre-Interview

1. Raised on farm (100 acres)-hay, wood, flowers. Cherokee Rose.
2. Peanuts, cotton, soybeans-not sure if native.
3. Work with a lot of Asians, would like to know more about to teach.
4. Feel comfortable expaining some of it. If climate is the same, I feel I can talk about it.
5. Little. Not thought of ecosystems.
6. Fairly
7. Rice, sugarcane

16 Post-Interview

1. Same as before.
2. Peanut, peach, cotton-all introduced
3. Add a lot from curriculum. Different techniques and tangents from workshop.
4. Climate. Same in other countries. Confident.
5. Everything works together. Not change ecosystem too much.
6. Cutting down Rainforests, dust bowl American history. Confident.
7. Indigo-dye, potatoes-andes

17 Pre-Interview

1. Had forestry in high school in a day of green houses, home gardens and house plants. More roses planted as an ornamental and wild flowers
2. Peanuts, peaches, cotton-all native
3. Not much now, hoping to gain more knowledge over the next few days.
4. Climate in GA is diverse- tropical forest, cooler in north. Would need more information before teaching students.
5. Feel ok but would need some help discussing the different systems.
6. Confident. Pollution, tree harvest affects wildlife habitat. Positive-erosion control for water runoff- not disturbing the environment-leave it alone.
7. Aloe-used for medicinal purposes, we use it for medicine but mainly ornamental.

17 Post-Interview

1. Plant wildflowers, garden, green house, hort teacher.
2. Peanuts-S.America, Oak-native, cotton-introduced Egypt.
3. have pp and books now. Would do ok.

4. Understand it now. Climate and different ecosystems can be taught using with curriculum.
5. do ok. Plant and animal refresh.
6. do ok. Confident
7. rice-nutritional value, bamboo-flooring, food

18 Pre-Interview

1. not a lot. Garden growing up. Cherokee Rose.
2. Peanuts, Vidalia onions, peaches-not sure if native
3. Not a lot right now.
4. Ok job. Don't teach science
5. Ok, do not teach science.
6. Ok. Average if did some research
7. Coffee, cacao, cotton

18 Post-Interview

1. like to keep older heirloom plants growing in GA.
2. Peaches-not native, peanuts-do not remember, Vidalia onions-not native
3. a lot more now then before workshop. Got a lot of great ideas now.
4. More confident now. Live in similar climate same distance from equator.
5. much better now
6. 100% better now, remember after ppt and new information.
7. Cassava and yams

19 Pre-Interview

1. Dad grew up on farm-garden, trees, and vegetables, little flowers. Peach tree.
2. Some native, others introduced. Peanuts, cotton, corn.
3. Immigration unit very applicable. Connect kids to their cultures and to other cultures.
4. Yes, research ahead of time. Went to Jekyll Island for field trip-saw climates/ecosystem changes.
5. Great-pond on school site talk about water issues and qualities.
6. Longleaf pine ecosystem-controlled burning-healthy. Indians used controlled burns. Negative-pollution, building/ development, habitat destruction, runoff.
7. Medicinal plants, food crops.

19 Post-Interview

1. daddy was farmer-had garden growing up. Peach tree-no house plants.
2. peanuts, cotton, corn-not native
3. culture, animals, ecosystem, jobs, economy. Math with any of it graphing, writing, cross curriculum.

4. Yes liked slide showing vegetation and distance from equator. Done it for years.
5. Just took students to jekyll island and the cycles of water testing-confident take many field trips to do these things.
6. show standing marsh near endangered birds and how we want to build there. Also positive because of controlled burning.
7. Coffee, chocolate, rice-not just for food, paper, etc. kudzu-invasive but good for food.

20 Pre-Interview

1. Grant for raised beds at school, had students construct and plant-pansies and cabbage. Gained compost from Dalton Utility.
2. E.White Pine-native,peanuts- introduced from S. America, peaches-introduced from Portugal. Cotton-egypt.
3. Limited, would need some research before confident to teach students.
4. Confident-climate similar and mild enough that many plants could tolerate different biomes within our state; coastal plain and piedmont.
5. Confident, need more research on specific plants and animals within systems but comfortable with general concepts.
6. Confident-kudzu introduced in 1940's for erosion control to world fair and took over. Positive would need more research. More concerned with negative.
7. tobacco- religious purposes, aloe-medicinal and ornamental.

20 Post-Interview

1. Wildflowers.
2. peanuts-introduced, peaches-introduced, pine-native
3. Somewhat comfortable need more research.
4. yes, temperature and growing conditions similar.
5. pretty confident, but need to do more research.
6. same as #5. pretty confident but need more research for specifics.
7. sweet potatoes, peanuts

21 Pre-Interview

1. Country garden every year. Plant bogs on school site. Poplar, white oaks, persimmon.
2. peanuts, cotton, pecans-not sure if native.
3. standards teach about GA. Students could benefit from origin of plants.
4. No not really, we are not really close to the equator or the north and we have 4 seasons.
5. Fairly well-read and learn more. Effects of erosion.
6. Interested in topics and work with bogs. Wetland habitat going away with developments.
7. Rely on plants for different reasons-medicinal and ceremonial purposes.

21 Post-Interview

1. Growing garden yearly, blueberries, like to take pictures in mountains. At school received grant for carnivorous garden- died because of drought. Always liked plants and nature.
2. peanuts-s America. Cotton-not native, peaches-most fruit from asia.
3. Lots of ways to see how different countries interact, social studies, reading, and how important conservation is, and the need to take care of your environment. Teach GA habitats and could branch to countries with similar plants-also talk about animals.
4. Yes, more so now. Almost every continent has regions like ours, things that can thrive here can flourish elsewhere. Migration and needs for plants. We are all dependent on each other.
5. We teach habitats. The workshop enriched this knowledge-gave new knowledge to extend what I know. Gave new cultures to incorporate into class, made it so I am not just limited to GA information.
6. Confident. Almost everything we do has an impact most cases have had a negative impact in the US. Seeds and fruits are becoming hybrids-becoming interested in heritage planting. Many plants now are hybrids or not from this area. We need to preserve plants and talk about fragile habitats.
7. cotton-start in GA, history of it and others that use cotton, dying, etc. peaches and apples to Africa-many directions you could go.

22 Pre-Interview

1. Mom gardens, vegetable and flower garden. Day lily, hydrangea, roses, heirloom tomatoes, squash, butterbeans.
2. peanuts and soy-introduced; pine-native
3. Medium Confidence.
4. Wind, travel, water, boat, similar climate. Pretty confident.
5. Fairly confident already part of curriculum.
6. Medium confidence.
7. Oak tree and peyote.

22 Post-Interview

1. herb and flower garden. Day lily collection and vegetables.
2. Soybean and peanut- introduced; pine and white oak-native
3. A lot not because of the information and slides from workshop.
4. People bring plants-historic; air travel; global transportation.
5. Good now, information received from workshop. Shamans use plants differently.
6. Next to school-stripped land of trees-students saw the damage; # of rainforests destroyed; have to slash and burn because of different landscapes. Fuss at students for littering; try to stress cleaning up.
7. oregano, peanuts, herbs-medicinal