



5-2008

# Impacts of an Environmental Education Program on Participants' Environmental Behaviors

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## Recommended Citation

Reilly Sheehan, Carolyn D., "Impacts of an Environmental Education Program on Participants' Environmental Behaviors." Master's Thesis, University of Tennessee, 2008.  
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To the Graduate Council:

I am submitting herewith a thesis written by Carolyn D. Reilly Sheehan entitled "Impacts of an Environmental Education Program on Participants' Environmental Behaviors." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Teacher Education.

Rita A. Hagevik, Major Professor

We have read this thesis and recommend its acceptance:

Claudia T. Melear, Bonnie H. Ownley

Accepted for the Council:

Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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We have read this thesis  
and recommend its acceptance:

Claudia T. Melear

Bonnie H. Ownley

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the  
Graduate School

(original signatures are on file with official student records)

IMPACTS OF AN ENVIRONMENTAL EDUCATION PROGRAM ON  
PARTICIPANTS' ENVIRONMENTAL BEHAVIORS

A Thesis Presented for the Master of Science Degree  
University of Tennessee, Knoxville

Carolyn Dixon Reilly Sheehan

May 2008

## ACKNOWLEDGEMENTS

Many thanks to those who assisted me with the development and completion of this research. These include Dr Rita Hagevik for introducing me to informal science education, and for her support and enthusiasm throughout the process. Also Dr Claudia Melear and Dr Bonnie Ownley for their assistance and time spent advising me and reviewing copies of this thesis. Cary Springer was a great help with the experimental design and statistical analyses used in this study. Additionally, I would like to thank those involved in the research, specifically Ijams Nature Center and especially Peg Beute and Kara Remington, who were kind enough to allow me to collect data as part of their program presentations and otherwise work with me throughout this research. The members of the public who attended these programs also receive my thanks for their patience and assistance. Thanks to Rich Norby for helping me to find this path, and to Jacob Sheehan for his love and support.

## ABSTRACT

Environmental issues are at the forefront of public scientific inquiry. There is a pressing need to change the way we do things in order to reduce the human impact on the environment (Brower, 1999; Bierbaum, 2007). Environmental education is one key for implementing change (Disinger, 1982). Ijams Nature Center's "Living Clean & Green!" program was developed with this goal in mind (P. Beute, personal communication, September 11, 2007). Ajzen's (1991) Theory of Planned Behavior and Hines, Hungerford, and Tomera's (1987) model of Responsible Environmental Behavior were used in this study to determine if behavior change occurred among adult participants of this program over a three-month period. Instructor interviews, workshop observation, pre-/post knowledge surveys, behavior questionnaires, and post telephone interviews were used to examine the characteristics of the program, participant knowledge, intention to engage in environmental behavior, and actual behavior change. The results indicated that participants did learn information in the course of the program, and intentions to change behavior were predicted by the Theory of Planned Behavior (Ajzen, 1991). However, three months after the workshop, actual behavior change was not predicted by the theory, although behavior change did occur in a majority of participants. Unfortunately, participants did not connect changes in their behavior with overall environmental issues and human impacts on the environment. This program, offered through Ijams Nature Center, is effective in its goal to change human behavior, although its impact may increase if audiences can connect their individual behaviors to overall environmental impacts.

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## LIST OF ABBREVIATIONS

BMP	Best Management Practice
CAA	Clean Air Act
CFL	Compact Fluorescent Light bulb
CWA	Clean Water Act
EE	Environmental Education
EPA	United States Environmental Protection Agency
ICEE	Intergovernmental Conference on Environmental Education
IPCC	Intergovernmental Panel on Climate Change
KUB	Knoxville Utilities Board
LCG	“Living Clean & Green!”
NAAEE	North American Association for Environmental Education
REB	Responsible Environmental Behavior
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization

## CHAPTER I

### Thesis Outline

This thesis is organized into five chapters, the first of which consists of the introduction. Chapter two contains a review of recent literature related to environmental education and behavior change. The third chapter contains an explanation of the methods used to conduct the study, including a description of the setting in which the study occurred and the instruments used. Results of statistical tests are given in chapter four, and the findings and conclusions are reported in the fifth chapter. Tables, figures, and survey instruments follow in the appendices.

### Introduction

The global community is becoming ever more aware of the impacts that humans are having on the environment. Anthropogenic impacts include air and water pollution through introduction of waste and chemicals into the environment, loss of native species, and global climate change, among many others (Houghton et al., 2001; Lodge, 1993; McCulloch, 2003). Some human impacts have incurred damage that is now beyond repair, but there is still opportunity to reduce or reverse some effects (Bierbaum, Holdren, MacCracken, Moss, & Raven, 2007). However, this will only occur if we, as a global community, change the way we do things (Brower & Leon, 1999). Changes in behavior can be made at the personal, governmental, and international levels. In order to make changes, we must first understand and communicate to others strategies that can be used. This may be accomplished in part through environmental education (Disinger, 1982). Having grown out of a history of nature study and conservation education, environmental education is currently defined by a three-fold approach. The focus areas are awareness of environmental issues, opportunity to gain knowledge and values necessary to mitigate impacts, and environmental behavior change (Intergovernmental Conference on Environmental Education [ICEE], 1978). Environmental education may occur in both

formal and informal settings and may focus on one, two, or all three components of the current approach.

One setting in which environmental education commonly occurs is nature centers. Nature centers act as a venue for several different forms of education, ranging from field trip destinations for school groups to community programs. Ijams Nature Center, located in Knoxville, Tennessee, is one such venue. One program offered, “Living Clean & Green!” consists of a series of workshops whose aim is to increase environmentally-friendly behaviors among the public (Spaid, n.d.). The workshops that make up this adult-oriented program address issues such as habitat destruction, pollution impacts to terrestrial and aquatic environments, and energy use. Regular workshops are offered free of charge to the public, on and off site, at a rate of three to four programs per week at the request of various local organizations, businesses, and schools (P. Beute, personal communication, March 8, 2007). This study examines the characteristics of the workshops and how they relate to the stated goals of the program. In addition, participants’ intentions to engage in environmental behaviors learned in the workshops were studied, as well as their actual engagement in these behaviors during the three months following the workshops. Relatively few studies have been done to examine behavioral changes over time in this type of short, one-time environmental education program (Disinger, 1982; Leeming, Dwyer, Porter, & Cobern, 2001; Zelezny, 2001). Measuring environmental behavior change resulting from broadly disseminated public programs such as this one is important to a greater public understanding of the environment and the role that humans play in environmental change.

### *Environmental Education as a Tool for Behavior Change*

Environmental education, the teaching and learning of socioeconomic and ecological issues that are related to environmental change (ICEE, 1978), stems from the educational precedents “nature study,” “conservation education,” and “outdoor education,” among others, each with its unique history and focus. Nature study, which was widely popular in the early twentieth century, focused on learning the elements of the natural world as an integrated whole (Disinger, 2001) rather than in distinct

disciplines, a philosophy that is shared with environmental education. Conservation education focuses on the human use of natural resources. This subject, together with the Natural Resources Conservation Service, arose from the Dust Bowl of the 1930s as a step in preventing soil erosion and maintaining food production (Helms, n. d.). Finally, outdoor education is a methodological approach to education that highlights using resources outside the classroom, and is used in nature study, conservation education, and environmental education (Disinger, 2001). Following these historical precedents and increased public awareness of environmental degradation, the first intergovernmental panel on environmental education met in Tbilisi, Georgia, in 1977 to determine the purpose and focus of worldwide environmental education (ICEE, 1978).

The intergovernmental meeting at Tbilisi, organized by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the United Nations Environment Program (UNEP), led to the preparation and publication of the Tbilisi Declaration, now considered a founding document of modern environmental education (ICEE, 1978). The Tbilisi Declaration builds upon the Belgrade charter (UNESCO - UNEP, 1976), a statement regarding environmental education that was adopted by the United Nations in 1976, in which the overarching goal of environmental education is succinctly stated:

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 (p. 2).

Authors of the Tbilisi Declaration (1978) built upon this framework to clarify three specific goals of international environmental education. These are:

- a) to foster clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas

- b) to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment
- c) to create new patterns of behavior of individuals, groups and society as a whole towards the environment (p. 26).

Together, these declarations state that it is important to educate all people on all sides of environmental issues, including not only the science but also all the political and social impacts that go along with them (ICEE, 1978; UNESCO – UNEP, 1976). The North American Association for Environmental Education (NAAEE), founded in 1971, used these goals as a central theme around which to develop guidelines for environmental education. Known as the “Guidelines for Excellence” (NAAEE, 2007), they are used to assist educators in curriculum development. The Guidelines for Excellence are similar to state and federal curriculum standards in that they are organized specific to grade level, age, and development (National Research Council, 1996; Tennessee Department of Education, 2006). These guidelines are organized into four strands that focus on different skill sets needed for addressing environmental issues. Each strand includes detailed guidelines on scientific, political, and social aspects of environmental issues to meet the Tbilisi Declaration and Belgrade Charter goals, with NAAEE’s overall goal being to increase environmental literacy continent-wide (NAAEE, 2007). These guidelines, as well as UNESCO’s goals for worldwide environmental education (EE), are implemented in many different educational settings around the world, including both formal and informal settings such as school programs, museums and nature centers, and volunteer organizations (Falk & Dierking, 2002; Hungerford, Bluhm, Volk, & Ramsey, 2001).

Ijams Nature Center is one such informal environmental education setting. Located three miles from downtown Knoxville along the Tennessee River, Ijams has been serving visitors for over 25 years with public trails and a variety of environmental education programs. The “Living Clean & Green!” program workshops are intended to “inform the public and improve the local environment” (Spaid, n.d.). The expected outcome of the program is that participants in the workshops will learn and implement

action that improves the local environment. However, it is not currently known if this is the actual outcome, as follow-up studies have not been done to determine what participants learn or what they do once prepared with this knowledge (P. Beute, personal communication, March 8, 2007). Because of the detrimental impact that humans continue to have on the environment, such programs that focus on behavior change should be at the forefront of environmental education. In addition, programs such as this need to be assessed to determine the most effective means possible for implementing environmental behavior change.

### *Environmental Impacts and Mitigation*

Environmental issues that are known to be human-caused include impacts to terrestrial and aquatic habitats and to human health and well-being (Houghton et al., 2001; Lodge, 1993). Emissions and discharges of pollutants into air and waterways, hazardous and non-hazardous waste streams, and habitat destruction are just a few of the wide-ranging issues that we face (Fahrig, 2002; U. S. Environmental Protection Agency [EPA], 2006). However, there are methods that can be implemented to mitigate our impacts. Mitigation, the reduction or removal of our negative impacts on the environment, may occur in many different forms and can be effective when practiced by individuals, state and federal governments, and multinational organizations (Brower & Leon, 1999; Houghton et al., 2001).

Pollution of waterways is a major issue that affects nearly every surface waterway and can be reduced through the actions of individuals together with government regulations (Hansen, 1988; EPA, 2006). Within the United States, water pollutants from point sources, such as drainage pipes, are controlled via regulations set forth in the 1972 Clean Water Act (CWA). The CWA focuses mainly on point-source pollutants because they are relatively easy to control and regulate (EPA, 2006). However, diffuse sources of water pollution, non-point source pollutants, have an equally detrimental effect on waterways. There have been efforts to reduce their impacts through the use of Best Management Practices (BMPs), practices that individuals can undertake to protect natural

resources. Because most BMPs are voluntary, only through educational and support efforts can they be implemented to protect waterways (Hansen, 1988).

Similar to water pollution, air pollution can be somewhat mitigated by actions of individuals and organizations. Airways are impacted by pollutants such as particulate matter and ground-level ozone, the components of smog (Brower & Leon, 1999), and also by greenhouse gases that contribute to global climate change (Houghton et al., 2001). Smog is particularly dangerous to human health, especially for those with compromised lung function and immune systems (Chen, Gokhale, Shofer, & Kuschner, 2007). Smog, unlike global climate change, can occur with greater intensity in localized patches than in surrounding areas. Climate change, which consists of the increase in global temperature and associated precipitation regime changes, can cause weather and ocean current disruptions (Houghton et al., 2001), disjunct range and phenological shifts of codependent biological organisms (Parmesan, 2006), and social and cultural upheaval (Starke, 2006). Many air pollution impacts are associated with energy use, mainly the burning of fossil fuels for transportation and building cooling and heating. Because combustion of fossil fuels is the main contributor to both smog and climate change, an increase in energy efficiency, decrease in fossil fuel-powered transport, and similar changes are called for (Brower & Leon, 1999; Houghton et al., 2001). As with water pollution, the United States has legislated some emissions regulations with the Clean Air Act (CAA) of 1970, which focused on reduced emissions from moveable and stationary sources. However, the CAA does not cover climate change because greenhouse gases like carbon dioxide have not historically been regulated (EPA, 2006). Because there is little legal protection, various voluntary measures must be taken to reduce the sources of climate change. There are many BMPs that can be implemented, but the public must be educated to fully understand what actions can be taken and which have the biggest impact (Brower & Leon, 1999). Education is a necessary component of behavior change in regards to environmental protection (Disinger, 1982).

As with air and water pollution, BMPs and government regulations also deal with release of chemicals into the environment (Bohmont, 2003; EPA, 2006). Pesticides are widely used throughout agriculture, as well as by municipalities and household residents

to control unwanted insect, plant, and disease-causing pests. Integrated pest management and companion planting are examples of the many BMPs known to reduce use of pesticides (Bohmont, 2003). In addition, the Federal Insecticide, Fungicide, and Rodenticide Act (1972) deals with the manufacture, labeling, use, and disposal of pesticides. Besides pesticides, other toxic chemicals may enter the environment through various pathways. The Toxic Substances Control Act (1976) requires screening, testing, and tracking of all toxics within the United States, including those developed within the country as well as any that are imported (EPA, 2006).

Waste management is also dealt with through BMPs and legislation (EPA, 2000, 2006). The well-known educational campaign to reduce, reuse, and recycle consists of a set of BMPs targeted at the consumer level, with a focus on reducing waste by purchasing items that have minimal packaging, reusing and recycling as much as possible, and composting food waste (EPA, 2000). This effort has been particularly successful in the recycling arena, which has drawn criticism but is overall considered to be effective (Brower & Leon, 1999). Regulations that deal with waste focus mainly on hazardous waste, via the Comprehensive Environmental Response, Compensation, and Liability Act (1980), to clean up closed or abandoned hazardous waste sites; and the Resource Conservation and Recovery Act (1976), to provide for “cradle-to-grave” management for those sites still active (EPA, 2006). To deal with household hazardous wastes, public educational campaigns have been one focus of EE for the encouragement of household residents to identify and properly dispose of such wastes (Evenson, 1985).

Habitat loss, yet another impact of human activities, may occur through habitat destruction (Fahrig, 2002) and through loss of native vegetation when non-native invasive species take over an area. Biological invasion, a characteristic recognized as commonplace in nature and occurring regularly throughout geologic history, is also becoming exacerbated through human activity (Lodge, 1993). Non-native invasive species are those species that enter an ecosystem outside their native range and become established to the extent that native species are harmed through reduced resources, introduced pathogens, and changes in nutrient cycles, among others (Sax, Stachowicz, & Gaines, 2005). Non-native invasives have become an issue of great concern among

ecologists and land managers, and are gaining notoriety with the public, as humans vastly accelerate the rate at which species move into new ecosystems. This accelerated rate of change can lead to “global homogenization” (Lodge, 1993), in which a few species dominate the global landscape. Further, climate change is implicated in increased biological success of invasive species, in which plant invaders in particular are anticipated to respond favorably to factors of climate change. Animals, including invasives, will be affected both directly by climate change factors and indirectly through impacts to plant populations. These changes that occur will be to the detriment of native ecosystems as ecosystem functioning is altered and genetic diversity declines (Dukes & Mooney, 1999).

It is possible to reduce human impacts to the environment through personal actions, governmental regulations, and multinational efforts. Acting on the personal level, everyday behaviors can be changed by implementing BMPs that reduce waste, increase energy efficiency, and reduce water pollution. People may also wish to become involved in reducing their impact by becoming politically active. With regulations as well as voluntary actions, some impacts can be mitigated. Citizens can play a part by regularly contacting elected officials, voting, and running for office themselves. Governments act by implementing and enforcing regulations and agreements among governments allow for worldwide cooperation (Brower & Leon, 1999; Houghton et al., 2001; EPA, 2006). One component integral to all of these actions is that of education. By becoming educated ourselves, and by educating others, we can all become knowledgeable and aware of environmental issues and the steps that can be taken to mitigate them (Culen, 2001). The “Living Clean & Green!” program at Ijams Nature Center addresses mitigation of many environmental issues, including those discussed above, specifically at the personal level.

With the impressive list of potential actions, humans can mitigate impacts to the environment, but education is needed to help the public learn, understand, appreciate, and undertake these actions (Bierbaum et al., 2007; Brower & Leon, 1999). Public education campaigns on such issues as recycling have taken root (EPA, 2000), but with impacts of climate change occurring worldwide (Houghton et al., 2001), larger steps must be taken.

Concern among the public is growing, but without the knowledge of the issues, as well as knowledge of strategies and skills to address them, environmental behavior will not change (Brower & Leon, 1999; Hines, Hungerford, & Tomera, 1987). Through education, the public can be better informed of human impacts to the environment as well as ways in those impacts can be mitigated (Culen, 2001).

### *Theoretical Framework*

The theoretical framework used in this study consists of Ajzen's (1991) Theory of Planned Behavior (TPB) and Hines et al.'s (1987) Model of Responsible Environmental Behavior. Ajzen's Theory of Planned Behavior describes how individuals come to engage in a behavior, by taking into account several factors that influence one's intention to engage in a particular behavior as well as the actual control an individual has over the behavior. The theorized influential factors include attitude toward the behavior, perceived control over the behavior, and subjective norms, the perceived social pressures regarding a behavior. To understand how these constructs affect behavior, an individual's beliefs regarding each of these is assessed when using the TPB. Each construct is interconnected, and together they influence one's intention to engage in a specific behavior. When an individual feels pressure from others that are important to him/her to engage in the behavior, has a positive attitude toward the behavior, and has high perceived control over the behavior, that person will likely have high intentions to engage in the behavior. At this point, whether an individual engages in a particular behavior is also based on the actual control that individual has over the behavior. In regards to environmental behavior, there are additional complexities related to the nature of environmental issues that are not specifically addressed by Ajzen's theory. Hines et al. (1987) developed the Model of Responsible Environmental Behavior, based on previous research on environmental behavior. Hines et al. included several of the elements that appear in the TPB into their model, under the umbrella "personality factors." Hines et al. also incorporated three additional components that work with personality factors that lead to the intention to act. These components are the knowledge of environmental issues, which are often very complex, containing not only scientific, but also social and

economic factors. The knowledge of which courses of action are available and effective for addressing an environmental issue is another prerequisite to action. Finally, individuals need to have the skill to translate knowledge of appropriate strategies into action. Without these three components related specifically to environmental behaviors, individuals that already have appropriate attitudes, perceived control, and social pressures to engage in environmental behaviors may still be unable to act. Finally, similar to Ajzen's (1991) "actual behavioral control" (approximated by perceived behavioral control) that may influence behavior even when intention is high, Hines et al. (1987) reference "situational factors" that may influence an individual's behavior either toward or away from participating in environmental behaviors. These factors are events or situations such as personal economic limitations. For example, an individual may not be able to afford to contribute funds to an environmental organization (con-environmental behavior), but that same personal limitation may lead to use of public transportation over owning a personal vehicle (pro-environmental behavior).

In this study, I examine the outcomes of the "Living Clean & Green!" program to determine if the program motivates participants to take action to improve the local environment based on what they learn in the workshops. Here, behavior change is defined as any action that an individual has learned in a workshop and then takes steps to implement to reduce his/her individual impact on the environment. Survey instruments were designed specifically for this study, based on the Theory of Planned Behavior (Ajzen, 1991) and the Model of Responsible Environmental Behavior (Hines et al., 1987). In addition to observation, instructor interviews, pre-/post knowledge surveys, behavior questionnaires, and post telephone interviews were used to address the following research questions:

*Research Question 1: What are the characteristics of a "Living Clean & Green!" workshop and how do they contribute to the overall goals of the program?*

*Research Question 2: What are participants' intentions to implement environmental behaviors immediately following a workshop?*

*Research Question 3: How are participants' environmental behaviors changed as a result of the program over a three-month period following participation in a workshop?*

## CHAPTER II

### Review of the Literature

Environmental issues are global issues that can be addressed through actions at the personal, national, and global levels. Because of this, environmental educators worldwide must work in concert to individually achieve the overarching goal of reducing human impact on the environment (Gotch & Hall, 2004; Gudgion & Thomas, 1991; Hines et al., 1987; Koger & Scott, 2007; Ramsey, 1993; Sia, Hungerford, & Tomera, 1986). The Tbilisi Declaration acts as a guideline, outlining specific goals for environmental educators everywhere (Intergovernmental Conference on Environmental Education [ICEE], 1978). Indeed, the North American Association for Environmental Education (NAAEE)'s Guidelines for Excellence, meant to improve environmental education (EE) throughout North America, are based on the three major goals set out in the Tbilisi Declaration (NAAEE, 2007). These are: a) encouraging awareness and concern about environmental issues in every individual; b) providing opportunities to every individual to gain knowledge about environmental issues; and c) to change human behavior in regards to the environment (ICEE, 1978). It is this last goal that is the most difficult.

Although changing behavior is difficult, it is necessary to reduce or reverse our environmental impact (Intergovernmental Panel on Climate Change [IPCC], 2007a). The major environmental problems that we face, while based in part in natural cycles, are exacerbated by human actions such as resource consumption and fossil fuel burning (IPCC, 2007b). Recent climate change studies have indicated that at the current rate of change due to human impacts, new climates may arise by the year 2100, affecting ecological systems in unprecedented ways. These issues lead to unexpected ecological responses, including the possibility of loss of ecosystem services upon which living organisms depend (Ellison, 2007; Williams & Jackson, 2007). Additional findings in climate change research indicate that greenhouse gases in the atmosphere are increasing at higher rates than anticipated due in part to lower-than-expected carbon sequestration on land and in the ocean (Raupach et al., 2007). In order to reduce the human impacts on

the planet that are the root causes of these crises, humans must make changes in their everyday lives to reduce energy and resource consumption, reduce pollutant emissions, and take other such actions. Without human behavior change, environmental issues as they currently exist will continue to worsen (Brower & Leon, 1999; IPCC, 2007a). Specified as one of the goals of EE in the Tbilisi Declaration (ICEE, 1978), human behavior change is a necessary part of the equation of reducing human impact on the environment.

Due in part to the Tbilisi Declaration's EE goals, environmental educators worldwide have made efforts to create programs with the end goal of changing behavior. While several researchers have examined impacts of interventions on behavior change, others have looked solely at attitude change (Armstrong & Impara, 1991; Dresner & Gill, 1994; Gigliotti, 1992; Gillett, Thomas, Skok, & McLaughlin, 1991; Keen, 1991; Leeming et al., 1993); relying on the traditional model that attitude change results in behavior change (Hungerford, 1996). Research has shown that attitude change, while in many ways as important as behavior change and closely related to it, does not consistently lead to behavior change (Ajzen, 1991; Fazio & Roskos-Ewoldsen, 1994).

Several studies examining attitude toward the environment found no change in attitude following participation in an EE program (Armstrong & Impara, 1991; Gillett, Thomas, Skok, & McLaughlin, 1991; Keen, 1991). For example, both Armstrong and Impara (1991) and Keen (1991) found no change in attitude in fifth, sixth, and seventh grade students following one-time EE programs. This was true both in the form of EE lessons inserted into a traditional classroom curriculum (Armstrong & Impara, 1991) and in a 5-day residential program in a natural setting attended by school groups (Keen, 1991). Both studies cite findings in increased knowledge, another component important to measure in EE programs, but attitudes toward the environment did not change. Armstrong and Impara (1991) commented that "what is critical is that [a] program . . . not result in negative attitudes" (p. 36), with no effort to examine what could result in a positive attitude change.

Unlike the previous studies in which the program was a one-time isolated event for students, Gillett et al. (1991) examined a program in which students were involved in

planning and participating in a wilderness experience. The twelfth-grade students were involved in all details of planning, such as organizing equipment and food, studying and preparing for safety measures, learning about environmental etiquette, and so on. The program itself consisted of a six-day hiking and camping trip, and no follow-up activities related to the trip were discussed. Students who participated in the program did gain environmental knowledge throughout the duration of the trip preparation and implementation, but, as in the previous studies discussed, the authors found no attitude change among participants as compared to the control group that participated in no stage of the program. Gillett et al. also commented that there had been little previous research in which attitude change had been consistently observed.

Dresner and Gill (1994), on the other hand, did observe changes in attitude following participation in a two-week nature camp (students ages ten to thirteen). Unfortunately, studies of attitude appear to be confounded with behavior changes here, in which the authors state that “a significant number of campers showed increased *awareness* of environmental issues after camp” (p. 38; emphasis added) and refer the reader to a table of statistical results in which “awareness” is not listed, but rather, “environmentally responsible behavior.” It seems that Dresner and Gill, while they do list examples of attitude and awareness change found during their analyses and also list behavior changes, discuss the concepts interchangeably, with no differentiation of attitude from behavior or discussion of their impacts on each other.

Several researchers recognize that attitude and behavior change are not synonymous, but do little to clarify the difference between them. For example, Howenstine (1980) pointed out that “true environmental education must include a change in attitude *that results in a change in behavior*” (p. 21; author’s emphasis), but she did not further develop this statement. Scott and Willits (1994) held that a change in attitude leads to behavior change, but upon further study found that this positive link did not always hold true. Harris (2006) recognized that attitude does not lead directly to behavior, but then used findings of environmental attitudes to make recommendations on how to promote behavior change.

Still other researchers identify the difference between attitude and behavior change, but through observed behavior change in the course of attitude change research. While not specifically studying behavior change, they recognized this desired outcome. In a study of college students' willingness to give up items or actions that may have a negative environmental impact, Gigliotti (1992) noted that one item students were willing to give up in 1990 (as opposed to 1981 or 1971) was beef steaks. Although a desirable environmental action, he attributed this behavior change to successful health information campaigns.

Evans et al. (2005) also observed behavior change in the course of examining the impact of a citizen science project. Participants in the Smithsonian Institute's Neighborhood Nestwatch program were involved in reporting nesting behavior and success data, but researchers also found that more than half of the participants engaged in further action to make their own yards more hospitable to local bird populations. While Evans et al. (2005) did not set out to specifically study behavior change, they were clearly intrigued by their observations. They attributed the behavior changes in part to the fact that participation in the project may "[foster] stronger connections to the ecology of a location" and "[increase] awareness of the value of a backyard as a habitat for plants and animals" (p. 592). Participants also had direct contact with scientists, through mist-netting activities and on-line communication, which were credited as some of the critical components that led to behavior change.

Despite these examples of behavior change taking place when it was not specifically encouraged, such change occurring in these situations is rare. Additionally, research shows that behavior change does not result solely from changing attitudes (Ajzen, 1991; Fazio & Roskos-Ewoldsen, 1994; Fishbein & Ajzen, 1975), which many EE researchers and practitioners have attempted. Fazio and Roskos-Ewoldsen (1994) elucidate the difference between attitude and behavior and review several ways in which attitude can influence behavior. Their description and analysis of models designed to explain the mechanisms behind behavior change reveal the complex relationship between the two and in what cases attitude may impact behavior. It is important that those in EE

engage in research that explores the intricate relationships between attitude and human behavior.

While several EE researchers have been examining this relationship, one factor that has been lacking in much EE behavior change research is that of the incorporation of the field of psychology and collaboration with psychology researchers (Koger & Scott, 2007). Because of a history of research into behavior change and a strong grounding in peer-reviewed academic research, psychology is a field that EE researchers and practitioners should look to when trying to encourage behavior change. Not only should EE researchers and practitioners draw on psychology research, but collaborations with researchers in the field of behavior change would be of great benefit to the EE goal of implementing behavior change with lasting impacts and can be used when planning programs with behavior change as the end goal (Monroe, 1993). Research traditions in psychology include several subfields. EE researchers can gain an understanding of how humans respond to environmental degradation from cognitive psychology. The human brain works to focus on short-term visually noticeable events rather than the slow inevitable issues that are the source of much environmental degradation. From social psychology, we learn that social influence has a sizeable impact on human behavior. Use of developmental psychology can demonstrate why introducing people to nature, particularly at a young age, can influence their environmental behaviors. Finally, health psychology connects the health of the individual to the health of the planet both biologically and mentally (Koger & Scott, 2007). Because of its well-founded research in behavior change in a number of different sub-disciplines, psychology may be an extremely useful field for EE researchers to turn to in order to develop and implement effective EE programs and curricula aimed at behavior change.

There has been a movement among some EE researchers to examine behavior change. Many have reviewed the literature (Cude, 1993; Fedler, Siemer, Knuth, & Matthews, 2001; Gayford, 1996; Hungerford & Volk, 1990; Ramsey & Hungerford, 1989; Yerkes & Biederman, 2003), theorized (Hines et al., 1987; Hungerford, 1996; Hungerford & Volk, 1990; Knapp, 1996; Mittelstaedt, Sanker, & VanderVeer, 1999; Ramsey, 1993; Ramsey & Hungerford 1989), or have undertaken studies to test for

specific components that may lead to desired behavior change (Gayford, 1996; Hungerford, 1996; Knapp, 1996; Maiteny, 2002; Mittelstaedt et al., 1999; Orams & Hill, 1998; Ramsey, 1993; Ramsey & Hungerford, 1989; Sia et al., 1986; Stepath, 2004). Others have examined EE programs in which environmental behavior change took place and have generated lists of characteristics of “successful” EE programs in a variety of settings (Ballantyne & Packer, 2005; Fedler et al., 2001; Oskamp et al., 1998; Yerkes & Biederman, 2003).

There are several components that researchers have found to be important to individuals for behavior change. One of these is knowledge of environmental issues, in which program participants have a clear understanding of the ecological and social impacts of environmental degradation (Ballantyne & Packer, 2005; Fedler et al., 2001; Gayford, 1996; Mittelstaedt, et al., 1999; Orams & Hill, 1998; Oskamp, Burkhardt, Schultz, Hurin, & Zelezny, 1998). Many researchers also agree that knowledge of strategies and skills for dealing with these issues is a necessity for implementing behavior change, as is experience and skill using such actions (Ballantyne & Packer, 2005; Fedler et al., 2001; Gayford, 1996; Yerkes & Biederman, 2003). Attitude toward the issue or behavior plays a role in behavior change, though it does not always directly contribute to behavior change (Ballantyne & Packer, 2005; Fedler et al., 2001; Mittelstaedt et al., 1999; Orams & Hill, 1998; Oskamp et al., 1998; Yerkes & Biederman, 2003). Development of a personal locus of control (Ballantyne & Packer, 2005; Fedler et al., 2001; Gayford, 1996; Yerkes & Biederman, 2003), as well as a feeling of personal responsibility (Maiteny, 2002), are also necessary for individuals to engage in a new behavior. An individual’s intention to act often leads to engagement in behavior (Fedler et al., 2001; Mittelstaedt et al., 1999; Yerkes & Biederman, 2003), though this may be modified by situational factors and demographics (Oskamp et al., 1998). Additionally, social norms can influence an individual as to whether or not s/he changes behavior (Yerkes & Biederman, 2003). Finally, many researchers agree that having positive outdoor experiences (Ballantyne & Packer, 2005; Fedler et al., 2001; Maiteny, 2002; Stepath, 2004) and intense emotional responses (Ballantyne & Packer, 2005; Maiteny,

2002) to the outdoors or environmental issues may also cause an individual to engage in environmental behaviors.

Some researchers have looked at the issue of behavior change from a slightly different angle, preferring instead to list specific characteristics that should be used in EE programs to encourage environmental behavior. These include a program that occurs outdoors (Yerkes & Biederman, 2003) for an extended period of time (Cude, 1993; Gayford, 1996). If it is in a school setting, EE should be infused into the curriculum rather than presented as an individual unit (Gayford, 1996; Yerkes & Biederman, 2003). Others state that EE programs and curricula need to begin by building on what students already know (Gayford, 1996), be problem-based (Yerkes & Biederman, 2003), and should allow students to feel ownership (Gayford, 1996). Educators should encourage students to engage in critical thinking to examine and practice action skills and strategies for dealing with environmental problems (Yerkes & Biederman, 2003). At the completion of a project/program, there should be time allowed for reflection and follow-up activities should be provided (Ballantyne & Packer, 2005).

Still other EE researchers have taken these suggested predictors of behavior change a step further and created models. Hungerford, through various collaborations with Hines, Ramsey, Sia, Tomera, and Volk, developed two frequently-cited models of environmental behavior change (Hines et al., 1987; Hungerford, 1996; Hungerford & Volk, 1990; Ramsey & Hungerford, 1989; Sia et al., 1986). Sia et al. (1986) reviewed the literature and developed a list of eight predictor variables of environmental behavior: 1) level of environmental sensitivity, 2) perceived knowledge of environmental action strategies, 3) perceived skill in using environmental action strategies, 4) perceived individual locus of control, 5) perceived group locus of control, 6) psychological sex role classification, 7) belief in/attitude toward pollution, and 8) belief in/attitude toward technology. They followed this with research demonstrating that all but “belief in/attitude toward technology” were significant predictors of behavior change among their two samples of convenience of Sierra Club and Elderhostel members.

Ramsey and Hungerford (1989) tested a similar set of seven predictor characteristics, in which characteristics one through five above were retained, and overt

environmental behavior and knowledge of environmental action skills were added. In testing these on seventh-grade students, all characteristics except environmental sensitivity were found to be significant in predicting behavior change. Ramsey (1993) tested these characteristics further on eighth grade students, and had similar findings; however, in this study, individual locus of control as well as environmental sensitivity were not significant predictors of environmental behavior. These results indicate that perhaps some of the described characteristics are indeed accurate behavior change predictor variables, but that those that are significant may vary with subject group.

These efforts of creating a model appropriate to a variety of subject groups were expanded upon with continued work in EE and behavior change through meta-analysis of current research and development of a behavior change model (Hines et al., 1987). In the introduction, Hines et al. noted that the “development of environmentally responsible and active citizens has become the ultimate goal of environmental education . . . [but] has not, as yet, been achieved” (p. 1). They performed a meta-analysis of environmental research published from 1971 to approximately 1987 to again identify variables of EE programs that were most likely to lead to responsible environmental behavior. They then examined the relative strengths of these variables, and proposed a model upon which to base future EE curricula. The Hines et al. model (Figure 1, Appendix A) consists of a series of personality factors and knowledge and skills that lead to one’s intention to act, which, together with situational factors, lead to responsible environmental behavior.

Hungerford and Volk (1990) later re-examined the Hines et al. model in the context of research that had occurred concurrently with the model’s development. From these, they developed a linear behavior flow chart, which consists of a series of three overarching types of variables that, when followed in a linear fashion in EE, may result in behavior change (Figure 2). These are entry-level variables, the “prerequisites” (p. 11) which are those that appear to be good predictors of behavior. Ownership variables are the next step, and consist of those characteristics that make an individual feel like s/he has a stake in an issue. The third step, empowerment variables, are those that make people feel that they can make a difference.

Knapp (1996) developed yet another behavior change model intended for the environmental interpretation field, based on the work by Hungerford and Volk (1990). The Environmental Interpretation Behavior Change Model (Figure 3) consists of three overarching variables (though termed “goals” in this model) that although termed similarly (entry-level, ownership, and empowerment goals), do not have as well-developed sub-themes as those in the Behavior Flow Chart. Knapp went on to test this model in three different school-based settings, looking specifically at knowledge, attitude, and behavior change in each setting. In two of the three settings, he found that knowledge increased, but attitude and behavior did not change. In the third setting, he compared knowledge, attitude, and behavior change in an ecology-based program versus an issue-based program, both using the model. The ecology-based program effected greater change in knowledge, attitude, and behavior than did the issues-based program. It appears that the outcome of behavior change depends as much on the setting in which it is used as on predictor variables employed.

Other EE researchers have specifically drawn from psychology research to inform their methods. Day and Smith (1996), for example, needed an iterative process that addressed the needs and behaviors of individual target audiences in their work encouraging environmental behavior change in international settings. Based in part on the Theory of Reasoned Action (TRA; Fishbein & Ajzen, 1975), a precursor to Ajzen’s Theory of Planned Behavior (TPB), they developed the Applied Behavioral Change framework. This is a flexible framework that is intended to address behavioral determinants within each target audience, is easy to use, and once implemented, creates a positive feedback loop as components of an educational effort are continually assessed and monitored. Using their own examples of its application in EE, they found this model to be comprehensive, practical, flexible, and useful for EE practitioners.

Ham and Krumpal (1996) drew from Fishbein and Ajzen’s TRA (1975; Figure 4) as well as Ajzen’s (1991) TPB (Figure 5), both of which are based in the idea that intentions lead to behavior. Components influencing intention and behavior are attitude toward the behavior, subjective norms, and perceived behavioral control (Figures 4, 5). These in turn are driven by individuals’ beliefs underlying each of these components.

What educators have to get at, Ham and Krumpe argue, are those beliefs that are most salient to the behavior in question.

Based on these theoretical models, Ham and Krumpe outlined a five-point plan to assist nonformal educators trying to teach their audiences to change their behavior where needed. Using natural areas in which public visitation and use is allowed as an example (such as a state park or national forest), they suggest that managers and educators conduct research in the following manner: 1) identify the main threats to the area; 2) identify the behaviors that lead to these threats; 3) determine the target audiences responsible for the identified behaviors; 4) identify the audience's beliefs salient to the problem behaviors, and 5) analyze key audience characteristics to help determine the best method to reach them. Much of this research can be determined through qualitative research such as focus groups, whereas steps four and five require more intensive sampling through survey research (Ham & Krumpe, 1996). These guidelines, based fully in psychology behavior change research, are designed to help EE practitioners change behavior of their audiences as needed.

Gotch and Hall (2004), too, used the TRA to examine an environmental education program. They point out that the TRA has been used in much behavior change literature, but mainly in areas such as dieting and exercise, safe sex behavior, drug use, consumer purchases, and voting behaviors. Very little research has utilized the TRA to examine environmental behavior change, and of those that do, the focus is on prediction or explanation of recycling and waste disposal, water or energy conservation, anti-pollution petition signing, and agricultural conservation measures. Here, the authors examined adolescent (ages nine to fourteen) participants of a residential EE program to determine the weight of the influence of attitude versus subjective norms on behavior (Figure 4). They found that attitude was a significant factor in explaining most of the participants' nature-related behaviors and intentions. Based on their results, the TRA can be used to inform EE; however, Gotch and Hall felt that adding a single behavioral construct, perceived behavioral control, to the model would explain a larger proportion of the variability. Perceived behavioral control, the individual's perception of the level of ease/difficulty with which an action can be performed, is what Ajzen added to the TRA,

renaming it the Theory of Planned Behavior (Figure 5; Ajzen, 1991). Perceived behavioral control is also included in Hines et al.'s model as "locus of control," (Figure 1; Hines et al., 1987), as Gotch and Hall point out. Additionally, the TPB may be a more useful theory for informing EE instruction when desiring behavior change, because environmental actions themselves are subject to outside influences that participants do not always feel they can control (Gotch and Hall, 2004).

Continued linkage and collaboration with the field of psychology should be encouraged, something that until recently has happened very little (Gotch and Hall, 2004). Because of this missing link in EE, the research presented here utilizes a methodology based on Ajzen's (1991) Theory of Planned Behavior, and includes the additional components of the Hines et al. (1987) Model of Responsible Environmental Behavior that are unique to environmental behavior change. By combining these theories for use in testing an adult free-choice EE program, I am drawing on a tradition of behavior change research in psychology and including some of the unique elements of environmental issues.

Behavior change has long been a goal of environmental education, but gained additional emphasis as shown by its inclusion as one of three major goals of worldwide EE in the Tbilisi Declaration (ICEE, 1978). Many EE researchers have attempted to research environmental behavior change simply by examining and implementing attitude change interventions (Armstrong & Impara, 1991; Dresner & Gill, 1994; Gigliotti, 1992; Gillett et al., 1991; Keen, 1991; Leeming et al., 1993); however, it has been shown through research that this link is not always realized (Ajzen 1991; Fazio & Roskos-Ewoldsen, 1994). Other EE researchers looked to studies within the field of EE that effectively led to behavior change, and generated lists of characteristics of behavior change itself as well as of effective programs (Ballantyne & Packer, 2005; Fedler et al., 2001; Oskamp et al., 1998; Yerkes & Biederman, 2003). Others still developed their own behavior change models based on EE research (Hines et al., 1987; Hungerford, 1996; Hungerford & Volk, 1990; Knapp, 1996; Sia et al., 1986). In addition, the field of psychology has much to contribute to EE (Koger & Scott, 2007; Monroe, 1993). Collaborations between the two fields can accomplish much and already some EE

research has been implemented based on behavior change theories from the field of psychology (Day & Smith, 1996; Gotch & Hall, 2004). In the research presented here, the outcomes of an adult EE program that has the specific goal of reducing human impact on the environment through behavior change are examined through the lens of the Hines et al. (1987) Model of Responsible Environmental Behavior as well as Ajzen's (1991) Theory of Planned Behavior.

## CHAPTER III

### Methods

Environmental issues are at the forefront of public scientific inquiry. There is a pressing need to change the way we do things in order to reduce the human impact on the environment (Brower, 1999; Bierbaum, 2007). Environmental education is one key for implementing change (Disinger, 1982). Ijams Nature Center's "Living Clean & Green!" program was developed with this goal in mind (P. Beute, personal communication, September 11, 2007), and in this study, changes in behavior following attendance at program workshops were assessed. Following Hines et al.'s (1987) Model of Responsible Environmental Behavior (REB) and Ajzen's (1991) Theory of Planned Behavior (TPB), several instruments (Appendix B) were used to examine knowledge gain as well as factors of attitudes, subjective norms, and perceived behavioral control to predict intentions to act. Post telephone interviews were used to assess actual behavior change. Data were analyzed in order to characterize the program, assess participants' intentions to act, and to determine behavior change that occurred as a direct result of workshop attendance.

### *Setting*

This study was conducted through a program offered by Ijams Nature Center, 2915 Island Home Avenue, in Knoxville, Tennessee. The nature center has been in operation for over twenty-five years as a woodland park and the city's center for environmental education. The property that encompasses the nature center was originally owned by the Ijams family. Harry (H.P.) and Alice Yoe Ijams built their home on the property in 1910, and worked for the next 50 years to develop their twenty acres into a wildlife sanctuary, while raising a family of four children. The Ijams family contributed to the community by hosting a Girl Scout day camp and by inviting members of the public to visit their land to walk the trails. After the deaths of H.P. in 1954 and Alice Ijams in 1964, the wildlife sanctuary property (including the family home) was purchased

by the combined efforts of the Knoxville Garden Club, Knox County Council of Garden Clubs, and the City of Knoxville. Ijams Nature Center was incorporated as a non-profit organization in 1976, and two years later educational programs for the public were begun. Since then, the acreage of the property has increased with purchases of adjacent properties, a new visitors' center has been built, and educational programs have continued to expand. The programs currently offered at Ijams Nature Center are available for all ages. They range from programs designed for visiting elementary school classes, to programs for families designed to introduce parents and children to the outdoors, to overnight trips to outlying areas (Spaid, n.d.).

#### *Description of the Program*

Ijams Nature Center offers a program that is geared toward adults with the specific intention of educating the public on reducing the human impact to the environment. This program, "Living Clean & Green!" is offered in a series of stand-alone workshops available both on and offsite with the stated educational goals being to "inform the public and improve the local environment" (Spaid, n.d.). "Living Clean & Green!" consists of sixteen workshops, each with a focus on a different component of environmental protection. Many of the workshops are intended to instruct participants on issues related to caring for their yard and the local wildlife while others are natural history-related. In addition, two environmentally-related documentary films are offered for screenings. To date, the program has served over 15,000 visitors in 500 plus programs (P. Beute, personal communication, September 11, 2007). Information about current program offerings is available online or in a brochure available at the Ijams Nature Center visitor center, and includes titles such as "The Air We Breathe," "Can You Hear the Frogs?" and "Organic Gardening - The Basics" (Spaid, n.d.). The program is free to the public, and is offered to organizations, clubs, and gatherings of any type, as well as to middle and high school classes. Informational materials and occasionally supplies (such as seeds and books) are given away as part of the workshops, which can last from twenty minutes to three hours or more (P. Beute, personal communication, September 11, 2007). The program goals are oriented toward behavior change to reduce

individual environmental impact; however, it has not been known if this is the outcome, as studies have not been undertaken to examine the program's impact on participants over time (P. Beute, personal communication, March 8, 2007).

## *Procedures*

### *Description of Sample*

The subjects of this study consisted of consenting adults (over age 18) who attended "Living Clean & Green!" workshops between September 12 and December 12, 2007. Workshops that were presented to middle and high school classes were not included in the study. Public workshops that occurred during the time period from which data were collected included one air quality/energy use themed workshop, "Kilowatt Ours," and five land/wildlife conservation themed topics, three of which were offered twice: "Butterflies are Free" (two offerings), "Organic Gardening," "Gathering Seeds" (two offerings), "Wildscaping," and "Bird Friendly Yard" (two offerings). Of these nine workshops, four were onsite public workshops, one was an onsite workshop requested by a garden club, two were offsite workshops requested by garden clubs, and the remaining two were offsite workshops requested by church programs. Workshops lasted anywhere from 22 to 95 minutes, averaging 53 minutes, and the number of participants ranged from two to 40, with the average being fifteen adults per workshop and total  $n = 97$  (Table 1, Appendix C).

Program attendees were asked to read and sign a letter of consent containing details of the research study and information regarding maintenance of confidentiality prior to participation. Participation in all components of the study was voluntary. Attendees were majority female (65%) and white (77%) with 15% males and 1% American Indian or Alaskan Native, the remainder being unreported. Participant age was concentrated in the 55-64 (28%) and 65-74 (22%) ranges, with several over age 75 (14%) and between ages 45 and 54 (10%). Few participants were younger than age 45 (6%), and 20% did not report their age. Most participants had had some college (19%), were college graduates (23%), or had some sort of post-graduate

education (24%). Participant income level was variable, with some participants (14%) earning below \$33,000 per year. Twenty-three percent earned \$33,000 to \$60,000 per year, an additional 11% had earnings of \$60,000 to \$80,000 earnings per year, and 19% earned greater than \$80,000 per year. Thirty-three percent of participants did not report this information.

Repeat attendees were present at some workshops, specifically at the onsite public programs. For each workshop, attendees were offered the opportunity participate in the study, but most declined on repeat occasions. Of those that did choose to participate a second time, data were used from their first participation only. Thus, repeat attendees were treated as one-time attendees at the first workshop they attended during the data collection period.

### *Data Collection*

The researcher began studying the program by attending “Living Clean & Green!” workshops to gain an understanding of the characteristics of the program. Instructors were interviewed and audio recorded in order to learn background about the program, instructor knowledge regarding the goals of the program, and insights into the instructors’ views of the success of the workshops.

Data collection began on September 12, 2007, with the researcher attending programs offered to adult audiences through mid-December 2007. At the beginning of each workshop, participants were informed of the study and asked to complete a pre-knowledge survey. During the workshop, the researcher observed and took notes regarding environmental behaviors that were discussed by the instructor, questions and comments from participants, length of time spent on lecture or discussion, outdoors activity, and additional details. At the conclusion of the workshop, participants completed a post knowledge survey as well as a behavior questionnaire to assess their intentions to engage in the behaviors discussed in the workshop.

At the conclusion of the workshop data collection period, workshops were selected for post telephone interviews through a stratified random sampling technique. Prior to the data collection period, workshops in the program had been divided into three

categories by the researcher; those that pertained to air quality or energy use, those related to land and wildlife conservation, and those related to water conservation. Of the nine workshops at which data were collected, all but one fell into the land/wildlife conservation category. The one remaining workshop was in the air quality/energy use category. This workshop, “Kilowatt Ours,” was selected for post telephone interviews. Of the land/wildlife workshops, two of the eight were randomly selected for post telephone interviews. The post telephone interviews were conducted approximately three months following participation in the workshops.

Finally, the workshop instructors were interviewed a second time, during which they examined the transcripts of their previous interviews, in a method known as respondent validation, to allow them to make any changes or additions they wished.

### *Instrumentation*

The instructor interviews, pre-/post knowledge surveys, behavior questionnaire, and post telephone interview instruments were developed for use in this study by the researcher (Table 2). Instructor interviews, consisting of an open structure using guided questions, were developed in order to determine each instructor’s perception of the development and day-to-day implementation of the program, their understanding of the goals of the program and how their implementation contributes to those goals, their perception of program attendee demographics, and what contributes to the success of the program. Instructor interviews lasted up to one hour each and were audio recorded and transcribed.

The pre-/post knowledge survey was developed based on the Hines et al. (1987) REB model. This model indicates that knowledge of environmental issues as well as knowledge of skills and strategies to address those issues are important contributors to responsible environmental behavior. Questions on the pre-/post knowledge survey consisted of one (pre-) or three (post) open-ended questions as well as four Likert-scaled statements (Likert, 1932) regarding what attendees anticipated learning (pre-) and what they had actually learned (post) regarding environmental issues, skills, and strategies. Approximately five minutes were allowed for participants to complete the pre-/post

knowledge surveys. Pre-/post knowledge surveys were identical for all workshops, with general wording used to allow for the variety of program workshop topics.

The behavior questionnaire consisted of a multiple-choice demographics section followed by a section containing items on a Likert-type scale (Likert, 1932) to assess behavioral intention. The twelve demographics items included questions related to personal identity, education, and socioeconomic status, as well as motivations for attending the workshop. This information was used to further characterize the program. The Likert-scaled items, used to predict participants' intentions to change their behavior, were developed using Francis et al.'s (2004) handbook for applying the TPB, which states that behavior can be predicted from three variables; attitudes, subjective norms, and perceived behavioral control. Attitudes toward the behavior are the overall view a person has of a particular behavior and are influenced by beliefs about consequences and the corresponding (positive or negative) judgments of such consequences. This construct was assessed using four items on the behavior questionnaire, consisting of bipolar adjectives to evaluate a single statement defining the behavior. Subjective norms about the behavior, assessed using four items on the behavior questionnaire, are the believed social pressures associated with the behavior and judgments of beliefs about each associated social pressure. Perceived behavioral control, also measured with four items, consists of a person's understanding of his/her own ability to complete the behavior, both as far as confidence in his/her own ability and also how well s/he is able to control all the factors that go into a particular behavior. Three additional questions were used to assess learning that occurred during the workshop, and three more were used to directly measure intention to engage in the behaviors presented in the workshop. The total of fifteen statements were arranged at random within the behavior questionnaire. Participants took approximately fifteen minutes to complete the behavior questionnaire.

Finally, the post telephone interviews occurred three months after the workshops. Using the stratified random sampling technique described above, three workshops were selected for post telephone interviews: "Kilowatt Ours," "Organic Gardening," and "Gathering Seeds." Participants that provided contact information for post telephone interviews and consented to be interviewed totaled 24. In addition to an open structure

using guided questions to determine behavior change, the fifteen Likert-scaled statements that were on the behavior questionnaire were included. Each post telephone interview lasted about fifteen minutes.

### *Reliability*

Prior to obtaining overall scores for knowledge on the pre-/post knowledge surveys, Cronbach's alpha (Cronbach, 1951) was calculated to determine reliability of the test as a whole. The same statistic was calculated to determine reliability of combined scores for attitude, subjective norms, perceived behavioral control, and behavioral intentions from data on the behavior questionnaire and post telephone interviews.

### *Data Analysis*

The statistical programs SPSS 16.0 for Windows and SPSS Text Analysis for Surveys, version 2.1, were used to examine the data in relation to each research question:

*Research Question 1: What are the characteristics of a "Living Clean & Green!" workshop and how do they contribute to the overall goals of the program?* This question was addressed through the instructor interviews and observations made during the workshops, using SPSS Text Analysis for Surveys to score and analyze the transcribed qualitative data. The instructor interviews were examined to assess program goals, history and development, instructor perceptions of the program, and program characteristics and effectiveness. Observations of each individual workshop that were scored and analyzed included types of activities during each workshop and artifacts offered to participants.

*Research Question 2: What are participants' intentions to implement environmental behaviors immediately following participation in a workshop?* To examine this question, data from the pre-/post knowledge surveys, workshop observations, and behavior questionnaires were used. Participant knowledge was assessed through pre-/post knowledge surveys, containing both quantitative and qualitative data. These data were used to assist with finding participant intention based on the Hines et al. (1987) REB model, in which knowledge of environmental issues,

skills, and strategies is an integral component of behavior change, in addition to the constructs described in the TPB (Ajzen, 1991). The quantitative portion of the pre-/post knowledge surveys was compared with paired *t*-tests, following a reliability assessment through calculation of Cronbach's alpha for combined knowledge scores. Both the overall knowledge change and change on each individual question was examined with paired *t*-tests. Text analysis was used to score and analyze qualitative answers on both pre-/post knowledge surveys.

Observations during the workshop used to examine this research question consisted of notes taken during each workshop regarding environmental behaviors presented by the instructor as well as questions and comments from participants. These data were also scored and analyzed, using the same themes as had been developed for analysis of the knowledge data collected in the pre-/post knowledge surveys.

Finally, to examine participants' intentions to change their environmental behaviors, information gained from the behavior questionnaire based on Ajzen's (1991) TPB and Hines et al.'s (1987) REB model was used. Each construct present in Ajzen's model—attitude toward the behavior, social pressure to implement the behavior, and perceived control over the behavior—as well as knowledge-related questions from the REB model, were examined through three to four components on the behavior questionnaire. Factor analysis was performed to determine actual component groupings based on participants' interpretations of each question. Reliability scores (Cronbach's alpha) were calculated on each factor. Using these analyses as a basis, overall scores for each construct were calculated from the multiple components used to assess each construct. Finally, linear regression analysis assisted in determining whether the constructs predicted participants' intentions to engage in environmental behaviors described in the workshops.

*Research Question 3: How are participants' environmental behaviors changed as a result of the program over a three-month period following participation in a workshop?* The final research question was addressed through the post telephone interviews. Constructs from each model were again assessed through repeating the Likert-scaled (Likert, 1932) statements from the behavior questionnaire and open-ended

questions were used to learn about actual behavior change that took place at any time between workshop attendance and the post telephone interview. With the quantitative data, a linear regression was repeated to examine any causation relationship between the TPB constructs and actual behavior change. Recall of behaviors discussed in the workshops and actual behaviors that occurred were scored and analyzed, again using the same themes as had been previously identified.

## CHAPTER IV

### Results

*Research Question 1: What are the characteristics of a “Living Clean & Green!” workshop and how do they contribute to the overall goals of the program?*

The Ijams Nature Center “Living Clean & Green!” (LCG) program series has been in existence for six years, and in that time has been implemented by several different staff members. Of the two original nature center employees that developed it, one of these (“Instructor A”) continues to work with the program and presents approximately half of the workshops. “Instructor B” became employed by the nature center two years after the program series had been developed, and is currently responsible for booking the workshops and presenting half of them. Both instructors are female and are part of the community programming staff at Ijams Nature Center.

#### *Program History and Development*

Ijams Nature Center’s “Living Clean & Green!” is a flexible program series that was developed beginning in 2001 and continues to change with time and sponsorship. Series development began with funding from a local utility company, Knoxville Utilities Board (KUB), which allowed two staff members at Ijams Nature Center to work for one year developing the program series full-time, a luxury not common to the nature center.

[Instructor A]: Two staff members full-time could focus on developing those programs, which is not something we’d been able to do in the past. . . .So their funding allowed us to create . . . twelve [workshops] because we just had a lot of opportunity to focus on it because of their funding.

Following development of these initial twelve workshops, the program was promoted and implemented beginning in October 2001. At that time, the goals of the program were to teach adult audiences about wastewater-related issues in the community

and what adults can do as individuals to help the entire community. Several of the original workshops were water-related to meet KUB's goals, and some of these exist in the program series today, including "What Makes a Healthy Creek?" "Wetlands: Why They Are Important," and "Know Your Watershed." Additional workshops were developed from offerings previously available through the nature center, and the funding allowed the staff to incorporate these workshops into the original LCG series.

[Instructor A]: We were working with a partner here locally, the Knoxville Utilities Board, to try and develop some program themes that would benefit both of our mission statements. Something that Ijams could present here in the way of environmental education programs that would help get out some of the messages that the utility board was wanting to get out to the general public about, particularly about wastewater issues, about how people could impact their sewer systems and their wastewater use. That they had some information they wanted to get out about grease control and about different wastewater problems in the community. We wanted to focus on working with adult groups about ways they impact the environment, so we partnered together to get their message out and to incorporate it into some programs that we wanted to focus on.

Program offerings have since been updated as needed, through combination with other workshops, updating of information, or deletion from the series. Early funding from KUB and current funding from Knox County Air Quality and the Alcoa Foundation continue to allow two staff members to devote a large portion of their time to this program series. With changes that have occurred since the inception of the program series, the current series contains workshops that address three main themes, though they are not described as such in program advertising: Air quality and energy use, land and wildlife conservation, and water conservation. Topics that fall within these categories are:

Air quality/energy use theme:

The Air We Breathe

Creating a Green Household

Kilowatt Ours

Land/wildlife conservation theme:

The Bird Friendly Yard

Butterflies Are Free

Gathering Seeds

Let's Take a Walk: Greenways Connecting our Community

Organic Gardening: The Basics

Recycling: Trash to Treasure Workshop

Trees: Creating the Air We Breathe

Urban Wildlife: Precious Things or Pests?

Wildscaping

Water conservation theme:

Can You Hear the Frogs?

Know Your Watershed

Wetlands: Why They Are Important

What Makes a Healthy Creek?

### *Workshop Characterization*

A typical "Living Clean & Green!" workshop begins with an introduction to Ijams Nature Center and the program series. This is followed by a lecture (often accompanied by a PowerPoint slideshow) on the topic and a question and answer session. In some of the workshops, a walk around the area or a hands-on activity occurs at the end, allowing for more discussion and interaction with and among participants.

[Instructor A]: So we introduce Ijams, we talk about "Living Clean & Green!" generally, and then we introduce the topic. . . .

[Instructor B]: We always, at the beginning we talk a little bit about Ijams, and the nature center. We talk about the "Living Clean & Green!" program as a

whole, and what it is and why we do it, and then we just do the program, which [is] usually 30-45 minutes.

This general format varies with workshop topic. For example, two of the workshops consist of an educational video screening, which takes the place of the lecture portion of the workshop. Of those topics that focus on a group of living organisms, the natural history of the organism is provided along with the needs of such organisms and how that can be included in a backyard habitat. Those that focus on gardening include discussion of use of native plants, methods for saving water, planting to attract or repel various insects, and other environmental topics. This common framework does vary with audience type. For example, one workshop that I observed had only two participants, and thus became more discussion-oriented, with the instructor alternating between lecture (and the PowerPoint slideshow) and discussion with frequent comments from the participants.

[Instructor A]: We . . . do the workshop and sometimes that's a question and answer or sometimes it's a discussion; sometimes it's the PowerPoint and then a hike or walk around the property if it's the "Wildscaping" program which focuses on native plants—usually that's such a short PowerPoint program, then we go outside of the building here where we have quite a few native landscaped areas and we talk about each plant and what the benefits of it are and its role in the ecosystem. . . . And then usually the ending is just a question and answer time or sharing of information. Sometimes it's the, some of the workshops in particular—the propagation workshop, which is called "Gathering Seeds," the end part of the workshop is people employing those propagation techniques we talked about and doing some cuttings, and sorting out the seeds they want, and getting information about how to plant each thing.

[Instructor B]: There's the ones we do with the PowerPoint and then there's the ones we just do with, you know, like, props. Like "Bird Friendly Yard" there's

just a lot of props. Then we just always try to leave five to ten minutes at the end for questions. . . .

Content of workshops is not typically varied, except to allow for shifts in lengths of time available for each workshop. Several of the workshops have had a PowerPoint presentation developed to go along with the content, and these vary in length from fifteen to 30 minutes or more, with increased time due to further comments that the instructor may choose to add and interjected discussion. Of the programs that do not have a presentation, the instructors include predetermined information that remains consistent for various audiences.

[Instructor A]: I won't say we have a script because each one of us does, has their own teaching style in that we, so there's not really a written script, but you sort of have bullet points that we go through.

Offsite programs, those in which instructors travel to a location other than Ijams Nature Center, are available upon request. Offsite programs are taken to church groups, garden clubs, neighborhood organizations, senior centers, and business/industry groups, among others. I directly observed and collected data at offsite garden clubs and church groups.

[Instructor A]: We go offsite to a garden club or neighborhood association or a Rotary, or any other community group that would want us to come and speak.

[Instructor B]: We do a lot of garden clubs, and we do go to a lot of senior centers, or church groups, which are often, senior groups.

Location seems to have the greatest impact on the delivery of a program, with drastically varying time allotments as well as variations in outside and hands-on activity.

[Instructor A]: The offsite programs differ from one group to another. Sometimes a group only has twenty minutes. But they want a speaker. And so we take a three-hour or a two-hour program and try to make it be twenty minutes. . . . But it can be a two- or three-hour program as well.

[Instructor A]: So, often, particularly with the programs that are done here at Ijams there's an outside part of it. That's not always possible when you go somewhere to a garden club or to a neighborhood association.

Onsite programs are offered upon request to similar groups that may be interested in bringing their group to Ijams Nature Center (data were collected from one such group, which was a garden club), and in the form of public programs offered at least once monthly. These are also highly variable in length.

[Instructor A]: There are the ones we offer here at Ijams, monthly, or sometimes two or three times a month depending on the schedule. We offer them here on Saturdays, usually, in the early afternoon, and they're typically between an hour and a half and three hours somewhere in there an hour and a half to three hours long, depending on the size of the group, depending on the topic, 'cause some topics are just longer because of their information to be given out or the interactive workshop part of it could maybe make it longer.

Another aspect in which programs vary is that of active and hands-on activities, such as walks to identify native plants for gardens, selection and gathering of seeds, and making plant cuttings. Some of the programs have built-in hands-on activity which are typically included when the program occurs onsite. When programs with activities such as these are taken offsite or need to be shortened, it is often these hands-on activities that are eliminated. In one instance, a "Gathering Seeds" workshop that I observed was taken offsite to a garden club meeting, and the instructor brought her usual selection of native seeds to allow participants to select and collect seeds for their own use. However, the

club meeting had a set time limit, so the instructor left the seed selection with the garden club for members to collect from at their leisure, without input from the instructor. Other programs, such as “Organic Gardening,” usually have a component involving a walk around the grounds at Ijams to identify native plants that could be used in gardens and to explore the various composting options on display. When offsite, a walk to explore plants may or may not occur, depending on what outdoor plantings are available. Other programs may have items that are passed around, whether on- or offsite, to provide some hands-on examples to audience members, particularly when other hands-on activities are not provided. One example of this is the “Butterflies are Free” program, in which collections of butterflies and moths are passed among participants.

In addition to activities, workshops vary by take-home items that are offered to participants. For all the workshops, instructors provide general Ijams and LCG information in the form of the LCG brochure and Ijams membership brochures. Other take-home items on specific topics include handouts such as “Air Quality and Health,” “Car Care,” “Five Steps to Reduce Air Pollution,” “Landscaping with Native Plants,” and “How to Start a Butterfly Garden.” Some of the same handouts are offered in different programs. Instructor A often provides printouts of the PowerPoint slides, when applicable. Additionally, a few workshops include items that are given away for free. For example, a drawing might be held to give away books or birdseed to a few participants. Other workshops, including “Gathering Seeds” and “Wildscaping,” free plants or seeds are offered to all participants to take home.

### *Changes in the Program over Time*

The LCG workshops are continually being revised and updated with a new brochure of offerings published annually. Workshop success is considered based on numbers of attendees and how often a workshop is requested.

[Instructor A]: The one that is the most requested, numbers of people, and, is the one about creating a “Bird Friendly Yard.” That’s far and away, I mean there’s not even anything close to that. And I think it’s because, you know, it’s a, it’s

approachable by people. You know, everybody has a birdfeeder. Everybody has a birdbath, or. You know, I mean everybody wants to attract birds. And it's a number one, you know, passive hobby out there in the world. So that's far and away the, the big attractor. . . . Whenever we offer ["Can You Hear the Frogs?"], the room just fills up. You know, we get 70 or 80 people. And we often have to offer it two days in a row, because we can't accommodate the number of people who are interested in it.

[Instructor B]: We have groups that repeatedly ask us back, so they at least enjoy the programs, and find them, I mean, I imagine they must find them helpful, otherwise they wouldn't have us back.

Although success is mainly measured in numbers, instructors are careful to update the workshops as new information is made available.

[Instructor A]: Some of the programs, particularly the programs about green energy and those things that are on, sort of the cutting edge technology things that we have to constantly be aware of what's new and what's happening. Even in the, some of the natural history directed ones, the butterfly habitat and the bird habitat you still try to have the latest thing out there that they can do, or the newest information about native plants, and, you know, some of it doesn't change, but some of it you keep tweaking to kind of make sure that it's fresh.

Those workshops that are not well attended by the public and that are requested infrequently are considered to be less successful than others. Of these, the first thing that is examined is the program's title and description. If these are changed and the program is still deemed unsuccessful, the content is then examined and changed as necessary.

[Instructor A]: If a program is not being requested, then in our role, sometimes, that's not because it isn't a good program, it may be because it doesn't have the

right description with it, and it's not, when somebody reads it, they're not, it's not hitting home with them, where it fits into their needs. So we may change the title, change the description, we may target an audience with a certain one. We have a, we do a program on our, on walking, and greenways, and connectivity in the community. And that's not a highly requested program, but we have promoted it through different organizations that promote healthy lifestyles, like the health department, and St Mary's, Baptist Hospital health programs. And that's where we've found an audience for that program.

Additional program series offerings may change as sponsors change over the years.

[Instructor B]: Because of our sponsorship from Knox County Air Quality we try to focus on air quality more in a program that maybe you wouldn't necessarily think air quality was a part of, and try to, at least make that connection.

Finally, program offerings have changed since 2001 due to instructors learning more about their audiences through presenting workshops, which one instructor connected back to workshop attendance.

[Instructor A]: Early on in the program's history, some programs were found to contain too little information for a stand-alone program—that is, the participants' base knowledge had been underestimated. Multiple programs were then combined into one program that continues to be part of the series offerings.

[Instructor A]: As we've done these programs and found out what people's base knowledge is, or what our general audience's interests are we've learned to kind of fine-tune and focus the programs on topics that people are interested in because for us, if we can't get their interest in the beginning then they don't come to the program and that sort of defeats the whole purpose!

With the development and continuing changes to workshops, instructors have clear goals for this program series, with the main goal being to help people develop green living behaviors in order to reduce their impact on the environment. Additionally, through presenting program workshops, instructors find themselves engaging participants in an ongoing conversation to assist them with finding solutions to environmental questions they might have about their lives.

[Instructor A]: To empower people to reduce their impact on the environment. And I guess in connection with that it's, it is to let people know that or give them the idea that one person makes a difference, and not be overwhelmed by the, to help them not be overwhelmed by the, just the sheer immenseness of global problems, I guess. And so our goal is that, really, is just to give people the tools, some basic tools, to reduce their impact on the environment. And hopefully encourage them to do that. Hopefully that, giving them the that tools makes them, more likely to go out, and, and change their behavior.”

[Instructor B]: To change people's ideas, and to let them know there are things they can do.

[Instructor B]: To try to present things as easy solutions, easy changes of habit. . .

[Instructor A]: To engage people in conversation about their interests and their issues so that we can get pretty quickly to where they can have some kind of action, to reduce their impact on the environment, whether it's energy conservation, or reducing the number of chemicals that they use, or just raising their awareness about how they, how they do impact the environment.

Instructors want participants to not only understand and engage in the big picture of environmentalism, they also want them to learn what is meant as far as success in engaging in these activities.

[Instructor A]: Part of the success there is seeing your plants eaten to the ground. And that's a hard, that's a hard lesson for people. They, they're, you know, we're geared to think success is a beautiful plant, whereas with butterfly gardening, part of the success that your dill is eaten to the ground, or your fennel is eaten. That means there's some happy, fat, swallowtail caterpillars out there, who are going to turn into butterflies. So, some of the successes are not traditional successes. You have to, encourage people to keep on going. . . .

Instructors recognize that participants often come to a program workshop with their own agenda, and that this impacts the workshop.

[Instructor B]: "Bird Friendly Yard," there's just so many different like—so many people are into attracting birds to their yard, and they each have their little like, "I have a problem with this species," or "I want to get this species," or "there's a woodpecker pecking on my house," like there's just so many different things that that's why they came to the workshop, to address that question, so there's always a big long answer-question.

Although attempts have been made in the past, instructors find it difficult to obtain feedback from participants regarding the success of the program. They do receive feedback in terms of program enjoyment as well as learning what participants may have tried at home. Often, participants from one or two programs will continue to work closely with an instructor until solutions are found for his/her specific issue. From this, instructors gain some constructive feedback from single individuals. Other participant feedback often occurs immediately after a workshop.

[Instructor A]: I have had some positive comments from people who wanted more in-depth information.

[Instructor B]: After a program, people come up and tell you they really enjoyed it, and it was good information, and that I did a good job, and that kind of stuff.

More in-depth feedback may occur at later workshops, often via a participant that returns to attend another workshop.

[Instructor A]: We get a lot of repeat visitors who come back to other programs within the series and talk about what they've been doing, you know, all that sort of stuff, and talk about what's worked for them, what hasn't worked, and so we do get that kind of feedback. Particularly those programs that we do here onsite. And then if we go back to an audience, offsite, we often get the same, kind of, "Oh, when you were here before, we talked about this, and I did that, and it worked or didn't work, or you know, and now that I'm doing that, or now that I'm planting native things and attracting these birds then it's also attracting snakes," I, you know, we just, all sorts of different things. Or "I can tell a difference in the temperature around my house since I've planted the shade trees" or different things like that.

The most in-depth feedback instructors receive is when they continue to work one-on-one with a participant on a particular issue. This appears to be highly satisfying for an instructor.

[Instructor A]: Well, a lot of times people come to our programs, and they've already got, they've already done something in their yard. Like they've started to—I'll focus on the "Wildscaping" one. Like they've started to—they've planted something—coneflower, black-eyed Susan, one or two native plants. And they've had some limited success with that. But what they want is, is more success with that. Or they want to improve on their success or expand their success with that. And I've had a number of people who have called back after they've done that and come back over here to the nature center and spoken, you

know, we've had like, their own little individual session, or I've gone to their house, or, you know, seen what they've done so far, made suggestions, or talked to them on the phone, and, "I've done this and this and this didn't live or that died, or this got eaten or, you know, my cat peed on that," or, you know different problems they were having. . . . You know, I've had more after-the-fact contact with people from "Wildscaping." Where, "Okay, I did these things and they're working, or, this part worked and that part didn't, what should I do now," more so than any other program. You know so I have long-term clients with that.

The "Living Clean & Green!" program series was initially developed with funding from KUB beginning in 2001. The impact of the LCG series is measured through the numbers of people and organizations that are reached over time. Program goals are accomplished through carefully planned individual workshops, which are updated and modified regularly to meet the needs of their audiences. Characteristics of the program include:

- funding by various local agencies;
- a variety of topics designed to meet goals of both the sponsors and Ijams Nature Center;
- organization into a lecture-discussion-activity format, although there are variations within this framework;
- free of charge to the public and to organizations upon request, either onsite or offsite;
- variable length, lasting anywhere from twenty minutes to three hours;
- handouts, and occasionally free supplies given to participants; and
- hands-on and/or outdoor activities in some workshops.

Instructors:

- measure the program's success by numbers of participants attending and workshops presented;
- want to help participants do things at home to reduce their environmental impact;

- help people understand “success” in the context of environmentally-friendly behavior; and
- are rewarded when they receive repeat workshop requests or are able to continue to work with a group or individual at reaching solutions for their individual situations.

The “Living Clean & Green!” program series is designed to be flexible to meet the needs of individual audiences and attempts to instill ideas about good environmental stewardship in the form of actions that can happen at an individual level.

*Research Question 2: What are participants’ intentions to implement environmental behaviors immediately following a workshop?*

The second research question was that of assessing participants’ intentions to change their behavior following attendance at a single workshop. This was measured by the pre-/post knowledge surveys, containing both qualitative and quantitative questions, researcher observations of participant questions and comments during the workshops, as well as through the behavior questionnaire based on the Theory of Planned Behavior (TPB; Ajzen, 1991; Francis et al., 2004) and the model of Responsible Environmental Behavior (REB; Hines, et al., 1987).

Prior to analysis of quantitative data on the pre-/post knowledge surveys, the questions were tested for reliability using Cronbach’s alpha. The set of quantitative knowledge questions were found to be reliable in both the pre-/post knowledge surveys, with scores for both sets of questions above 0.700 (Table 3). With both reliability scores deemed acceptable, a paired *t*-test was performed on combined pre-/post knowledge survey scores. Participants’ knowledge significantly increased across all workshop topics observed ( $P < 0.01$ ; Table 4), with a pre-workshop score of 3.88 compared to a post-workshop score of 4.23 (out of 5). When pre-/post knowledge survey scores were examined by question, there was a significant difference ( $P < 0.05$ ) in knowledge change for each of the four questions. For each of the first three questions, “I am familiar with environmental issues in general,” “I am familiar with the environmental issues that are the topic of today’s workshop,” and “I am familiar with general strategies that can be

used to address the environmental issues that are the topic of today's workshop," the mean score increased significantly. On the last question, "I am familiar with specific things I can do in order to address the environmental issues that are the topic of today's workshop," the score decreased significantly (Table 5). This could be due to a variety of factors. Participants may have been confused by the use of the term "environmental issues" in the pre-/post knowledge survey questions, as was evidenced by some questions and comments during survey administration. Participants may have felt that they did learn information about and general strategies for dealing with environmental issues (the additional pre-/post knowledge survey questions), but did not feel that they learned specific skills to address such issues. A likely reason that participants scored lower on this question is that they realized after the fact that there are many more specific skills involved in engaging in these behaviors than they had been aware.

During the workshops, environmental behaviors that were discussed were recorded and analyzed. While these varied with the individual topic presented, there were several common themes that emerged from the data collected. Of the nine workshops observed, one of them was an air quality/energy use workshop while the remaining eight were land/wildlife conservation workshops. The energy workshop consisted of a screening of the documentary "Kilowatt Ours," in which reducing emissions through energy efficiency and alternatives was the main focus. Specific behaviors discussed in the video include increasing energy efficiency through the replacement of incandescent light bulbs with compact fluorescent light bulbs (CFLs) and upgrading home appliances to those that are energy star compliant. Other behaviors recommended included buying alternative energy through local utility companies to take advantage of large-scale wind farms and solar arrays as well as investing in home energy generation through solar panels, solar water heaters, and geothermal home heating and cooling. A final behavior not discussed in the video, but mentioned by the instructor afterward, was to turn off electrical items and to unplug appliances when not in use.

The other eight workshops that were observed were all land/wildlife conservation themed, specific topics being "Bird Friendly Yard," "Butterflies are Free," "Gathering Seeds," "Organic Gardening," and "Wildscaping." Among the animal-focused

workshops, topics covered included food and water, as well as shelter in terms of both plants and other items, such as birdhouses, or rocks for butterflies, for the target group of animals. In the bird program, specific birdhouses for different species were discussed, as well as how to build birdhouses and how to prevent predators from entering birdhouses. Gardening was discussed as it related to providing food and shelter for these animals. In the garden-specific workshops, plants were discussed in great detail, from methods to use for propagating plants, when and how to plant, to plant identification through photos, examples, or outdoor plant identification walks. Composting and use of fertilizers and pesticides were discussed in detail in these workshops as well. Specific animals were mentioned as either desirable or undesirable species to have present, along with methods for attracting or repelling them. Water was discussed in all workshops, mainly as a resource for the various animals to attract to one's yard but also in regards to how to conserve water in gardening.

Participants' questions and comments during the workshops were recorded. In the single energy workshop, there was one comment from a participant who used a geothermal furnace. In reply to another participant's question regarding cost savings, he shared that he had had the geothermal furnace for about nine years, and was told to expect cost savings to return in about five years. However, he had not specifically done the math to determine actual cost savings return. Questions asked of the instructor tended to focus on specifics regarding solar panels and whether they were locally available.

In the land/wildlife conservation workshops, many of the questions and comments were about very specific behaviors, often for clarification of something stated by the instructor. For example, in a "Wildscaping" workshop, questions during a walk to explore native plants were very focused on plant identification and growth requirements, such as type of light needed by one species or how to prune a particular shrub species. In a "Gathering Seeds" workshop, questions were specific to seed care, such as whether seeds need to be soaked prior to planting, and where to purchase rooting hormone to use on plant cuttings. Other questions asked of the instructor related to a specific issue a participant was facing related to the topic. One of these, during a "Bird Friendly Yard" workshop, was a question about how to stop woodpeckers from pecking on one's home.

Similar questions regarding participants' individual situations were common. In addition to questions, comments were occasionally made, from participants' personal experiences either as a direct reply to other participants or for the benefit of the group regarding some specific local interest. For example, one participant in "Butterflies are Free" recalled a relative of hers who had the opportunity to see overwintering monarch butterflies in Mexico. In "Organic Gardening," during the discussion of composting, one participant pointed out to the rest of the group that it is possible to purchase worm castings, which may increase the nutritive value of compost. During plant identification walks or hands-on activities that occurred with some of the onsite programs, discussion among participants and between the instructor and participants continued, focused very directly on the activity and related specific skills.

Participants answered qualitative questions about knowledge gain. Pre-knowledge surveys contained a single qualitative question: "List up to three environmental issues that you anticipate will be discussed in today's workshop." In answer to this question, many participants anticipated discussion of the general idea of the topic they were about to hear, such as food, water, and shelter for animals and general ideas about composting and gardening. Many participants listed an energy-related topic, even when the title and description of the topic did not include an energy-related theme.

In post knowledge surveys, three questions were used: "List up to three environmental issues that were presented in today's workshop;" "list up to three general strategies for dealing with environmental issues that were discussed in today's workshop;" and "list up to three specific things you can do to address the environmental issues that were presented in today's workshop." Unlike the pre-knowledge surveys, for all of the land/wildlife conservation-themed workshops there were far fewer responses containing energy-related comments, except in two land/wildlife conservation workshops in which instructors gave each participant a free compact fluorescent light bulb (CFL). Otherwise, plants were commonly discussed, in regards to specific gardening practices as well as use of native plants to attract wildlife. Compost and chemical use, especially as they relate to gardening and water use, were commented upon regularly. In the single air quality/energy use workshop, "Kilowatt Ours," energy-related comments were given

almost exclusively. In general, answers given on the post knowledge survey reflected behaviors discussed by the instructor during the course of the workshop.

Finally, the behavior questionnaire was used to assess participants' intentions. Questions were developed to assess the four constructs in the TPB (Ajzen, 1991; Francis et al., 2004); attitude toward the behavior, subjective norms, perceived control over the behavior, and intention to engage in the behavior. Three to four questions were used to assess each construct. Additionally, three questions were used to incorporate a fifth component, knowledge of the topic, from the REB model (Hines et al., 1987), for a total of fifteen separate Likert-scaled items.

Following data collection, factor analysis was used to determine groupings of the questions based on participants' interpretations of them. Using the default factor analysis in SPSS 16.0, principal components analysis, five groups were initially developed from the questions (Table 6). However, when reliability testing was done on each of the five groups, the weakest of these groups, containing only two items, had an unacceptably low Cronbach's alpha reliability score of 0.175 (Table 7). Factor analysis was re-run, this time forcing the data into four factors (Table 8). This changed little in the actual question groupings that had occurred with the original factor analysis, and reliability scores were improved (Table 9) to a level that was satisfactory for question groupings. The factor groupings still encompassed the four constructs from Ajzen's model, as well as the knowledge questions from the REB model, although some question items were shifted into new groups, and one was dropped entirely (Table 10). All questions from the REB model grouped with intention questions, and a few other questions were slightly shifted; however, the changes were such that it was possible to retain the TPB constructs. With the factor analysis groupings now defining each construct, a linear regression was conducted to determine the predictive value of attitude, subjective norms, and perceived behavioral control on intention to engage in the behavior. Regressing attitude, perceived behavioral control, and subjective norm onto intention resulted in an  $R^2$  of 0.444 at  $P < 0.01$  (Table 11), indicating that 44% of the variation in the model was explained by the constructs in the TPB, which were present in the model as independent variables. The

remaining 56% of variation leading to intention was not explained by this model as applied in this study.

While the regression analysis was significant, it indicates that there is more to LCG participants' intentions to engage in environmental behavior than is explained by the TPB psychological constructs. Perhaps because the population of participants is self-selected, they arrive at a workshop with positive attitudes, feeling social pressure, and with high perceived behavioral control, and so these constructs may explain less of the variation for this particular population than it might for the general population.

Overall, it is clear from the data that participants learned new information about environmental behaviors during the workshops, and intended to engage in those behaviors upon workshop conclusion.

*Research Question 3: How are participants' environmental behaviors changed as a result of the program over a three-month period following participation in a workshop?*

Post telephone interviews were used to address the third research question, assessing actual behavior change over a three-month period following participation in a workshop. Questions used in the behavior questionnaire were repeated in the post telephone interview, in addition to open-ended questions asking participants to recall the workshop title or topic, specific actions that were introduced in that workshop, and specific actions that the participant had taken in the three-month time lapse since attending the workshop. As in the behavior questionnaire data analysis, linear regression was performed using the same question groupings for TPB constructs. Examining participants' engagement in actual behavior, it appears that attitude toward the behavior, subjective norms, and perceived behavioral control were not significant predictors of engagement in behavior, with  $R^2 = 0.340$  ( $P > 0.05$ ; Table 12). However, the data trend toward a relationship ( $P = 0.093$ ), meaning that although not currently indicated, there may be a relationship if more data were collected, but as it is, the data are inconclusive regarding a relationship between the TPB predictor variables and actual behavior change. Minimum sample size for the post telephone interviews should have been predetermined based on a power calculation to reduce type II error in this instance. The data indicate

that three months after the workshop, participants' attitude, subjective norms, and perceived behavioral control alone were unable to predict actual behavior change.

In addition to the quantitative questions, participants were questioned regarding what behaviors they actually recalled and what behaviors they performed, if any. Post telephone interview qualitative data indicate that participants in the "Kilowatt Ours," and "Organic Gardening" workshops did change their behavior during the three months after attending the workshop, but those attending the "Gathering Seeds" workshop did not.

All but one participant in the "Kilowatt Ours" air quality/energy use workshop did engage in one or more behaviors that they recalled from the workshop. Seven of the eight post telephone participants (87%) engaged in new behaviors, and the eighth had not because he felt that he had already done all that he could, personally, to reduce energy use or change to alternative energy sources. Participants recalled several specific behaviors that were presented in the workshop, and the most common behavior they engaged in was changing their incandescent light bulbs to CFLs. They also recalled and performed other behaviors related to energy savings, such as becoming more aware of turning off and unplugging appliances when not in use as well as replacing old appliances with those that are Energy Star rated. One participant was involved in taking what she had learned about reducing energy use and spreading that information to others. Several respondents additionally commented that they found the documentary film to be simple yet effective in helping them learn what they can do themselves to save energy and reduce the impacts of climate change. Multiple participants remarked that they learned that "every little bit helps," and that the film was effective in making them more conscious of their energy-consuming habits.

The success in this workshop is likely due to the excellent documentary in use, "Kilowatt Ours," by filmmaker Jeff Barrie. This documentary is focused in the southeastern United States, and includes memorable visual images with each behavior discussed. In addition, environmental behaviors are repeated throughout the video such that viewers get repeat exposures to some behaviors through a single viewing. Further, in this particular workshop, at least one participant had seen the documentary prior to this screening of it, which likely had an increased influence on her behavior.

Of those participants in the “Organic Gardening” workshop, ten of thirteen (77%) participants in the post telephone interview had engaged in environmental behaviors. Several participants commented that they had already been familiar with several components of the workshop presented, and had been implementing some of them, such as composting, but had learned some new specific skills that they (in some cases) were now implementing or were able to use to improve their previous methods. One participant commented that she was planning to try out a method of composting that was described in the workshop, and that she was planning to look up more information about it on the internet. Additionally, participants recalled learning new information about reducing water use through mulching. Interestingly, those who discussed composting often recalled recycling-related behaviors, although recycling was not discussed during the actual workshop. It is probable that these participants considered recycling and composting to be interchangeable, with one participant even using the word “recycling” to indicate composting behavior that she engaged in, as well as using it to refer to household solid waste. It may be that recycling should be discussed in conjunction with composting in this workshop, in order to clarify their similarities and differences for participants who are familiar with one or both. Of those that had engaged in environmental behavior including composting and recycling, few had done any gardening, though they had plans to engage in particular behaviors when they began their spring gardening. In addition, two of the three remaining participants that had not engaged in environmental behaviors cited that the time of year had prevented them from engaging in environmental behaviors, being not conducive to gardening; however, the instructor did describe during her presentation some methods for gardening preparation that should occur in the fall (when the workshop took place) as well as methods for winter gardening. It is possible that the instructors may wish to focus more on some of these methods when presenting this workshop in the autumn.

Participants in the “Gathering Seeds” workshop that participated in the post telephone interview also cited the time of year as one reason for not participating in environmental behaviors. Again, the instructor had been clear in describing specific actions that should take place in the autumn, but it appears that this type of information

needs to be discussed more in-depth and reinforced during such workshops that occur in the fall or winter.

Over a three-month period following attendance at a single LCG workshop, changes in behavior had occurred among participants, including some behaviors that were not specifically discussed within the context of the workshop. Here, the TPB was not adequate to predict actual behavior change. During the post telephone interviews, two participants found the component of the TPB described as social pressure to be lacking, leading to a possible reduction in participants' desires to engage in environmental behaviors. This may decrease engagement among many of the participants, and thus should be considered an important component of the TPB that should be addressed by environmental educators. Other factors that may have decreased the adequacy of the TPB in predicting actual behavior change include the small sample size used, which decreased the power of the regression analysis. In addition, the population of workshop attendees is self-selected, and this could reduce the usefulness of the TPB. Overall, it appears that the LCG program is successful in encouraging engagement in environmental behaviors among its participants, although there may be methods by which instructors could increase these behaviors. This is particularly true in gardening-related workshops that occur in the fall and winter.

## CHAPTER V

### Conclusions

Instructors have several goals they strive to accomplish in the course of presenting “Living Clean & Green!” (LCG) workshops. The most basic of these is to attract participants and to continue to present workshops to additional organizations and individuals. Beyond that, they want to provide participants with simple tools to perform environmentally-friendly actions in their everyday lives. The overarching goal of the LCG program is to encourage participants to reduce their overall personal impacts on the environment. These goals are reached through several means, and are accomplished to varying degrees.

The first goal, attracting participants to workshops and increasing numbers of organizations that request LCG workshops, is being accomplished. The LCG program has drawn over 15,000 participants and instructors have conducted over 500 workshops. The program series has, throughout its history, been funded by external sources. This allows the Ijams Nature Center staff some flexibility in determining workshop topics, but also demands data in the form of numbers of participants and workshops conducted. In addition, unless new participants (as well as repeat visitors) are attracted to workshops, the workshops would not occur, thus ending the program series. These external motivations assist in the accomplishment of attracting new participants and organizations to the LCG program series.

However, while the LCG instructors do well in continuing to attract new people and organizations to the program, there are additional adult audiences that are not reached, as may be indicated by the behavioral intention data. They may consider increasing their targeted advertising to additional populations that normally do not attend public programs nor are involved in organizations that would specifically request a workshop. This effect may be somewhat ameliorated by the offering of some workshop topics to middle and high school classes, but this component of the program was outside the scope of this study. Making the effort to reach audiences outside the typical scope of

environmental education may be something toward which environmental educators in general should strive, in order to increase the impact of not only the education itself, but in order to meet the goals of the Tbilisi Declaration, including especially that of individual behavior change to reduce human impact on the environment (Intergovernmental Conference on Environmental Education [ICEE], 1978).

A second goal of the LCG program is to provide participants with specific knowledge regarding actions that they can perform at home related to the workshop topic. As shown in the pre-/post knowledge surveys, participants learned information that instructors intended to communicate during their attendance at a LCG workshop. Quantitative data indicate that there was an overall decrease in score in the question related to “specific skills,” but the qualitative data show that participants were involved in learning specific skills, in part indicated by the nature of the questions that participants asked during workshops, the majority of which were related to specific skills.

Overall, it is clear from the post telephone interviews that participants did indeed learn new behaviors, including the specific skills necessary for implementing those behaviors, from the workshops. They are involved in engaging in them and, in some cases, encouraging others to do the same. Instructors could further increase participants’ engagement in these behaviors by clarifying some issues to participants. That is, in regards to gardening-related workshops offered in the fall and winter, instructors may wish to focus on specific skills oriented to that time of year. Additionally, instructors should try to clarify similar concepts that participants may confuse, such as recycling and composting.

The final goal of the LCG program, reducing one’s overall environmental impact, does not appear to be part of participants’ prior knowledge when they arrive to attend a land/wildlife conservation workshop. Energy-themed answers were given as responses on the pre-knowledge survey, and these persisted in the land/wildlife conservation workshops in which participants received a free compact fluorescent light bulb. This may indicate that the overall goal of reducing environmental impact is not being effectively communicated to participants in the course of a single land/wildlife conservation workshop. While this may not be true of all participants, it was

corroborated by statements of some participants (either before or after a workshop, sometimes both) that they were attending a program to learn more about the specific topic being presented (such as birds or butterflies), not environmental issues.

Unfortunately, it is unclear what specific connections participants were making to the term “environmental issues” as it relates to what they anticipated would be discussed. Nonetheless, this may be something for instructors to specifically include in their workshops if they wish for participants to make the connection between land/wildlife conservation topics and environmental issues.

Behavior change is one of the major goals of the Tbilisi Declaration (ICEE, 1978) for environmental education worldwide, and it is clearly evidenced in this adult-oriented environmental education (EE) program. Because prior knowledge of some of the behaviors discussed in the workshop was in evidence, it is likely that it plays a significant role in encouraging participants to engage in new behaviors. Other audiences that have less prior knowledge may be less willing to engage in such behaviors prior to a workshop due to less positive attitudes, lower social pressure, and reduced perceived behavioral control; thus, environmental educators should be creative in finding ways to reach these populations.

Environmental education is necessary to bring about changes in human behavior that result in an overall reduction in anthropogenic environmental impact. The Theory of Planned Behavior (TPB; Ajzen, 1991) can be used to assist with structuring of programs to ensure high behavioral intention. In particular, environmental educators may wish to ensure that they focus on all components of the TPB, including not only attitude and behavioral control, but also social pressure as well as situational factors. Additionally, inclusion of knowledge of environmental issues, strategies, and skills in a program, as described in the Hines et al. (1987) model of Responsible Environmental Behavior, may be necessary to increase behaviors among audiences that do not enter a workshop with high prior knowledge or intention. Further, researchers in EE have found that additional components, such as situational factors and demographics, positive outdoor experiences, and intense emotional responses (Ballantyne & Packer, 2005; Fedler et al., 2001; Maiteny, 2002; Stepath, 2004) appear to be important specifically for environmental

behavior change. While the TPB was useful in predicting participant intentions to engage in behavior, it was less effective in predicting actual behavior change. Inclusion of some of these additional components that influence environmental behavior change may be helpful in designing programs that effect actual behavior change. Overall, using the TPB to assist with designing and analyzing educational programs may be very helpful for implementing and ensuring behavior change in EE. Addressing additional factors, including situational factors and social pressures that may be beyond the control of participants, would assist in connecting intention directly to behavior. Behavior change can and does occur as a result of EE programs, and use of EE must be implemented in many settings for audiences of all ages.

### Limitations of the Study

There were several limitations present in this study. Self-reported data, as used in this study, are known to be relatively unreliable without a verification method. Verification did not occur in this study, so reported behavior change may have differed from what actually occurred. Additionally, participants were self-selected, likely leading to a more positive attitude, higher perceived behavioral control, and higher subjective norm scorings than would be the case among the general public.

For the post telephone interviews, workshops were randomly selected and all participants attending those workshops were contacted. In the future, individual participants should be randomly selected to obtain a more representative cross-section of participants from the entire series of workshops. In addition, a minimum sample for the post telephone interviews should be determined based on a calculation of minimum acceptable power for the regression analysis.

Finally, the sample used was likely not representative of the program series as a whole. The time frame was inadequate for capturing workshops that encompass all three themes apparent in the workshop topics. This study should be expanded to a minimum of one year in the future. Further, because a sample of convenience was used, it was not possible to include a control group. While the research methodology was intended to accommodate realistic situations, such situations may not allow for conclusive results.

## Future directions

While the Theory of Planned Behavior (Ajzen, 1991) was able to predict nearly half of the variation in intention to engage in environmental behaviors, it still left a large portion of the variation unexplained. In the future, focus groups should be used to examine *a priori* what issues may specifically influence this population's intention and actual behavior (Francis et al., 2004). This would allow additional survey questions to be developed that might be more specific to this particular populations' beliefs and may better assess their attitudes, subjective norms, and perceived behavioral control. Additional behavior models should be considered in order to examine how to implement increased behavior change in this type of free-choice environmental education setting. While this study shows that behavior change is a result of these types of programs, it may be possible to increase behavior change through incorporation of additional elements, such as inclusion of positive outdoor experiences or activities that lead to intense emotional responses, that have been found to be important to effective environmental education (Ballantyne & Packer, 2005; Fedler et al., 2001; Maiteny, 2002; Stepath, 2004). Finally, it is important that this and similar programs be extended to diverse audiences in order to increase engagement in environmental behaviors to lead to an overall reduction of human impact on the environment.

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## APPENDICES

## Appendix A: Figures

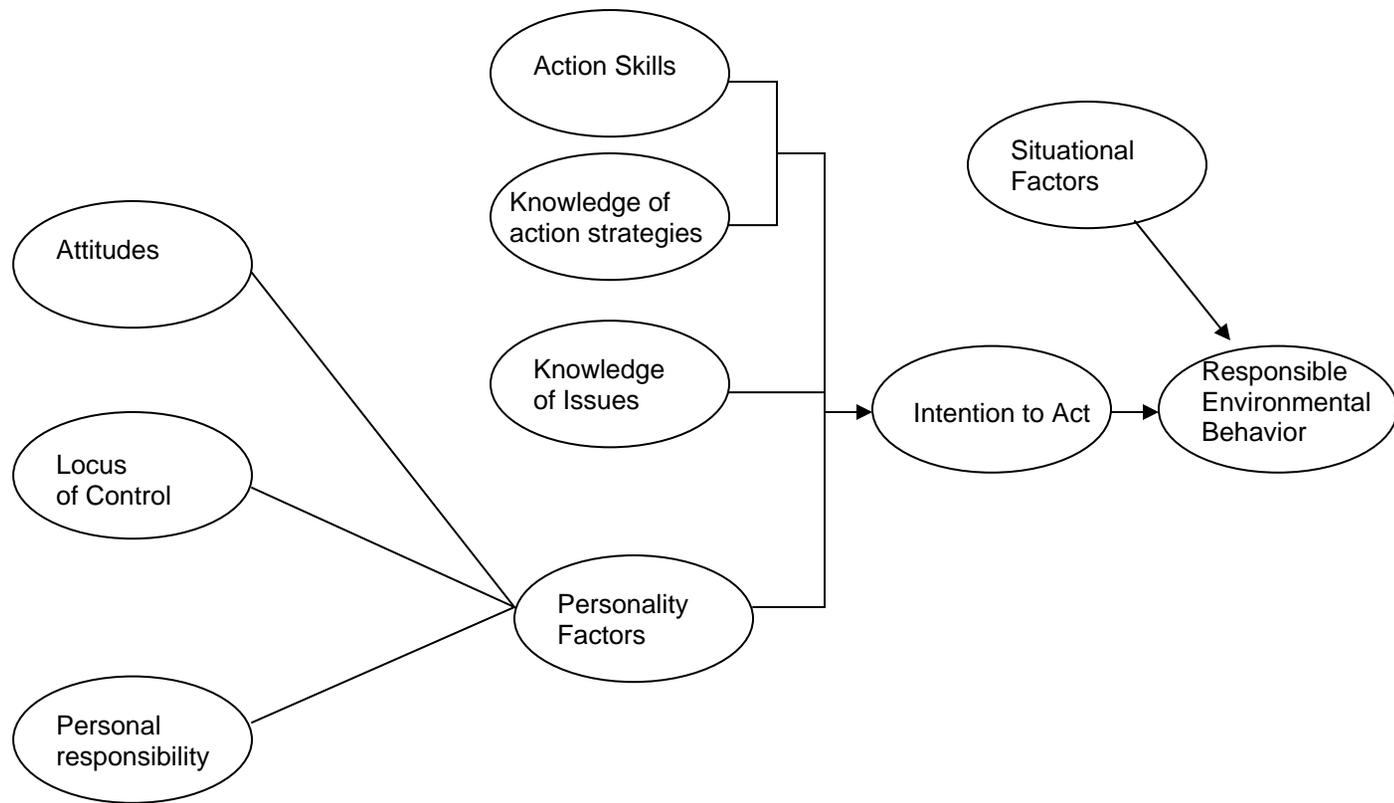
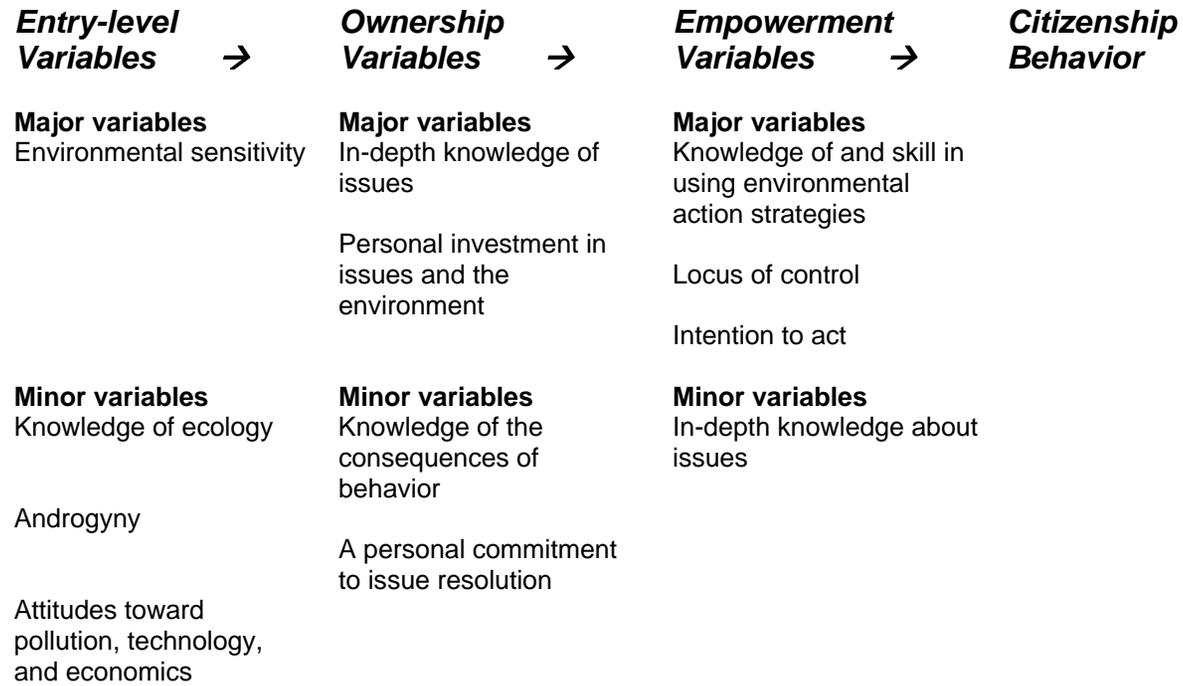


Figure 1. Proposed model of responsible environmental behavior (adapted from Hines et al., 1987).



*Figure 2.* Behavior flow chart (adapted from Hungerford & Volk, 1990).

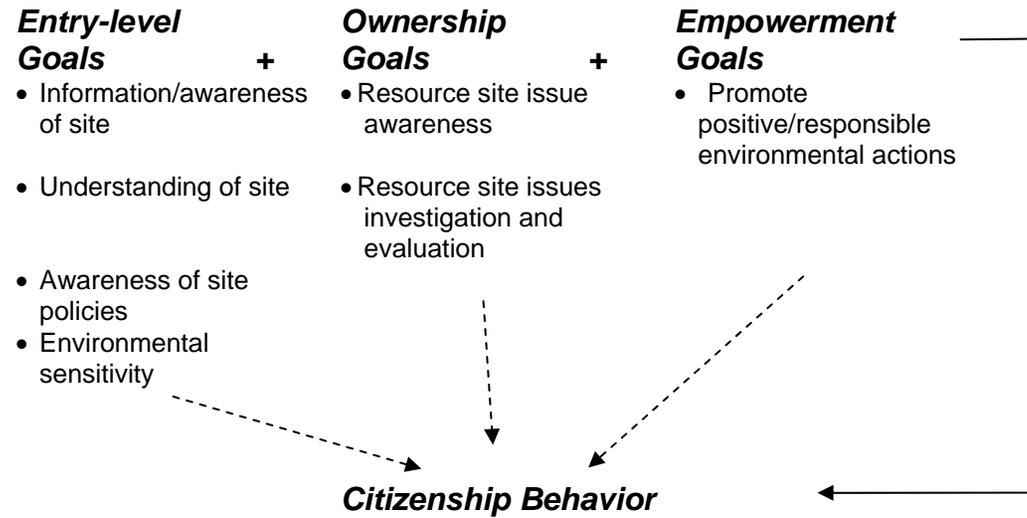


Figure 3. Environmental interpretation behavior change model (adapted from Knapp, 1996).

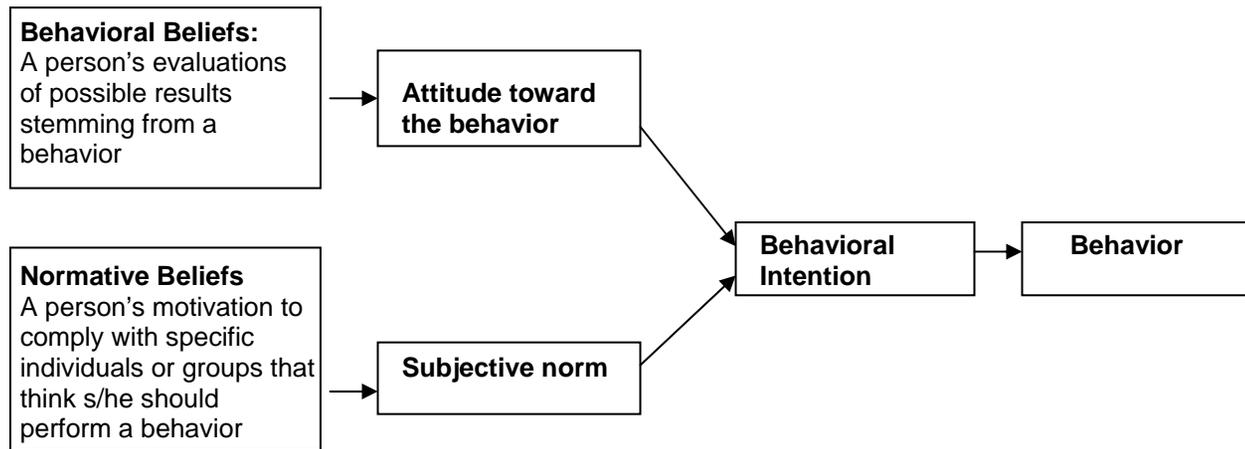


Figure 4. Theory of reasoned action (adapted from Gotch & Hall, 2004; Ham & Krumpal, 1996).

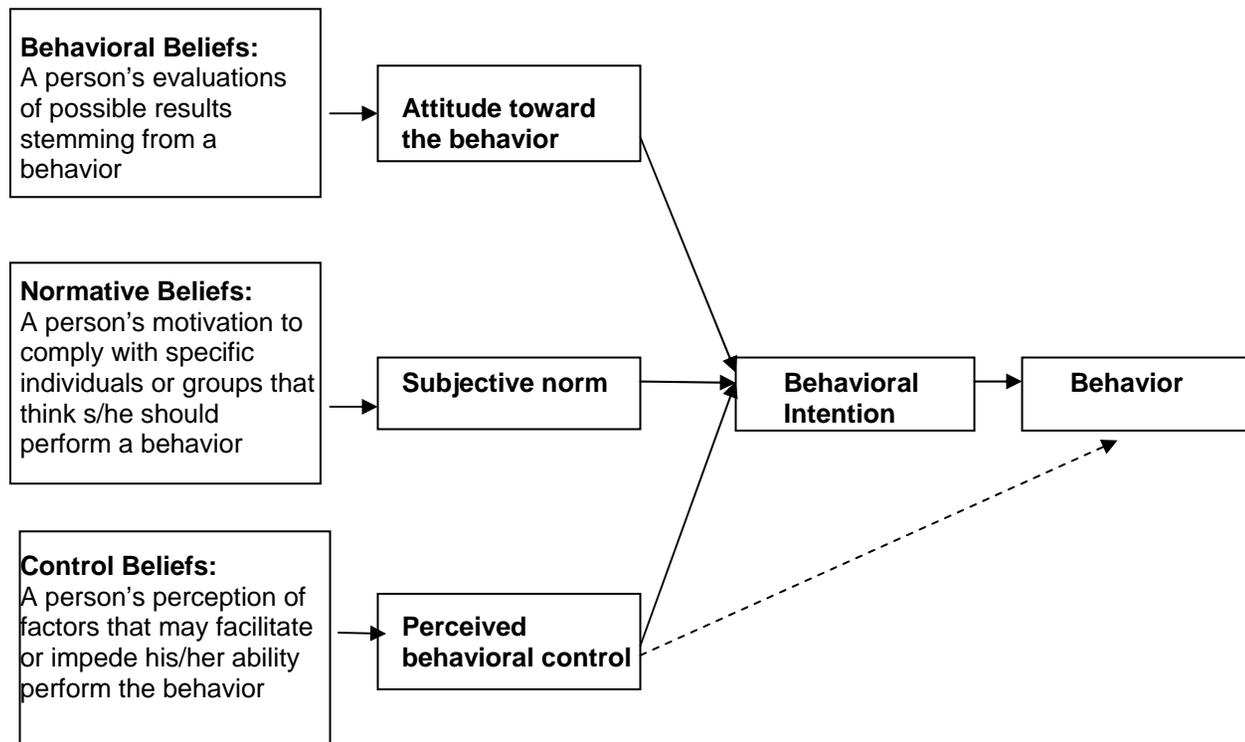


Figure 5. Theory of planned behavior (adapted from Ajzen, 2006; Ajzen, 1991; Ham & Krumpal, 1996).

## Appendix B: Instruments

### **Instructor Interview Script:**

I would like to ask you some questions about your role at Ijams Nature Center and your involvement in and perceptions of the “Living Clean & Green!” program. Please answer each question as thoroughly as you can. The entire interview will be kept confidential. If it is all right with you, I would like to audio tape the interview so that I can keep an accurate record of what you say. The audiotape will afterward be stored in A404 Bailey Education Complex at UT, Dr. Hagevik’s office. The tapes will be destroyed after I transcribe and analyze them.

Do you have any objection to the interview being audiotaped? **YES NO**

Do you have any questions or concerns before we begin? **YES NO**

All right, let’s begin. Each question that I ask you pertains to individual “Living Clean & Green!” workshops or the “Living Clean & Green!” program as a whole. I’ll refer to either a “workshop” or “the program.”

1. First, I would like for you to tell me a little bit about yourself and how you became involved in the “Living Clean & Green!” program.
2. What are the overall goals of the program?
3. How long have you been involved and how has the program changed over time?
4. Could you please describe a typical workshop to me—describe a little bit about what happens during a workshop and why.
5. I know it’s variable, but in general, who would you say makes up your audience during each workshop?
6. How does what you do during the workshop contribute to the overall goals of the program?
7. In your opinion, what has been the impact of the program as a whole?
8. What feedback have you received from participants?
9. What has been the most successful workshop you have done and why?
10. What has been the least successful workshop and why?
11. Is there anything else you would like to tell me about the program?

Okay, those are all my questions. Thank you so much for doing this interview!

**Researcher LCG Workshop Observation Checklist:**

<i>Item</i>	<i>Notes</i>
Workshop title	
Workshop date	
Workshop location	
Number of participants	
Start time	
End time	
Time spent on PowerPoint/lecture	
Time spent on discussion and questions	
Time spent on hands-on activities	
Time spent outdoors	
Outdoor activity	
Hands-on activities that occurred during the workshop	
Artifacts offered to participants during the workshop	

<i>Item</i>	<i>Notes</i>
Environmental behaviors discussed during workshop	
Discussion and questions that occurred during the workshop	

Name \_\_\_\_\_

Date \_\_\_\_\_

### Pre-Workshop Survey

**Directions:** Please fill in the blank or circle the number that best describes your response. Your participation is appreciated.

1. List up to three environmental issues that you anticipate will be discussed in today's workshop:
  - a.
  - b.
  - c.

- |   | Strongly<br>Agree |   |   |   | Strongly<br>Disagree |
|---|-------------------|---|---|---|----------------------|
| 2. I am familiar with environmental issues in general.  | 1                 | 2 | 3 | 4 | 5                    |
| 3. I am familiar with the environmental issues that are the topic of today's workshop.  | 1                 | 2 | 3 | 4 | 5                    |
| 4. I am familiar with general strategies that can be used to address the environmental issues that are the topic of today's workshop. | 1                 | 2 | 3 | 4 | 5                    |
| 5. I am familiar with specific things I can do in order to address the environmental issues that are the topic of today's workshop.   | 1                 | 2 | 3 | 4 | 5                    |

**Additional Comments (if any):**

Name \_\_\_\_\_

Date \_\_\_\_\_

### Post-Workshop Survey

**Directions:** Please fill in the blank or circle the number that best describes your response. Your participation is appreciated.

1. List up to three environmental issues that were presented in today's workshop:
  - a.
  - b.
  - c.
  
2. List up to three general strategies for dealing with environmental issues that were discussed in today's workshop:
  - a.
  - b.
  - c.
  
3. List up to three specific things you can do to address the environmental issues that were presented in today's workshop:
  - a.
  - b.
  - c.

- |   | Strongly Agree |   |   |   | Strongly Disagree |
|---|----------------|---|---|---|-------------------|
| 4. I am more familiar with environmental issues in general.   | 1              | 2 | 3 | 4 | 5                 |
| 5. I am more familiar with the environmental issues that were the topic of today's workshop.  | 1              | 2 | 3 | 4 | 5                 |
| 6. I am more familiar with general strategies that can be used to address the environmental issues that were the topic of today's workshop. | 1              | 2 | 3 | 4 | 5                 |
| 7. I am more familiar with specific things I can do in order to address the environmental issues that were the topic of today's workshop.   | 1              | 2 | 3 | 4 | 5                 |

**Additional Comments (if any):**

*Ijams Nature Center's "Living Clean & Green!"  
program participant questionnaire*

**I. Directions: Please answer the following questions by placing a check in the appropriate box. Your responses are appreciated.**

1. What is your gender?  
 Male  
 Female
  
2. Which category below best describes your race/ethnicity?  
 African-American (not of Hispanic origin)  
 American Indian or Alaskan Native  
 Asian or Pacific Islander  
 Hispanic, regardless of race  
 White (not of Hispanic origin)
  
3. What is your age?  
 18-24  
 25-34  
 35-44  
 45-54  
 55-64  
 65-74  
 75+
  
4. What is the highest level of education that you have attained?  
 Some high school  
 High school diploma/GED  
 Some college  
 College diploma  
 Post-graduate  
 Other
  
5. What is your approximate annual household income?  
 \$0-\$14,999  
 \$15,000-\$32,499  
 \$32,500-\$59,999  
 \$60,000-\$79,999  
 \$80,000+

Over →

6. Are you a member of Ijams Nature Center?  
 Yes  
 No
7. Do you volunteer at Ijams Nature Center?  
 Yes  
 No
8. To what environmental organization(s) do you belong? (check all that apply)  
 Audubon Society  
 Earth First  
 Green Peace  
 Nature Conservancy  
 Sierra Club  
 Other (please specify) \_\_\_\_\_
9. For what reason are you attending today's program? (check one)  
 For a course I am currently attending  
 For fun/something to do  
 Invited by friend or family  
 Participation (optional) for/with my business/organization  
 Participation (optional with incentive) for/with my business/organization  
     (please specify incentive): \_\_\_\_\_  
 Participation (required) for/with my business/organization  
 Wanted to learn how to reduce my personal environmental impact  
 Wanted to learn more about the topic  
 Other (please specify): \_\_\_\_\_
10. Which "Living Clean & Green!" programs have you ever attended other than this one? (check all that apply)  
 The Air We Breathe  
 The Bird Friendly Yard  
 Butterflies Are Free  
 Can You Hear the Frogs?  
 Creating a Green Household  
 Gathering Seeds  
 Kilowatt Ours  
 Know Your Watershed  
 Let's Take a Walk: Greenways Connecting our Community  
 Organic Gardening: The Basics  
 Recycling: Trash to Treasure Workshop  
 Trees: Creating the Air We Breathe

Over →

- Urban Wildlife: Precious Things or Pests?
- Wetlands: Why They Are Important
- What Makes a Healthy Creek?
- Wildscaping
- Other (please specify): \_\_\_\_\_

11. For what reason have you or your family visited Ijams Nature Center in the past 12 months? (check all that apply)

- For a teacher workshop
- For my child to attend a program (for example, school field trip, summer camp, birthday party, Junior Naturalist, Scouts, etc.)
- For sales or recycling events (for example, Christmas tree recycling, plant sales)
- My family and I have not visited Ijams Nature Center in the past 12 months
- To attend an adult- or family-oriented program (for example, Air Quality Initiative or Nature and Wildlife programs)
- To attend a program with my toddler or preschooler (for example, Nature Pre-School or Wee-ones)
- To visit the grounds (for example, picnicking, walking the trails, etc.)
- To volunteer (for example, as a naturalist or with River Rescue)
- Other (please specify): \_\_\_\_\_

12. What will you take home following today's program? (check all that apply)

- Free supplies
- Informational handouts
- Nothing
- Purchases from the gift shop (if attending program at Ijams Nature Center)
- Other (please specify): \_\_\_\_\_

Over →

**II. Directions: Please circle the number that best describes how you feel about the statement given. Your responses are appreciated.**

	<i>Strongly Agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
1. Others will expect me to engage in one or more environmental behaviors that I learned in today's workshop.	1	2	3	4	5
2. I have learned new information about the environmental issues presented in today's workshop.	1	2	3	4	5
3. I am confident that I could engage in one or more environmental behaviors that I learned in today's workshop if I wanted to.	1	2	3	4	5
4. I expect that I will engage in one or more environmental behaviors that I learned in today's workshop.	1	2	3	4	5
5. I have learned specific skill(s) that I may be able to do at home to reduce my impact in regards to the environmental issue(s) discussed in today's workshop.	1	2	3	4	5
6. I have learned about various general strategies that can be used to address the environmental issues presented in today's workshop.	1	2	3	4	5
7. People who are important to me will want me to engage in one or more environmental behaviors that I learned in today's workshop.	1	2	3	4	5

Over →

	<i>Strongly Agree</i>	<i>Agree</i>	<i>Neutral</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
8. Whether I engage in one or more environmental behaviors that I learned in today's workshop or not is entirely up to me.	1	2	3	4	5
9. I want to engage in one or more environmental behaviors that I learned in today's workshop.	1	2	3	4	5
10. I feel under social pressure to engage in one or more environmental behaviors that I learned in today's workshop.	1	2	3	4	5
11. I am planning to engage in one or more environmental behaviors that I learned in today's workshop.	1	2	3	4	5
12. The decision to engage in one or more environmental behaviors that I learned in today's workshop is beyond my control.	1	2	3	4	5
13. For me to engage in one or more environmental behaviors that I learned in today's workshop is difficult.	1	2	3	4	5
14. Most people who are important to me think that I should engage in one or more environmental behaviors that I learned in today's workshop.	1	2	3	4	5

Over →

**III. Directions: Please circle the number that best describes how you feel about the statement given. Your responses are appreciated.**

1. Engaging in one or more environmental behaviors that I learned in today's workshop is:

Good	1	2	3	4	5	Bad
Useful	1	2	3	4	5	Worthless
Pleasant (for me)	1	2	3	4	5	Unpleasant (for me)
Harmful	1	2	3	4	5	Beneficial

2. Overall, my satisfaction with today's workshop is:

High	1	2	3	4	5	Low
------	---	---	---	---	---	-----

**Additional Comments (if any):**

## Telephone Interview Script

**Message:** Hi. My name is Carolyn Reilly Sheehan and I am calling for \_\_\_\_\_. I'm calling because I'm a graduate student at the University of Tennessee and I'm studying a program offered by Ijams Nature Center. I believe you attended one at \_\_\_\_\_ back in \_\_\_\_\_. If you remember, I asked everyone there to fill out some surveys about the program. I'm calling now because I have some follow-up questions that I'd like to ask. If you could give me a call back at (865) 548-7174 that would be great. If you're interested, it'll take about 15 minutes. Otherwise, please call and just let me know that you're not interested and I won't bother you again. Again, my number is (865) 548-7174. Thanks for your time! Bye!

**Answer:** Hello. This is Carolyn Reilly Sheehan, and I'm calling for \_\_\_\_\_. Is s/he available?

Hi. My name is Carolyn Reilly Sheehan and I'm calling because I'm a graduate student at the University of Tennessee and I'm studying a program offered by Ijams Nature Center. I believe you attended one at \_\_\_\_\_ back in \_\_\_\_\_. If you remember, I asked everyone there to fill out some surveys about the program. I'm calling now because I have some follow-up questions that I'd like to ask. If this is a good time for you and you wouldn't mind answering a few questions, this should take about 15 minutes.

Are you up for answering a few questions? / willing to participate?

Yes (*continue*)

No (*thank participant and end the call*)

Is this a good time for you?

Yes (*continue*)

No (*determine an appropriate call back time*)

I'm going to ask you a series of fifteen questions that are all related to that program that you attended which is part of the "Living Clean & Green!" series. I'll take written notes only of your answers and your answers will be kept completely confidential. My written notes will be used only for this study and your name won't be connected with the data anywhere else, including in any publications. Only myself and my advisor at UT, Dr. Rita Hagevik, will see your name, and the written notes of this interview will be stored in a secure area so that no one else has access to them. In fact, after the study is completed, I'll destroy all of the written interview notes.

The purpose of this interview is to find out what effect the "Living Clean & Green!" program had after this three-month time delay.

Do you have any questions before we begin?

All right, let's begin.

1. Do you recall which “Living Clean & Green!” program you attended three months ago?
2. If you learned any specific actions you can take to reduce your impact on the environment, what were they, if you recall?

For the following questions, please answer for yourself only, based on the specific actions you recall, if any. I am going to refer to them as “environmental behaviors.” Otherwise answer based on your recollection of the program in general. Please rate each of the following statements on a scale of 1 to 5, with 1 being “strongly agree” and 5 being “strongly disagree.” Consider how you felt from the time immediately after you attended the program until now.

3. Others expect me to engage in one or more environmental behaviors that I learned in the program.
4. I learned new information about the environmental issues presented in the program.
5. I am confident that I could engage in one or more environmental behaviors that I learned in the program if I wanted to.
6. I expect that I will engage in one or more environmental behaviors that I learned in the program.
7. I learned specific skills that I may be able to do at home to reduce my impact in regards to the environmental issues that were discussed in the program.
8. I learned about various general strategies that can be used to address the environmental issues presented in the program.
9. People who are important to me want me to engage in one or more environmental behaviors that I learned in the program.
10. Whether or not I engage in one or more environmental behaviors that I learned in the program is entirely up to me.
11. I want to engage in one or more environmental behaviors that I learned in the program.
12. I feel under social pressure to engage in one or more environmental behaviors that I learned in the program.
13. I am planning to engage in one or more environmental behaviors that I learned in the program.

14. The decision to engage in one or more environmental behaviors that I learned in the program is beyond my control.
15. For me to engage in one or more environmental behaviors that I learned in the program is difficult.
16. Most people who are important to me think that I should engage in one or more environmental behaviors that I learned in the program.

For the next question, I'd like you to respond to a statement, but I'll be asking you to answer the same statement on various different scales of 1-5. I'll give you the scale each time. Here is the statement, and I'll be happy to repeat it at any time:

17. Engaging in one or more environmental behaviors that I learned in the program is:

Good, or bad? Good being 1, bad being 5.

Useful, or worthless? Useful being 1, worthless being 5.

Pleasant, or unpleasant, for you? Pleasant being 1, unpleasant being 5.

Harmful, or beneficial? Harmful being 1, beneficial being 5.

I only have two more questions for you. I would like you to answer them as thoughtfully and thoroughly as you can.

18. Between your attendance at the program and today, have you completed or have you taken steps toward completing any of the environmental behaviors you learned about in the program?

If yes, please describe:

If no, please explain why:

19. Do you have any additional comments or questions regarding your participation in the program, the survey, or this telephone interview?

Thank you very much for participating in this study. Your identity will be kept confidential, and we anticipate that the results obtained will be useful for Ijams Nature Center staff as well as for the researchers. Thank you. Goodbye.

## Appendix C: Tables

Table 1

*Workshops Included in Data Collection*

Title	Theme	Instructor	Date	Location	Participants (N = 97)	Total Time (minutes)
Kilowatt Ours	Energy use	B	12-Sep-07	Offsite	17	45
Butterflies are Free	Land/wildlife conservation	B	27-Sep-07	Onsite	4	33
Gathering Seeds	Land/wildlife conservation	A	29-Sep-07	Onsite	12	95
Butterflies are Free	Land/wildlife conservation	B	14-Oct-07	Onsite	2	22
Organic Gardening	Land/wildlife conservation	A	17-Oct-07	Offsite	26	52
Wildscaping	Land/wildlife conservation	A	20-Oct-07	Onsite	4	73
Gathering Seeds	Land/wildlife conservation	A	6-Nov-07	Offsite	10	34
Bird Friendly Yard	Land/wildlife conservation	A	7-Nov-07	Offsite	19	52
Bird Friendly Yard	Land/wildlife conservation	A	10-Nov-07	Onsite	3	69

Table 2

*Instrumentation*

Instrument	Developed from	What it measures	When administered	Time allowed	Analysis used
Instructor interviews	Prior discussion and observation	Program characteristics	Immediately prior to beginning data collection on programs	Up to one hour	Text analysis
Observation	REB <sup>a</sup>	Workshop characteristics; knowledge imparted to participants	During the workshops	NA	Text analysis
Pre-/post knowledge survey	REB <sup>a</sup>	Knowledge of the topic and environmental issues in general	Immediately before and after each workshop	5 minutes	<i>t</i> -test, text analysis
Behavior questionnaire	TPB <sup>b</sup>	Participants' intentions to behave; demographics	Immediately after each workshop	15 minutes	Regression
Post telephone interview	TPB <sup>b</sup>	Participants' intention to behave and actual behavior	Three months following workshop	15 minutes	Text analysis, regression

<sup>a</sup>REB = Model of Responsible Environmental Behavior.

<sup>b</sup>TPB = Theory of Planned Behavior.

Table 3

*Reliability Statistics (Cronbach's alpha) for Pre-/Post Knowledge Survey Quantitative Questions*

Workshop	Cronbach's Alpha	N of Items
Pre-	0.712	4
Post	0.937	4

Table 4

*Combined Knowledge Change Following Workshop Attendance*

	Mean	t	df	Sig. (2-tailed)
Knowledge_pre- – Knowledge_post	3.88 4.23	-3.596	76	0.001

Table 5

*Knowledge Change by Question Following Workshop Attendance*

	Mean	t	df	Sig. (2-tailed)
Env issues - general (pre-) – Env issues – general (post)	3.84 4.11	-2.186	73	0.032
Env issues - workshop (pre-) – Env issues - workshop (post)	3.26 4.31	-7.216	70	0.000
Knowledge of strategies (pre-) – Knowledge of strategies (post)	3.27 4.26	-6.732	71	0.000
Knowledge of skills (pre-) – Knowledge of skills (post)	4.88 4.27	6.013	76	0.000

Table 6

*Factor Analysis with Five Factor Groupings*

	Component				
	1	2	3	4	5
I am confident	0.857	--	--	--	--
Learned strategies	0.847	--	--	--	--
I plan to	0.836	0.378	--	--	--
I want to	0.801	0.395	--	--	--
Learned skills	0.785	--	--	0.427	--
I expect to	0.742	0.488	--	--	--
Pleasant	0.694	0.392	--	--	--
Learned info	0.516	--	--	0.432	--
Harmful	--	0.784	--	--	--
Useful	0.501	0.778	--	--	--
Good	0.487	0.761	--	--	--
Difficult	--	--	0.861	--	--
Beyond my control	--	--	0.847	--	--
Important others	--	--	--	0.765	--
Others expect me	--	--	--	0.667	--
Most important	--	--	-0.453	0.540	--
Social pressure	--	--	--	--	0.845
Up to me	--	--	--	--	0.512

*Note.* All factor loadings less than 0.300 were omitted.

Table 7

*Reliability Scores (Cronbach's alpha) for Each of the Five Factor Groupings*

Group	Cronbach's Alpha	N of Items
1	0.928	8
2	0.820	3
3	0.875	2
4	0.518	3
5	0.175	2

Table 8  
*Factor Analysis with Four Factor Groupings*

	Component			
	1 Intention	2 Attitude	3 PBC <sup>a</sup>	4 Subjective Norms
I am confident	0.857	--	--	--
I plan to	0.849	0.348	--	--
Learned strategies	0.831	--	--	--
I want to	0.813	0.383	--	--
Learned skills	0.770	--	--	0.438
I expect to	0.763	0.467	--	--
Pleasant	0.698	0.421	--	--
Learned info	0.539	--	--	0.432
Harmful	--	0.757	--	--
Useful	0.564	0.718	--	--
Good	0.544	0.716	--	--
Difficult	--	--	0.829	--
Beyond my control	--	0.372	0.783	--
Up to me – recode	--	--	0.450	--
Social pressure	--	--	--	--
Important others	--	--	--	0.764
Others expect me	--	--	--	0.678
Most important	--	--	-0.429	0.523

*Note.* All factor loadings less than 0.300 were omitted.

<sup>a</sup>PBC = Perceived Behavioral Control.

Table 9

*Reliability Scores (Cronbach's alpha) for Each of the Four Factor Groupings*

---

Group	Cronbach's Alpha	N of Items
1 – Intention	0.928	8
2 – Attitude	0.820	3
3 – PBC <sup>a</sup>	0.537	3
4 – Subjective Norms	0.518	3

---

<sup>a</sup>PBC = Perceived Behavioral Control.

Table 10

*Question Groupings Based on TPB Psychological Construct (“Questionnaire Development Groups”) and Factor Analysis (“Factor Analysis Groups”)*

Construct:	Questionnaire Development Groups:	Factor Analysis Groups:
	--	I have learned new information about the environmental issues presented in today’s workshop.
	--	I have learned specific skill(s) that I may be able to do at home to reduce my impact in regards to the environmental issue(s) discussed in today’s workshop.
	--	I have learned about various general strategies that can be used to address the environmental issues presented in today’s workshop.
<b>Component 1:</b>		
<b>Intention</b>	I expect that I will engage in one or more environmental behaviors that I learned in today’s workshop.	I expect that I will engage in one or more environmental behaviors that I learned in today’s workshop.
	I want to engage in one or more environmental behaviors that I learned in today’s workshop.	I want to engage in one or more environmental behaviors that I learned in today’s workshop.
	I am planning to engage in one or more environmental behaviors that I learned in today’s workshop.	I am planning to engage in one or more environmental behaviors that I learned in today’s workshop.
	--	I am confident that I could engage in one or more environmental behaviors that I learned in today’s workshop if I wanted to.
	--	Engaging in one or more environmental behaviors that I learned in today’s workshop is pleasant, or unpleasant, for me?

Table 11

*Continued*

<b>Construct:</b>	<b>Questionnaire Development Groups:</b>	<b>Factor Analysis Groups:</b>
<b>Component 2: Attitude</b>	Engaging in one or more environmental behaviors that I learned in today's workshop is: Good or Bad? Useful or Worthless? Pleasant (for me) or Unpleasant (for me)? Harmful or Beneficial?	Engaging in one or more environmental behaviors that I learned in today's workshop is: Good or Bad? Useful or Worthless? -- Harmful or Beneficial?
	The decision to engage in one or more environmental behaviors that I learned in today's workshop is beyond my control.	The decision to engage in one or more environmental behaviors that I learned in today's workshop is beyond my control.
	For me to engage in one or more environmental behaviors that I learned in today's workshop is difficult.	For me to engage in one or more environmental behaviors that I learned in today's workshop is difficult.
	Whether I engage in one or more environmental behaviors that I learned in today's workshop or not is entirely up to me.	Whether I engage in one or more environmental behaviors that I learned in today's workshop or not is entirely up to me.
	I am confident that I could engage in one or more environmental behaviors that I learned in today's workshop if I wanted to.	--

Table 10

*Continued*

<b>Construct:</b>	<b>Questionnaire Development Groups:</b>	<b>Factor Analysis Groups:</b>
<b>Component 4: Subjective Norms</b>	Others will expect me to engage in one or more environmental behaviors that I learned in today's workshop.	Others will expect me to engage in one or more environmental behaviors that I learned in today's workshop.
	People who are important to me will want me to engage in one or more environmental behaviors that I learned in today's workshop.	People who are important to me will want me to engage in one or more environmental behaviors that I learned in today's workshop.
	Most people who are important to me think that I should engage in one or more environmental behaviors that I learned in today's workshop.	Most people who are important to me think that I should engage in one or more environmental behaviors that I learned in today's workshop.
	I feel under social pressure to engage in one or more environmental behaviors that I learned in today's workshop.	--
<b>Learning (REB)</b>	I have learned new information about the environmental issues presented in today's workshop.	--
	I have learned specific skill(s) that I may be able to do at home to reduce my impact in regards to the environmental issue(s) discussed in today's workshop.	--
	I have learned about various general strategies that can be used to address the environmental issues presented in today's workshop.	--

*Note.* Component numbers correspond to those in the four factor analysis (Table 8). Empty cells indicate shifts of individual questions from one group to another following factor analysis.

Table 12

*Regression Model Summary for Behavioral Intention*

Model	df	R Square	F	Sig.
Regression	3	0.444	17.294	0.000

Table 13

*Regression Model Summary for Actual Behavior Change*

Model	df	R Square	F	Sig.
Regression	3	0.340	2.574	0.093

## VITA

Carolyn Reilly Sheehan attended Ohio University in Athens, Ohio, and received her Bachelor of Science in Environmental and Plant Biology, with a minor in Environmental Studies, in June 2002. Shortly thereafter, she relocated to Oak Ridge, Tennessee, to pursue a post-baccalaureate internship at Oak Ridge National Laboratory in which she was involved in research examining the impacts of climate change on forest and old-field plant communities. Upon completion of the internship, she became an AmeriCorps volunteer in Knoxville, Tennessee, in which she was involved in environmental education in local schools. She entered the University of Tennessee as a master's student in the autumn of 2005. Her Master of Science in Teacher Education, with a concentration in Informal Science Education, was completed in May 2008. Since then, she has continued to be involved in various environmental education activities in the East Tennessee area.