The impact of the Iowa Children's Water Festival on the children's attitudes and behaviors toward the environment

Sang-Min Kim

University of Northern Iowa

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THE IMPACT OF THE IOWA CHILDREN'S WATER FESTIVAL ON THE CHILDREN'S ATTITUDES AND BEHAVIORS TOWARD THE ENVIRONMENT

A Dissertation

Submitted

in Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

Approved:

Dr. Catherine Zeman, Chair

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December 2004
THE IMPACT OF THE IOWA CHILDREN’S WATER FESTIVAL ON THE
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Approved:

Dr. Catherine Zeman, Chair
Dr. Susan J. Koch
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December 2004
ABSTRACT

As a result of the growing concern about environmental issues, many countries have developed mechanisms and regulations directed at protection and conservation of the environment. As a part of this movement, many governmental and nongovernmental organizations (NGO) have launched a variety of environmental education programs, in an attempt to promote awareness of environmental issues. The Iowa Children's Water Festival (ICWF) is an annual half-day environmental education program in Iowa. The goal of the ICWF is to provide educational opportunities throughout the state to K-5 children and to educate customers of tomorrow on the importance of safe, reliable drinking water (ICWF, 2004). The purpose of this study was to investigate the impact of the Iowa Children's Water Festival on selected Iowa fifth graders' attitudes toward the environment. The researcher evaluated fifth graders' attitudinal/behavioral changes toward the environment before and after their participation in the 2003 Iowa Children's Water Festival.

Of the total number of 38 schools participating in the ICWF, 12 schools (participants n = 274) that completed both the pre/posttest Children's Attitudes Toward the Environment Scale (CATES) were assigned to the experimental group. Three of 12 schools (participants n = 42) that did not participate in the ICWF and returned the pretest CATES were assigned to the control group. Participants (n = 274) were compared to non-participants (n = 42) to determine whether there were substantial differences in the general attitudes toward the
environment based on several factors (e.g., pre/posttest, gender, locale, and school type). A one-page survey instrument (CATES) was administered two times (pre/posttest) in a three week period for both groups. Descriptive, inferential statistics were used to investigate whether children who participated in the ICWF improved their attitudes toward the environment compared to children who did not participate in the educational event. An analysis of covariance was employed to test the hypothesis. ANCOVA (regression fashion) indicated that there was no difference in posttest CATES scores between those children who attended the ICWF compared to those who did not attend.

To explore the long-term impacts of the participants' attitudinal/behavioral changes, a qualitative follow-up interview was conducted six months after the children's attendance at the 2003 ICWF. Six students from a central, rural elementary school that completed both the pre/posttest CATES were interviewed employing open-ended interview questions. Responses for the major questions indicated that knowledge gain, new behavioral changes, and retaining specific information occurred after children's participation in the ICWF. The results also suggested that not only are such factors as knowledge gain and behavioral changes critical in the continuum of behavioral change, but factors like family involvement, teacher's enthusiasm and role-modeling, student's internal locus of control on environmental issues, and a curriculum that is hands-on are also essential for reaching the ultimate goals of forming environmentally responsible behaviors in younger children.
DEDICATION

To my parents, parents-in-law, wife, son, sister, sister-in-law, and brothers-in-law, who have expressed their sincere love, trust, moral support in the course of completing the doctoral program.
ACKNOWLEDGMENTS

The final product of the dissertation is, I believe, not a mere culmination of an individual endeavor but a well-orchestrated work of cooperative mentorship. I sincerely appreciate Dr. Catherine Zeman's friendly leadership in the course of completing the dissertation and her genuine care for students' learning. During the entire process of the doctoral program, not only have I learned much academic knowledge but also many valuable personal and professional lessons from her. I would like to address my special thanks to the members of the dissertation committee - Dr. Radhi Al-Mabuk, Dr. Dennis Cryer, Dr. Robert Scheneider, and Dr. Barry Wilson. Their great mentorship, wise use of academic knowledge, and unique personal advice has been an invaluable support from the beginning to the end in the journey of this dissertation.

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CHAPTER 1

INTRODUCTION

With the advent of technology, people have opportunities to enjoy different life-styles that they could only dream of before. Long-distance traveling, longer life expectancy, and a materially affluent environment are benefits that became available with innovations in technology (Jacobson & Price, 1991). However, along with the material comforts of life, advanced technology brings several by-products as well. And, one of the negative features caused by increasing material affluence is environmental degradation. It is often difficult to weigh the benefits and drawbacks of advanced technology, but population increases, resource depletion, and pollution have reached the point where more and more concern for the environment is necessary in order to create sustainable societies. As a result of the growing concern about environmental issues, many countries have developed mechanisms and regulations directed at protection and conservation of the environment (Moore, 2002). As a part of this movement, many governmental and nongovernmental organizations (NGO) have launched a variety of environmental education programs, in an attempt to promote awareness of environmental issues (National Environmental Education Advisory Council, 1996). Realizing the potential dangers of careless consumption of natural resources and growing public awareness, sensitivity, and knowledge regarding environmental issues (i.e., water pollution, air quality, and land pollution) triggered the creation of the United States Environmental Protection
Agency (Environmental Education & Training Partnership, 2002). The focus of pollution control has shifted from end of the pipe solutions, involving regulatory acts, to efforts to control non-point source pollution; in order to accomplish this, environmental education of the public is emphasized (Environmental Education & Training Partnership, 2002). On the international level, the first attempts to educate the public on issues of environmental protection and conservation were made at the Tbilisi Conference in the Republic of Georgia, 1977. This conference laid out important frameworks, guidelines, goals, and objectives for the future foundation of environmental education (Stevenson, 1993). Since then, numerous research studies have been conducted in the field of environmental education based on various frameworks: Goals for Curriculum Development in EE by Hungerford, Peyton, & Wilke, 1980; Assessment of Learning Outcomes in EE by Lozzi, Laveault, & Marcinkowski, 1990; The relationship between environmental literacy and responsible environmental behavior in EE by Marcinkowski, 1991; University of Wisconsin, Steven’s Point- Wisconsin center for EE, 1992 (Environmental Education & Training Partnership, 2002). Then, what is environmental education? Environmental education is not “nature studies.” Rather, it is defined as “a learning process that increases people’s knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address these challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action” (National Environmental Education Advisory Council,

The Iowa Children's Water Festival is an annual half-day environmental education event in Iowa. The Iowa Children's Water Festival is modeled after the Nebraska Children's Groundwater Festival. The Groundwater Foundation was established in 1985 for the purpose of providing accessible scientific information and education about the community environment (Seacrest & Herpel, 1997). In 1989, the Groundwater Foundation initiated the Nebraska Children's Groundwater Festival. The purpose of the Nebraska Children's Groundwater Festival is educating children about the importance of conserving and protecting groundwater resources (Nebraska Groundwater Foundation, 2003). The Festival is a one day, annual event that takes place in Grand Island, NE. The Festival's educative value and continuous success has resulted in replicating the Groundwater Festival both nationally (all 50 states) and internationally (12 countries) (Marsters & Associates, 2002). The Iowa Children's Water Festival (ICWF) is one of the 50 annual events taking place throughout the United States, and its purpose includes educating the public about the importance of conserving
and protecting groundwater resources. The first ICWF was commenced in 1997 and was hosted at the Des Moines Area Community College, in Ankeny, IA.

**Theoretical Framework**

The aim of environmental education should be geared not so much toward solely instilling in citizen’s knowledge of particular aspects of the ecosystem, but should also focus on encouraging becoming environmentally responsible citizens (Hungerford & Volk, 1990). However, traditionally, environmental education (EE) has been rooted in the EE model by Ramsey and Rickson (1977) which is based on the assumption that knowledge leads to changes in attitude, and consequently, behavioral modification would follow. More recent paradigms, on the other hand, have put such a linear model in disfavor, explaining that the process of attitude and behavior alteration is far more complex than the precedent assertion. According to Hungerford and Volk’s Behavior Flow Chart, the change process undergoes three major levels: (1) Entry-level variables, (2) Ownership variables, and (3) Empowerment variables.

Entry-level variables can be considered as precursors to bringing about behavioral changes and they encompass environmental sensitivity, knowledge, positive attitudes toward the environment, and androgyny (Hungerford & Volk, 1990). Ownership variables focus on the intensity of personal commitment to the environmental issues. Variables that contribute to this level are in-depth knowledge and personal investment in environmental issues (Hungerford & Volk, 1990). Finally, the third level, “empowerment variables” is crucial in order for
learners to sustain a responsible pro-environmental citizenship (Hungerford & Volk, 1990). The major variables pertinent to this level are perceived skill in using environmental action, knowledge of environmental action strategies, locus of control, and intention to act (Hungerford & Volk, 1990). In sum, educating children to be environmentally responsible citizens is not a straightforward task. Complex processes involved in attitude and behavior alternation quite often present a difficulty for educators and researchers in identifying long-term outcomes of environmental education programs. The scope of this study is limited to investigating the entry level variables, particularly positive attitude toward the environment, and does not seek to explain all the variables in the model. Thus, the focus of this study is to investigate the extent of attitudinal/behavioral changes before and after participating in Iowa Children's Water Festival, over a three week time period.

**Statement of the Problem**

Currently, a myriad of environmental education programs are available both in formal education and non-formal education settings. The purpose of such programs is to educate the public on the significance of environmental conservation and protection so that natural resources remain available to the next generation. Thus, the ultimate goal of environmental education programs is to help people to become environmentally responsible citizens (Hungerford, Peyton, & Wilke, 1980). In paralleled with the goal of environmental education programs, the goal of the Iowa Children's Water Festival is to help children
become better consumers who understand the importance of water resources in Iowa. Each year, approximately 2,000 fifth grade students and their teachers across the state of Iowa attend the festival. Students and chaperones spend about half a day at the festival and they arrive at staggered times throughout the morning. The program of the festival is divided into four sessions: students attend four educational presentations, visit the exhibit hall, play a water-related game, watch a stage performance, and have lunch. Various supporting public organizations include: Iowa Association of Water Agencies; Des Moines Water Works, Des Moines Area Community College, United States Geological Survey-Iowa District, University of Northern Iowa, Recycling and Reuse Technology Transfer Center, Iowa Geological Survey, Iowa Department of Natural Resources, Central Iowa Water Association, Iowa Groundwater Association, Iowa Rural Water Association, Iowa Department of Public Health, and American Water Works Association-Iowa Section. Additionally, there are more than 300 individuals who volunteer as class guides; classroom assistants help set-up and tear-down activities, and provide logistical support. More than 60 educational presenters and exhibitors provide an opportunity for students to interactively learn about water/water resources play in their daily lives (ICWF, 2004).

Purpose of the Study

The purpose of this study was to investigate the impact of the Iowa Children's Water Festival on selected Iowa fifth graders' attitudes and behaviors toward the environment. The researcher evaluated fifth graders'
attitudinal/behavioral changes toward the environment before and after participating in the 2003 Iowa Children's Water Festival. Participants were compared with non-participants to determine whether there were substantial differences in their general attitudes/behaviors toward the environment based on several factors (pre/posttest, gender, locale, and school type). To investigate potential long-term impacts of the participants' attitudinal/behavioral changes, a qualitative follow-up interview was conducted six months after their participating in the 2003 ICWF.

Research Questions

Part I. Quantitative Research Question

1. Will children who participate in the Iowa Children's Water Festival (ICWF) improve their attitudes and behaviors toward the environment, as operationalized by the CATES, compared to children who do not participate in the ICWF?

Null Hypothesis

1. There will be no significant differences on the posttest CATES score between children who participate in the ICWF and children who do not participate in the ICWF.

Part II. Qualitative Research Question

2. Will there be an impact on the children's attitude/behavior such as detectable or self-reported changes, and what factors get involved in sustaining new behavioral changes?
Significance of the Study

Since the beginning of the Iowa Children's Water Festival in 1997, efforts to informally evaluate the educational presentations and educational materials have been made. However, inconsistent evaluation processes and a lack of standardized tools have posed a challenge to the stakeholders. Therefore, to provide a deeper insight into the outcomes of the Iowa Children's Water Festival, this study utilized a formal evaluation procedure using a valid and reliable instrument (Musser & Malkus, 1994) in order to investigate children's attitudes toward the environment before and after participating in the ICWF.

Findings of this study will provide the members of the ICWF Steering Committee with insights into what types of learning environment contribute to forming positive attitudinal changes of fifth grade students with regard to water protection and conservation. Understanding the characteristics of the educational presentations given at the ICWF and their impact on the attitudinal/behavioral changes of the participants will allow the members of the ICWF Steering Committee to advise future presenters on the most widely used instructional strategies in the field of environmental education, in order to maximize the learning outcomes of the participants. Additionally, school teachers can use the results of this study as a guide when they make decisions about whether to implement a similar small-scale environmental education program or participate in other environmental education programs. Furthermore, this study will present formative evaluation findings which will help various
organizations better understand the importance of environmental education programs and allocate resources to enhance the pro-environmental attitudes/behaviors of younger generations. Lastly, this study will provide different stakeholders with pertinent information regarding the effectiveness of the Iowa Children’s Water Festival (ICWF) which will further aid in understanding the significance of environmental education in cohorts of young children and will lead to a greater community involvement in the issues of environmental protection and conservation.

**Limitations**

The following limitations were identified for this study.

1. The results may be limited by the validity and reliability of the Children’s Attitudes Toward the Environment Scale (CATES).

2. The study focused only on children who participated in the 2003 ICWF.

3. The results are limited by the number of the experimental group who returned both the pre/posttest.

4. The size of the control group was very small.

5. Small group of randomly selected individuals (taken from a non-random sample) comprise the subjects for the ANCOVA.

**Delimitations**

1. Participant’s pre/posttest CATES scores are delimited to the three week time interval (the first week and the last week of May).
2. The findings of this study for the control group are delimited to the attitudes/behaviors of the three non-participant schools, and, therefore, the findings of the control group do not represent the attitudes of other non-participant schools across the state of Iowa.

3. The findings of the qualitative study are delimited to the interview results, which are based on the responses of six students from a rural school that had completed both the pre/posttest.

4. The qualitative study is delimited to the interviews conducted six months after participating in the 2003 ICWF. Thus, the findings of the interviews may be slightly different in a different time period of the year.

Assumptions

1. The students who participated in the research understood the questions.

2. Teachers understood and followed the instructional sheet when administering the Children’s Attitudes Toward the Environment Scale (CATES) test to the students.

Definitions of Terms Used

Attitudes--An enduring positive or negative feeling about some person, object, or issue (Newhouse, 1990, p. 26).

Environmental Education (EE)--A process that increases people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address these challenges, and
fosters attitudes, motivations, and commitments to make informed decisions and take responsible action (National Environmental Education Advisory Council, 1996, p. 3).

**Environmentally Responsible Citizen**—One who has (1) an awareness and sensitivity to the total environment and its allied problems [and/or issues], (2) a basic understanding of the environment and its allied problems [and/or issues], (3) feelings of concern for the environment and motivation for actively participating in environmental improvement and protection, (4) skills for identifying and solving environmental problems [and/or issues], and (5) active involvement at all levels in working toward resolution of environmental problems (Hungerford & Volk, 1990, p. 9).

**Iowa Children's Water Festival (ICWF)**—ICWF is a nonprofit event dedicated to providing an integrated environmental education program to fifth grade students on water concepts from a fun, interactive, and basic science prospective. Water concepts include water conservation, water treatment processes, watersheds and the need to protect them, and our daily use of water (ICWF, 2004).

**Locale**

1. **Large Central City**—Central city of a Metropolitan Statistical Area (MSA) with a population greater than or equal to 250,000.
2. **Urban Fringe of Mid-Size City**—Place within a MSA (Metropolitan Statistical Area) of a Mid-Size Central City and defined as urban by the Census Bureau.

3. **Large Town**—Town not within a MSA, with a population greater than or equal to 25,000.

4. **Small Town**—Town not within a MSA and with a population less than 25,000 and greater than or equal to 2,500 people.

5. **Rural**—A place with less than 2,500 people and coded rural and outside a MSA (Metropolitan Statistical Area) by the Census Bureau (Speicher, 2002, p. 5).

**Nonpoint source**—Refers to pollutants entering the environment from a broad area and may include scattered sources (Moore, 2002, p. 558).
CHAPTER 2
LITERATURE REVIEW

Realizing the potential dangers of careless consumption of natural resources, numerous environmental public organizations have been established with the goal of raising awareness, sensitivity, and knowledge regarding environmental issues among the general public (Stukas & Dunlap, 2002). Klein and Merritt (1994) asserted that starting in 1960 a growing number of environmental education programs began appearing throughout the United States, mainly as environmental degradation had increased. And, as the public increasingly recognized the results of environmental deterioration, concerns for protecting the environment became widespread among the public, particularly, after the Tbilisi Declaration in 1977. This declaration, passed in the former Soviet Republic of Georgia, codified one of the first government sanctioned efforts to educate the public about environmental issues. This trend has only intensified with time as many environmental education programs have sprung up in order to meet the goals and objectives of the declaration (Cobb, 1998).

Among the numerous definitions of environmental education currently available in the literature, the most commonly used was first adopted in 1975 at a United Nations Educational, Scientific and Cultural Organization (UNESCO) meeting in Belgrade, Yugoslavia. According to this definition, “environmental education should increase public awareness and knowledge about environmental issues as well as provide the public with the skills necessary to make informed decisions
and the motivation to take responsible actions” (National Environmental Education Advisory Council, 1996, p. 3). This definition has been broadly used among 12 federal agencies in the United States as their definition and guidelines (National Environmental Education Advisory Council, 1996).

Aligned with the goals of environmental education outlined by UNESCO, a number of programs in the United States at the national, state, and local levels targeting K-12 populations have been launched (Cobb, 1998). Most of these programs use environmental education to raise students’ awareness and knowledge about the environment, and to help them develop environmentally responsible decision-making skills. These programs range from very specific, such as targeting a certain age group to quite general designed for various audiences in K-12. Among a variety of national, state, and local programs, the following 10 have been identified as the most popular by the National Education and Environmental Partnership (2002): (1) Adopt-A-Watershed, a K-12 program that uses a local watershed as a living laboratory; (2) Audubon Adventures, a program that presents facts about birds, wildlife, and their habitats to elementary school children; (3) Earth Force GREEN, providing necessary equipment, guides, and other national and local resources, this program aims to educate middle and high school youth and to improve watersheds in their communities; (4) GLOBE Office, a program that creates partnerships between students and professional scientists with the purpose of increasing students' scientific knowledge base in regard to the environment; (5) National Wildlife Federation's Environmental
Education Programs, a number of programs that are individually tailored to specific needs of communities and schools; (6) Project Learning Tree, a K-12 program that embraces a wide range of environmental education topics; (7) Project WET, a program aimed at educating students about water resources; (8) Project WILD, a K-12 program focusing on raising student interest in learning about wildlife; (9) Waste in Place, a classroom curricular supplement with the goal of educating students about waste management; (10) Windows on the Wild, Biodiversity Basics, this program addresses complex scientific, social, political, cultural, and economic issues in regard to the environment, using the interconnectedness approach.

Although not listed among the most popular programs, Groundwater Festival has been expanding its scope and has been widely adopted both nationally and internationally. Partially, in response to expansion of the popular environmental education programs and largely due to the degradation of groundwater quality, the Groundwater Association launched an environmental education program called, “Groundwater Festival” in 1989, in NE. The goal of this Festival was to increase awareness, positive attitudes, and knowledge about protecting and conserving groundwater. The first NE Children’s Groundwater Festival was held in Grand Island, Nebraska and its target group was grade 4-6 students (Nebraska Groundwater Foundation, 2003). Currently, all 50 states and 12 countries internationally have adopted a program based on the initial premises of the Nebraska Children’s Groundwater Festival. Iowa Children’s Water Festival is
one of the 50 children’s water festivals held each year in the United States (Marsters & Associates, 2002). First launched in 1996 at Des Moines Area Community College, Iowa Children’s Water Festival is now an annual event. The goal of the ICWF is to provide educational opportunities throughout the state to K-5 children and to educate customers of tomorrow on the importance of safe, reliable drinking water (ICWF, 2004).

The following subsections of this chapter explore the literature of environmental education (EE) in three sections: (1) Historical background of environmental education, (2) Trends in environmental education research and theory, and (3) Success factors in EE programs.

**Historical Background of Environmental Education**

The origin of environmental education goes back to the late 19th century, when it was rooted in “Nature study” that was early on led by John Muir and Enos Mills. To educate students living in urban environments who did not have a direct connection with nature, a scholar, Wilbur Jackman wrote *Nature Study for the Common* in 1891 (Athman & Monroe, 2001). A junior naturalist program was created by Cornell University in 1896 in an attempt to help students of rural schools better understand nature and form environmentally friendly attitudes. The purpose of nature study was to direct children’s attention to the natural life outside their classrooms. Children were to observe and interact with nature as a part of their education. Consequently, these and other nature study programs
encouraged and were encouraged by the establishment of the American Nature Study Society in 1908 (Weilbacher, 1996).

Nature study eventually led to the modern environmental education movement, but first, it matured through a couple of programs (e.g., conservation education and Earth Day) as concerns for the environment surged. Klein and Merritt (1994) pointed out that, starting from 1960, a growing number of environmental education programs began appearing throughout the United States, mainly as a result of an increasing awareness of environmental issues and concerns. Particularly after the release of Rachel Carson's book, *Silent Spring* in 1962, the concern for educating people about the environment soared (Briggs, 1987). This book mainly illustrates examples of ecological imbalance due to pesticides used for controlling insects and pests. Initially, chemicals were introduced to control insects and pests, but it only resulted in temporary effects. Further, it disturbed the natural chain of predator and prey relationships. As a result, chemical use not only brought about an imbalance in the ecological system, but it also resulted in contaminating the soil and water with toxins. The result, in a number of instances, has been real and suspect problems for human health, and a loss of biodiversity and increasing pest resistance. This book alerted the public to the potential hazards of chemical use as a method of pest control (Briggs, 1987). *Silent Spring* (1962) is "frequently identified as the catalyst for the environmental movement of the 1960s and 1970s, which differs from earlier conservation movements, because it was far more widespread and
popular, involving public values that stressed the quality of the human experience and hence of the human environment" (National Environmental Education Advisory Council, 1996, p. 3).

By the early 1970s, however, nature study had faded out as it was considered an old Victorian educational legacy. In place of it, a conceptually new era in environmental education has emerged. Thus, the focus of modern environmental education has been placed on promoting environmental literacy, which emphasizes not only factual knowledge about life out-of-doors, but also embraces a systems-oriented view of environmental functioning (Weilbacher, 1996). In keeping with this new movement, environmental education abandoned nature study as a primary paradigm; as a consequence, college degree programs required fewer courses than before. "Nature centers became EE centers, and naturalists became environmental educators. Membership in the American Nature Study Society dwindled, whereas that of the National (now North American) Alliance for Environmental Education grew" (Weilbacher, 1996, pp. 4-5).

During the 1970s, many initiatives to prevent environmental deterioration at both national and international levels have been undertaken. The first official attempt was at the international level and was manifested at the Tbilisi Conference in the former Soviet Republic of Georgia in 1977. The purpose of this conference was to educate the public on the issues of environmental protection and conservation at the international level (Wisconsin Department of
Public Instruction, 1994). This conference laid out important frameworks, guidelines, goals, and objectives for the future of environmental education. Since then, many new models based on the foundation established by the Tbilisi Conference have been developed (Hungerford & Volk, 1990). In the United States, the development of environmental education has reportedly found enormous support from various educational institutions, environmental organizations, and government agencies (National Environmental Education Advisory Council, 1996). Since the 1970s, paradigms of the environmental education movement in the United States have been formed through theoretical approaches which seek to understand environmental problems from the perspectives of societal issues/problems, technology, and science (National Environmental Education Advisory Council, 1996). In 1990, the National Environmental Education Act was signed by the President, and it was the first Congressional mandate that strongly supported environmental education as part of the EPA’s integral mission (National Environmental Education Advisory Council, 1996).

**Trends in Environmental Education Research and Theory**

The Tbilisi Declaration was an important historical landmark in environmental education. As a result of this conference, the framework, principles, and guidelines for environmental education at all levels (e.g., local, national, regional, and international) and for all age groups in and outside the formal educational settings were established (Hungerford & Volk, 1990).
Awareness, sensitivity, attitudes, skills, and participation have been outlined as the goals of EE by the 1977 Tbilisi Intergovernmental Conference. Raising awareness of and developing sensitivity to the environment, helping people acquire pro-environmental attitudes and gain necessary skills for solving environmental problems, and finally, providing individuals and social groups with an opportunity to be actively involved in environmental protection and conservation have become the target areas for EE programs as a result of the Tbilisi Declaration (Hungerford & Volk, 1990). Consequently, after the passing of the National Environmental Education Act of 1990 in the United States, efforts to educate the public about the environment at the national level have increased (Athman & Monroe, 2001). Aligned with this trend, Children's Groundwater Festival emerged as one of these nationally encouraged environmental education programs. As the quality of drinking water has gotten worse, due, at least in part, to increased pesticide use during 1960s and 1970s across the United States, the need for protecting groundwater has increased. In response to the concerns about water quality, the Groundwater Association made an attempt to improve the situation and initiated the general concept of a Children's Groundwater Festival in 1989, with the purpose of providing environmental education to Grade 4th, 5th, and 6th children (Nebraska Groundwater Foundation, 2003).

A behavioral impact study of Nebraska's Groundwater Festival conducted by the Rensselaer Institute in 1994 reported various positive findings in
younger age groups, such as adopting new behaviors and pre/posttest knowledge gain as a result of participating in the Groundwater Festival. The study also showed that on average there was a 20 percent increase in knowledge for groups tested both before and after the festival from the period 1989 to 1993 in the areas of groundwater, its protection, and its conservation (Rensselaerville Institute, 1994). Not only did knowledge gain occur in tested groups, but the study also reported that participants adopted new behaviors such as taking shorter showers, and turning off the faucet while brushing their teeth. However, these behavioral changes were found to be of a transient, not prolonged nature (Rensselaerville Institute, 1994). Leeming, Porter, Dwyer, Cobern, and Oliver (1997) conducted a quasi-experimental study to investigate changes in environmental attitudes and knowledge of children grades 1-3 before and after participating in eight, in-class, environmentally relevant activities during the course of an academic year. This study revealed that there was an improved attitude toward the environment in the experimental group between the pre/posttest, but there was no change in attitude in the control group. Furthermore, children among the experimental groups exhibited higher knowledge gains on environmental issues, although those gains were not statistically significant.

A qualitative follow-up study, which was conducted by Marsters and Associates from 1999 to 2002, with participants of the Nebraska Groundwater Festival, focused on behavioral impact. Such methods as observation, in-person...
interviews, surveys of 1999-2002 students, telephone interviews, parent evaluations, and 2000 and 2001 student evaluations were utilized. The key findings of this study were the following:

(1) The kids continue to love the festival, and it creates a desire in them for continued learning about groundwater.

(2) There are certain events of which students consistently retain a memory trace.

(3) Some students can remember significant details about the Festival 1-5 years after attending.

(4) Memory traces of attending the Festival were almost non-existent among students who received no follow-up.

(5) Students universally favor hands-on learning.

(6) Students continue to feel the event is too crowded.

(7) Students who had received continuing groundwater education in school stated that they continued to practice water conservation and protection behaviors. (pp. 4-5)

A number of studies conducted from 1974 until the early 1990s utilizing meta-analysis methods (Asch & Shore, 1975; Howie, 1974; Jaus, 1984; Jordan, Hungerford, & Tomera, 1986; Kostka, 1976; Lisowski & Disinger, 1991; Ryan, 1991) showed positive attitudinal changes and increased knowledge; however, the methodology and techniques used in those studies raised several issues concerning the quality of the study designs (Leeming, Dwyer, Porter, & Cobern,
Various issues regarding methodology and effectiveness of techniques include lack of a valid study design and analysis, small size to detect treatment effects, lack of compatibility in the measurement instruments, likelihood of strong demand or experimenter expectancy effects in many studies, lack of follow-up studies, and transient behavioral changes (Leeming et al., 1993). Apart from methodological weaknesses, a common problem of the studies conducted in the period from 1974 through the early 1990s, sprung from a perception that increased knowledge would lead to positive attitudes and, therefore, would result in behavioral changes (Hoody, 1995). Apparently, as it is aptly pointed out by Leeming and colleagues (1993), the relationship between attitude and behavior is very complex and there is much to be learned about the conditions under which changes in attitude are likely to lead to behavior changes. Hines, Hungerford, and Tomera (1986), after reviewing study findings on responsible behaviors reported since 1971, made an attempt to conduct a meta-analytical study based on research work to that date. Due to the scarcity of research in the field of environmental education, however, Hines and colleagues (1986) could not extract sufficient information to conduct a meta-analysis, and as a consequence, they shifted their direction and focused on identifying variables that were closely correlated with environmentally responsible behaviors. As a result of their analysis, Hines and colleagues (1986) have been able to categorize five elements closely associated with environmental behaviors.
including: verbal commitment, locus of control, attitude, personal responsibility, and knowledge (as cited in Hungerford & Volk, 1990).

**Traditional Environmental Education (EE) Model**

The aim of environmental education should be geared not only toward instilling in students knowledge of particular aspects of the ecosystem, but also toward encouraging children to become environmentally responsible citizens (National Environmental Education Advisory Council, 1996). Traditionally, however, environmental education (EE) has been rooted in the EE model by Ramsey and Rickson (1977) which is based on the assumption that knowledge leads to attitude change and consequently behavioral alteration follows (Bardwell, Monroe, & Tudor, 1994). Thus, this model views the relationship between knowledge and behavior as unidirectional. Proponents of the traditional EE model assumed that enhancing knowledge of the environment would help people to become more aware of the environmental issues around them consequently leading to the development of environmentally favorable attitudes and emotions. Overall, the premise of the EE model is that knowledge leads to attitude change and consequently entails behavior alteration. However, this model overlooked other synergistic variables that affect behavioral changes in human beings (Robottom & Hart, 1995).

**Hungerford and Volk’s Environmental Citizenship Behavior Model**

Based on the previous meta-analysis work by Hines, Hungerford, and Tomera’s learning models (1986/1987), Hungerford and Volk (1990) aided in the
development of a behavior flow chart, illustrating the process of behavioral change, which is based on three major levels: (1) Entry-level variables, (2) Ownership variables, and (3) Empowerment variables.

Entry-level variables can be considered precursors to bringing out behavioral changes and they encompass environmental sensitivity, knowledge, positive attitudes toward the environment, and androgyny (Hungerford & Volk, 1990). Environmental sensitivity deals with the degree of awareness of environmental issues. Knowledge of ecology is considered a required precedent tool in decision-making and finding solutions to problems. Knowledge is itself further subdivided by concepts. Alone it cannot lead to a pro-environmental behavior, but knowledge is a critical variable when an individual makes decisions about ecological issues (Hungerford & Volk, 1990). Attitudes toward pollution/technology/economics are described as minor variables assuming that attitude is not directly associated with behavioral change, this differs from some research findings showing a significant relationship between the two (Hungerford & Volk, 1990). Androgyny describes “those human beings who tend to reflect non-traditional sex-role characteristics. For example, an androgynous male may be a very sympathetic individual and able to cry in a sad situation (a traditional female characteristic)” (Hungerford & Volk, 1990, p. 11).

Ownership variables focus on the intensity of personal commitment to environmental issues. Variables that contribute to this level are in-depth knowledge and personal investment in environmental issues. In-depth
knowledge is a very important variable that can contribute to ownership. Several studies showed that an individual with a deeper understanding about the nature of environmental issues, and the ecological and human implications of these issues, was more likely to be engaged in environmentally responsible behavior. Personal investment can be translated into a key component of the ownership variables, and it is referred to as privately owned interest in relation to an issue or an action toward the environment. For example, a person might view recycling as a personal investment because he or she knows the economical benefits of recycling (Hungerford & Volk, 1990).

Finally, third level-empowerment variables are crucial in order for learners to sustain a responsible, pro-environmental citizenship. The major variables pertinent to this level are perceived skills in using environmental action, knowledge of environmental action strategies, locus of control, and intention to act (Hungerford & Volk, 1990). Knowledge of environmental action strategies and skill variables alone are not a strong predictor of environmentally responsible behaviors; however, when the two variables are incorporated, they have a synergistic effect on the forming of environmentally responsible behaviors. Locus of control refers to whether an individual perceives the focal point of control over a certain behavior as internal or external. Internal locus of control signifies that individuals believe that they are capable of changing the environment around them and, therefore, they are willing to participate in actions to do so (Hochbaum, 1958, & Hungerford & Volk, 1990). External locus of
control, on the other hand, refers to the belief that a person cannot change the environment and, therefore, is not willing to take action to do so. Intention to act is related to an individual's internal motivation to do so. It predicts that an individual who has exhibited more inclination to act has also had a greater intention to do so. This variable is intertwined with other variables such as personal investment, ownership, locus of control, and perceived skill in taking action (Hungerford & Volk, 1990).

Criticisms of the Traditional Model

The process of behavioral change is complex. However, theories developed in the early 1970s delineated this process as linear and made attempts to simplify it (Cottrell & Graefe, 1997). Researchers at that time asserted that educating an individual on various environmental issues could lead to behavioral change. This assertion is based on an assumption that when an individual is better informed, the individual becomes more aware of environmental problems; and as a result, the individual would be motivated to manifest pro-environmental behaviors (Bardwell et al., 1994). Interestingly, the traditional model was based on the ulterior research findings to justify the linear relationship; thus, this model has not gained a good reputation (Hungerford & Volk, 1990). This behaviorist's perspective on environmental education prevailed until the mid-1990s, and was lent support by the former chairperson of the North American Commission for Environmental Education Research, Thomas Marcinkowski, who explicitly spelled out in a 1990 publication that quantitative
research in environmental education should be presented in numerical and statistical form (Robottom & Hart, 1995). Unfortunately, the individualist’s ideal of behaviorism in environmental education has not resulted in any scientifically measurable positive change in forming or maintaining environmentally responsible behaviors among targeted groups.

Arguments on the EE Research Paradigms

Over the last few decades, the nature of research in education has been a critical issue mainly due to the fact that education is commonly viewed as a discipline rather than a field of study (Schulman, 1988). Thus, research in education has followed a tradition of research methodologies of other disciplines and failed to develop its own inquiry that fits the nature, purpose, and outcomes of the educational research. As a consequence, Hart (1993) stated, “this inadequacy has created debates within educational research that may be recognized in terms of deeper historical methodological debates within and between social and natural science disciplines; especially within and between anthropology, sociology, and psychology; over what counts as educational research” (p. 1). This debate fully emerged in the field of education by the 1970s (Schon, 1983). These debates have shifted from the crux of appropriateness of the quantitative methodological issues within social science disciplines to debates over strengths and weaknesses of two approaches: quantitative approach vs. qualitative approach (Carr & Kemmis, 1986).
Cantrell (1993) explains that the center of the debate between these two paradigms lies in the dichotomy between the natural and social science disciplines. Bernstein (1976) illustrates the differences of the two distinct theorists in terms of "man-in-the-world," either through a "scientific image" or through a "manifest image" (Cantrell, 1993). The former views human beings as complex physical structures that are different from the physical environment not in kind, but only in degree. Thus, science can explain the complexity of human concepts and systems with fundamental scientific principles. On the other hand, the social sciences aim to explain the relationship between humanity and the world from different epistemological concepts that are based on the notion that reality is constructed in the field of social science. The field of social science emerged later than that of natural science and scholars in the social sciences believed they could achieve similar intellectual development by adopting the methods of natural science (Smith, 1989). Dilthey (1985) stresses that natural and social sciences deal with different core subjects. Thus, social science deals with products that are generated by human minds and natural science, on the other hand, deals with physical objects and events. While physical objects and events can be controlled, manipulated, and quantified with a set of structured inquiry systems, human minds cannot be that easily objectified by a systematic approach, but are more meaningful when interpreted in the context of social reality.
Depending upon how researchers frame and interpret the nature of the reality, types of research paradigms vary. Paradigms of importance to education, and by extension EE, include positivism, interpretivism, and critical science. Each perspective differs with regard to the type of employed methodologies, view of reality, nature of knowledge, relationship between knower and the known, and values in various research paradigms. Thus, the purpose of research from the positivist orientation is to discover laws and generalizations that explain reality which will then allow for predicting and controlling. Knowable facts, real causes, or simultaneous effects help to explain events. There is no dependency between the knower and the known and knowledge is value free. Interpretivists, on the other hand, believe that knowledge is value-bounded and that events can only be understood through the mental process of interpretation within a social context. The purpose of research in this paradigm is to understand and interpret daily occurrences and social structures as well as the meanings people give to the phenomena. Finally, advocates of the critical science perspective view the relationship between knower and the known as interrelated and influenced by society. Knowledge is viewed as value bounded. The purpose of research in this paradigm is emancipating people through the critique of ideologies that promote inequity (Cantrell, 1993).

Without a discernable consensus in education research paradigms during the 1980s, the trend of the literature was to focus on comparative discussion between quantitative versus qualitative research. The core of this debate is
rooted in epistemological purity and cannot be easily clarified in the near future, but research has to be done (Miles & Huberman, 1988). Patton (1990) advocates a neutral stance and states that the purpose of research is to:

Increase the options available to evaluators, not to replace one limited paradigm with another limited, but different, paradigm. Rather than believing that one must choose to align with one paradigm or the other, I advocate a paradigm of choices. A paradigm of choices rejects methodological orthodoxy in favor of methodological appropriateness as the primary criterion for judging methodological quality. The issue then becomes not whether one has uniformly adhered to prescribed cannons of either logical-positivism or phenomenology but whether one has made sensible methods decisions given the purpose of the inquiry, the questions being investigated, and the resources available. The paradigm of choices recognizes that different methods are appropriate for different situations. (pp. 38-39)

Fetterman (1988) asserts that both quantitative and qualitative approaches have been misleadingly viewed as contrasting paradigms; but, in fact, each approach mixes both quantitative and qualitative techniques within research practice. The rational for the separation of paradigms is based in two widely held views; that is, researchers view the relationship between paradigm and method as (1) technique-oriented quantitative vs. qualitative, and (2) as

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logically justified by the informative paradigm (i.e., quantitative vs. qualitative) (Smith, 1989, p. 33).

Comber (1988) suggests that the main criterion used for validating research during the 1980s has to do with how and why the research is done. Thus, validating research has to do with which paradigm fits most in academia. One of the inherent problems for environmental education, however, resides in the notion that in one sense the field of environmental education fits into the natural sciences due to its science content; still, on the other hand, it is connected with social science because it deals with content, the methodologies, and processes of education such as knowledge, values, skills, motivation, and so on. Thus, due to its traditional connection to science-based content, the paradigm and method of environmental education research has been rooted in a quantitative approach that has been dominant in science education. However, part of education intertwines with social, political, and economic factors in a process which results in instilling contemporary beliefs, attitudes, and values of the society. Therefore, education is a complex matrix and alternative and multiple paradigms are necessary in order to understand education and to encompass the multiple variables of the process. Although the quantitative perspective has prevailed in education, the alternative perspectives including interpretive and critical science have started gaining popularity in recent years. Robottom (1985) contends that despite its acceptance in education, the field of
environmental education has yet to recognize the applicability of social inquiry as a solid methodology for research.

**Strengths and Weaknesses of the Two Models**

Some researchers (Colwell, 1976; Robottom & Hart, 1995) have argued that focusing on empirical outcomes is not relevant in determining the effectiveness of environmental education programs; but, rather, more emphasis should be placed on evaluating the process occurring during the educational activity, since precursors to behavioral change have not been firmly identified (Leeming et al., 1993). In other words, it is less meaningful for environmental education researchers to focus heavily on the empirical evidence; rather, their primary goal should be evaluating the learning processes during environmental education activities (Robertson, 1994). In order to encourage learners to develop environmentally responsible behaviors (ERBs) knowledge alone is not enough. Other factors intrinsic to the student and the student/teacher interaction must also be considered including the age of students, curriculum, teacher's enthusiasm, family involvement, and the learning environment as they are also significant contributors to the development and sustainability of ERBs (Athman & Monroe, 2001).

**Success Factors in Environmental Education Programs**

Jaus (1982) asserts that educating younger children is more critical than educating high school students because the attitudes of older children are already set, which creates challenges in modifying their attitudes. According to a
national public opinion poll, young people reported that "adults have failed to do enough to protect the environment and seek to influence their parent's behavior" (Zimmermann, 1996, p. 41). This result suggests that young people are more aware of the importance of protecting the environment, and are willing to exercise environmentally responsible behaviors (Zimmermann, 1996).

Teachers' enthusiasm and role-modeling are also identified as significant factors in shaping children's environmentally responsible behaviors (Furman, 1990). In addition, teachers' follow-up with on-going cues to action concerning the environmental learning is directly related to sustainability of the new learned behaviors (Rensselaerville Institute, 1994). Role-modeling by parents and teachers is also essential for retention when learning environmentally responsible behaviors, especially when the ultimate goal is long-term behavior change (Bredekamp, 1987; Furman, 1990; Marsters & Associates, 2002).

Apart from individual role modeling by teachers and parents, more systemic actions targeted at bringing about pro-environmental behaviors are argued to be very essential as well. Athman and Monroe (2001), for example, insist that instructionally sound environmental education programs that utilize the best educational practices should be the core of the environmental education curriculum. Traditionally, instruction in science education placed emphasis on equipping students with content rich facts and providing them with an understanding of the scientific method. Students are then expected to assimilate the facts and emulate research methods by exposure to teachers' laboratory
demonstrations. The statement above is a notion that students learn due to teachers' instruction, so this views learning as a passive process (Klein & Merritt, 1994). Contrarily, Cohen and Trostle (1990) have stated that active involvement in the learning process is an essential part of the learning experience. Thus, an environmental education curriculum that is rooted in hands-on activities has been found to improve results on performance-based tests and foster more positive attitudes about the environment and higher levels of motivation to learn more science. In addition, hands-on activities also increase the actual participatory level of the learner (Wilson, 1993). School curriculum alone incorporating environmental education elements is not sufficient for the development of active participation in environmental protection and conservation. Education at a broader community level when various stakeholders realize their personal role in the ecosystem is argued to be much more efficient than isolated school education programs. Thus, children who are aware of environmental problems and who see their local community members concerned and actively participating in environmental protection are more likely to model the pro-environmental behaviors of adults and form sustainable pro-environmental attitudes in their adult lives (Stepath, 2000).

Concerned with establishing a learning environment that corresponds more closely with the democratic principles of our society, educators and education researchers have shifted the view of the learner as a passive vessel accepting knowledge toward the view of a more active participant in the learning
process. A paradigm shift from the traditional view (passive learners) to the new paradigm (active learners), as supported by such, modern theories as cooperative learning and constructivism is obviously needed to meet the challenges that individual learning styles present within the learning environment (Driscoll, 2000). To guide this effort, various learning theories provide us with theoretical frameworks suggesting what effective classrooms look like, and under what learning environments students learn more readily (e.g., behaviorism, cooperative learning, and constructivism). In the next section, a brief overview of three active learning theories provides some insights that help determine what contributes to effective learning.

**Behaviorism**

Behaviorism theory consists largely of four subcategories presented here in chronological order: (1) Pavlov’s classical conditioning, (2) Thorndike’s connectionism, (3) Watson’s experiment, and (4) Skinner’s operant conditioning. Pavlov’s classical conditioning theory is based on experimentation involving the salivary reflexes of dogs, and its subcomponents include: unconditioned stimulus (food); unconditioned response (salivation); conditioned stimulus (bell); and conditioned response (salivation). Edward Thorndike’s connectionism theory argues for three key laws of learning: (1) Law of exercise (repetition strengthens the connections between stimulus and response), (2) Law of effect (connections that are satisfying will be strengthened; those that are annoying will be weakened), and (3) Law of readiness (learner preparation and interest
determines, at least in part, what satisfies or annoys) (Keefe & Jenkins, 1997, p. 37). Watson’s experiment reemphasizes Pavlov’s classical conditioning, although he further asserts that humans are born with limited reflexes and emotions like anger or love, for example. Skinner’s operant conditioning theory is aligned with Pavlov’s, Watson’s, and Thorndike’s theories. Skinner’s theory proposes that,

The behavior caused by the law of effect was called operant conditioning, because the behavior of an organism changed or operated on the environment. There were no real environmental stimuli forcing a response from organisms as in classical conditioning. Operant conditioning consists of two important elements, the operant or response and the consequences. If the consequence is favorable or positively reinforcing, then the likelihood of another similar response is more than if the consequence is punishing. (as cited in Mischel, 1993, p. 304)

Practitioners of the traditional EE model assumed that enhancing knowledge of the environment would help people be more aware of environmental issues, and, thus people would adopt and practice more environmentally favorable behaviors. They hoped that the more favorable the attitude, informed by basic knowledge, the more readily individuals would manifest environmentally positive behaviors and support pro-environmental legislation. However, behaviorism overlooked other synergistic variables that affect human behavior, behavior change, and learning (Robottom & Hart, 1995).
Cooperative Learning

Cooperative learning theory is defined as "instructional use of small groups through which students work together to maximize their own and each other's learning" (Johnson, Johnson, & Holubec, 1994a, p. 4). Wheatley (1991) further stated that by engaging in group work, learners will be able to acquire listening and group-interaction skills. Additionally, they learn new viewpoints and ideas in relation to problems presented in the learning process.

Cooperative learning theory is rooted in the notion that teamwork is essential in the real world in order to carry out complex assignments of the modern society. Schools, however, are viewed as a place where competition prevails over cooperation (Slavin, 1983). Apparently the realm of school disciplines has been affected by various stakeholders such as society, religious institutions, business industries, and politics. Business and industry, in particular, has become a role model for modern educational institutions. The notions of competition, cost reduction, and increased productivity have been drawn from business into the education environment. Thus, for example, 1910s 'Scientific Management' begun by Taylor have enormously impacted business and industry eager to promote cost reduction and increased production (Wertheim, 2004).

Traditionally educational methods are often blamed for the lack of effectiveness and there has been a widespread pressure to adopt a business model of education and invest in the end product. However, unlike product lines, educators interact with human ideas, beliefs, and values that are not clear cut.
like input and output. Thus, a means-end approach might bring out short-term efficacy, like improved test scores on standardized tests, but does not ensure long-term quality of education (Slavin, 1983).

Johnson, Johnson, and Holubec (1994b) identify three types of cooperative learning: formal cooperative learning, informal cooperative learning, and cooperative base groups. Formal cooperative learning is employed when students are asked to complete specific group tasks and assignments lasting from one class period to several weeks (Johnson & Johnson, 1999). Teacher’s roles are important in formal cooperative learning groups and these are the following: specifying the objectives for the lesson, making a number of pre-instructional decisions, explaining the task and encouraging positive interdependence, monitoring students’ learning, intervening within the groups to provide task assistance or to increase students’ interpersonal and group skills, and assessing student’s learning while helping students process how well their groups functioned (Johnson et al., 1994b). Informal cooperative learning is used when students are temporarily formed into a group to achieve a shared learning goal from a few minutes to one class period (Johnson et al., 1994b). During a lecture, demonstration or film, this group can be used for several purposes: “to focus student attention on the material, to set a mood conducive to learning, to help set expectations as to what will be covered in a class period, to ensure that students cognitively process the material being taught, and to provide closure to an instructional session” (Johnson et al., 1994b, p. 8). Cooperative base groups
are based on long-term and heterogeneous cooperative learning groups that rely on steady membership (Johnson, Johnson, & Holubec, 1992; Johnson, Johnson, & Smith, 1991). The reasons for using this technique are twofold: to help, support, and encourage each member's academic progress (e.g., attend class, complete assignments, and improve test scores), and to maintain cognitive and social health. In elementary school, base groups meet daily, but usually only twice a week in the secondary schools. Learners informally interact on a regular basis in order to aid each other's academic progress, and they also informally encourage each other to maintain hard work inside and outside of school. Thus, these groups last longer (at least a year or until members' graduation) relative to other groups. Johnson and Johnson (1999) affirm that base groups have been found to improve attendance and quality of learning.

In short, cooperative learning means that students discuss the material with each other, help and assist each other in understanding it, and encourage each other to work hard (Johnson & Johnson, 1999). Wilson (1993) points out that in environmental education both individual and group work is essential. Children need to experience the natural environment directly and through group work they can share their experiences with others and learn to appreciate the way others relate to the world of nature.

**Constructivism**

Keefe and Jenkins (1997) explain that constructivist theory is rooted in the beliefs that human beings give meaning to new experiences in the light of prior
knowledge they possess. According to Foote, Vermette, and Battaglia (2001), learning is "a process that engages the learner in sense-making activities that are shaped by prior knowledge, occur through social interaction" (p. 24). In addition, Ballantyne and Packer (1996) explained four key components of the constructivist theory and these include:

(a) Introduction of a real life problem by the students or teacher for the students to resolve, (b) Student-centered instruction facilitated by the teacher, (c) Productive group interaction during the learning process, and (d) Authentic assessment and demonstration of student progress. (p. 16)

Bruner (1960) suggests that the learner constructs new knowledge based on his or her current and past knowledge, and the process of information selection and internalization is determined by the learner's cognitive structure, which allows the learner to synthesize experiences beyond the information presented. The role of instructor, therefore, is to provide a learning environment that allows students to explore the information for themselves with only moderate engagement with a teacher. In regard to the development of curriculum, Bruner (1966) favored a curriculum that contains many tracks which can help learners to attain the same general goal. Further, Bruner (1966) stressed four aspects of instruction that significantly impact learning: predisposition towards learning, the ways in which a body of knowledge can be structured so that it can be most readily grasped by the learner, the most effective sequences in which to present material, and the nature and pacing of rewards and punishments.
Strengths and Weaknesses of the Three Theories

The three theories—behaviorism, cooperative learning, and constructivist theory have been popular at different periods of time during the course of educational history. Each of these theories has its proponents and critics, and each theory has its strengths as well as weaknesses. Among the benefits of behaviorism, a focus on a clear goal and a reciprocal learning structure are the most commonly identified. Assignments built on the principles of behaviorism help the learner to envision the end result. Moreover, behaviorism provides a reciprocal learning structure that requires intersubjectivity, a learning situation that is based on “shared power and authority, where inequality between partners resides only in their respective levels of understanding” (Driscoll, 2000, p. 251). Behaviorist theory, however, has been highly criticized over its inability to explain the mental development of human beings, because the research findings of this theory are rooted in experiments on animal subjects. The findings of experiments conducted on animals were directly applied to the complex learning and thought structure of human beings (Driscoll, 2000).

Johnson and Johnson (1994) provide a very comprehensive list of strengths of cooperative learning theory which includes benefits for students’ cognitive, psychological, and social development. Thus, Johnson and Johnson (1994) contend that in the process of negotiation, clarification, and explanation, the reflective and meta-cognition abilities of the learner undergo a complex process, which in turn enhances short-and long-term memory. Based on the
principles of interdependence, cooperative learning promotes the development of social and communication skills and leads to a positive peer relationship. Successful interaction among peers brings greater psychological health, improves self-esteem and appreciation for learning, and enhances intrinsic motivation. The interplay of cognitive, social, and psychological factors provided by a cooperative learning environment is argued to boost student achievement and productivity and help learners develop positive attitudes toward the subject areas studied. While being the proponents of cooperative learning, Johnson and Johnson (1994) do not fail to point out the weaknesses of the theory. They conclude that while cooperative learning overall promotes psychological health, introverted students and students with poor self-confidence might suffer from constant group work. Another potential drawback of group work is diffused responsibility and social loafing. High-ability members might take over leadership roles at the expense of others and less-able members might experience peer pressure to "hitch hike." In addition, the group might form a coalition against a task and destructive conflict can occur.

Similar to cooperative learning, the benefits of constructivism include collaborative construction of knowledge through social negotiation. Assignments based on the premises of constructivism enable context and context dependent knowledge construction through social negotiation, collaboration, and experience. Furthermore, constructivism presents tasks and activities that are realistic, relevant, and authentic which reflect the natural complexities of the real

Although constructivist theory provides many benefits, Jenkins (2000) raised concerns about its application, particularly in science education. Since the main premise of constructivism is that in order to develop understanding of some phenomenon the learner has to be actively engaged in the learning process by making observations and generating and testing hypotheses. This requires that the learner makes sense of the phenomenon by leaning on his or her own unique pre-existing knowledge. In this way learning is viewed as an internal matter rather than a social activity. Jenkins (2000), however, questions young students’ capacity to construct complex scientific explanations simply by observing and interacting with natural phenomena. Moreover, without proper instruction and explanations from the teacher, students might generate and sustain erroneous beliefs about scientific phenomena that consequently lead to cognitive conflicts difficult to resolve. In other words, common sense or everyday knowledge might occasionally be dangerously wrong in science education. Jenkins (2000), therefore, asserts that when constructivist science education is equated with helping students to “make sense” of the natural world it poses difficulties to constructing complex scientific knowledge. Thus, the role of the expert teacher
utilizing a didactic approach to instruction appears quite critical in science education.

Summary

In short, 15 years of research in environmental education have generated findings that are characterized as: (1) applied science in nature (quantified), (2) objectivist (discovering reality), (3) instrumentalist (quantitative methods), and (4) behaviorist (outcomes based) (Robottom & Hart, 1995). Thus, focusing on the measurable outcomes rather than the learning processes, research in environmental education has traditionally failed to view the learner as an active participant in the process of his or her own knowledge construction. Novak (1987) explained the process of knowledge production as "subjective and value based, involving the constructive integration of thinking, feeling, and acting" (p. 357). Therefore, future directions in curriculum development should not rely solely on infusing students with facts and knowledge about the environment, but must also be focused on helping learners to understand environmental issues they are facing, in the environments in which they live. Only then can the learner make a direct connection between environmental issues and their experiences. In addition, environmental education should occur in a cooperative context provided by thoughtful planning of the school curriculum as well as collaborative efforts of different parties such as parents, community, and public organizations who are involved in youth education (Hungerford & Volk, 1990).
CHAPTER 3

METHODS

The Iowa Children's Water Festival (ICWF) is a free, half-day environmental education program that provides fifth grade students across the state of Iowa with opportunities to learn about the importance of water in their daily lives through educational presentations, experiments, exhibits, games, and entertainment. The purpose of this study was to investigate the impact of the Iowa Children's Water Festival on selected Iowa fifth graders' attitudes and behaviors toward the environment. The researcher evaluated fifth graders' attitudinal/behavioral changes toward the environment before and after participating in the 2003 Iowa Children's Water Festival. To accomplish the purpose of this study, quantitative and qualitative methodology was utilized. Part I examined the outcomes of the ICWF quantitatively, and Part II investigated the participant's long-term attitudinal and behavioral changes after their attendance in the ICWF with a qualitative approach.

Part I. Quantitative Methodology

The following research question was examined.

Hypothesis

Research Question 1. Will children who participated in the Iowa Children's Water Festival (ICWF) improve their attitudes toward the environment, as operationalized by CATES, compared to children who did not participate in the ICWF?
Null Hypothesis 1. There will be no significant differences on the posttest CATES score between children who participate in the ICWF and children who do not participate in the ICWF.

Alternative 1. Children who participate in the ICWF will have significantly higher posttest CATES scores compared to children who do not participate in the ICWF.

Research Design

This was a quasi-experimental, pre/posttest, evaluative study that used quantitative methodology. This study evaluated fifth graders' general attitudes toward the environment before and after participating in Iowa Children's Water Festival. A one-page survey instrument (CATES) was administered two times (pre/posttest) in a three week period for both groups. Participants were compared to non-participants, based on several factors (pre/posttest, gender, locale, and school type), to determine if there were substantial differences in the general attitudes toward the environment.

Study Participants

Approximately 2000 fifth grade students attend the annual Iowa Children's Water Festival. In order to recruit schools for participation, each year the ICWF Registration Committee mails out registration forms to all fifth grade teachers listed under the Department of Education in Iowa. As a result of the fall 2002 recruitment effort by the ICWF Registration Committee, 38 elementary schools returned registration forms agreeing to participate in the 2003 ICWF. The 38
experimental schools were first classified by school type, number of students, and locale according to the 2003 National Center for Education Statistics. The researcher employed a cluster sampling method to identify the 38 control schools that are based on clusters such as district, school type, and number of students, equivalent to the 38 experimental schools. After classifying all the 38 experimental schools by these clusters, the equivalent control schools \((n = 37)\) were identified. In order to determine appropriate sample size, statistical power analysis was used in order to identify the minimum number of subjects needed to detect a one percent change after attending the ICWF. The result suggested a total number of 460 participants is needed to detect a one percent change due to attending the Iowa Children's Water Festival at the alpha level of 0.01. Based on the power analysis, 230 participants were needed in each group, but sample size for the control group was tripled \((n = 930)\) in order to increase the chances of participating in the study. The 12 schools \((n = 274)\) that completed both the pretest/posttest CATES were assigned to the experimental group among the 38 participating schools in the ICWF. For the control group, three of twelve schools \((n = 42)\) that returned the pretest CATES were assigned to the control group. The return rates for this study are the following: experimental group \((32\%)\), control group \((25\%)\).

Instrumentation

A one-page survey instrument (CATES) was administered two times (pretest and posttest) for both groups. The Children’s Attitudes Toward the
Environment Scale (CATES) (see Appendix C) designed by Musser and Malkus (1994) was utilized to investigate the general attitude toward the environment in both groups. The instrument was constructed after reviewing extensive children's literature, and it was specifically designed for children aged eight to twelve, with the purpose of detecting the general environmental attitudes. This instrument utilized psychometric principles (summing across items to create one score) that allowed for a single score to serve as an indicator of environmental attitudes across a wide spectrum of environmentally relevant constructs. Such a scale has enabled researchers to see whether a specific/particular intervention impacts environmental attitudes in general (Musser & Malkus, 1994).

**Data Collection**

The ICWF Registration Committee mailed out registration forms to all fifth grade teachers across the state of Iowa, and 38 elementary schools returned registration forms agreeing to participate in the 2003 ICWF. For the experimental group, a packet of documents was sent to all 38 schools ($n = 1,809$), which included a UNI human participants informed consent form, a letter to the principals, a letter to the classroom teachers, an instruction sheet, a letter to the parents and legal guardians, and the pre/post survey questionnaires. Based on the information given for the experimental group, the equivalent control group of 12 schools ($n = 690$) was identified by the cluster sampling method, and the set of documents listed above were mailed out to 12 control schools ($n = 690$) during the last week of April, 2003. For both groups, the requested time periods for
administering the pre/posttest were the following: (1) pretest: May 5\textsuperscript{th} - May 9\textsuperscript{th}, and (2) posttest: May 26\textsuperscript{th} - May 30\textsuperscript{th}. A one-page survey instrument (CATES) (see Appendix C) was asked to be administered by the school teachers to fifth grade students before participating in the 2003 ICWF for the experimental group, and the same posttest was asked to be conducted with students who participated in the 2003 ICWF, two weeks after the festival. Before administering the CATES survey, teachers were asked to review the checklist (see Appendix B). For the control group, classroom teachers were asked to follow a specific time period as requested on the instructional sheet. As for the details of administering the survey (CATES pre/posttest), an instructional sheet enclosed in the packet explained the specific procedure (see Appendix B). During the first week of June in 2003, 12 of 38 participant schools of the 2003 ICWF were selected as the experimental group that completed both pre/posttest; and, 3 of 12 non-participant schools were selected as the control that returned the survey instrument.

Data Analysis

Descriptive, inferential statistics were used to investigate whether children who participated in the ICWF improve their attitudes toward the environment, as operationalized by CATES, compared to children who did not participate in the control group. In order to detect possible interactions and/or correlations among independent variables, as well as bivariate associations between the dependent variable, the CATES and independent variables several preliminary tests were conducted. These included t-tests and one-way $F$-tests. Before conducting
inferential statistics, normality of the data was tested. After normality of the data was reviewed, inferential statistics (e.g., t-tests, factorial ANCOVA, and stepwise ANCOVA) were conducted. As indicated by Musser and Malkus (1994), factors such as gender, locale, and school type are commonly used research factors in the field of environmental education. An analysis of covariance model (factorial method) was used to detect main and interactional effects among four factors (group, gender, locale, and school type) in testing group independence of posttest CATES scores. An analysis of covariance model (regression method) was used to detect the effect of participation in the Iowa Children’s Water Festival between the experimental and control group, as operationalized by the CATES.

**Part II. Qualitative Methodology**

The following research question was investigated.

Research Question 2. Will there be an impact on the children’s attitude/behavior such as detectable or self-reported changes, and what factors get involved in sustaining new behavioral changes?

**Research Design**

This follow-up section utilized qualitative approach to investigate potential the long-term impacts on the participants' attitudinal/behavioral changes, six months after their participation in the 2003 ICWF. An open-ended interview method was used to investigate the research question.
Study Participants

For the follow-up interview, one rural school of the 12 experimental schools that returned both the pre/posttest was conveniently selected for the interview, and an informed consent from the principal and school teachers was made via telephone. After acquiring informed consent, six students from a rural school in central Iowa who completed both pre/posttest were interviewed six months after their attendance.

Data Collection

As a qualitative adjunct to the quantitative study, six of nine students from a rural school in central Iowa were conveniently selected by the researcher, and were interviewed. Six students who participated in the ICWF were selected by the teacher who chaperoned the ICWF. The classroom teacher suggested using the resource room, because it was quiet and situated with a round table in the center so that the interviewees could feel free to talk without any teachers or students being seen. Six students (three male and three female students) were interviewed one by one, and each interview lasted about 30 minutes.

Data Analysis

Open-ended interview questions were used to answer the research question. Interviewee's responses for the major questions were analyzed in order to look for congruent themes of how participants view their experiences in the ICWF, and major themes identified in the literature on the topic of pro-environmental attitude formation and behavior change were probed. The major
themes suggested by the literature are the following factors: (a) Family Involvement, (b) Hands-on activity, (c) Teacher's enthusiasm, (d) Teacher's role-modeling, and (e) Internal locus of control.
CHAPTER 4

RESULTS

The purpose of this study was to investigate the impact of the Iowa Children's Water Festival on selected Iowa fifth graders' attitudes and behaviors toward the environment. To accomplish the purpose of this study, quantitative and qualitative methodology were utilized. The following two subsections of this chapter are outlined: (1) Results of Quantitative study, and (2) Results of the Interview.

Results of Quantitative Study

Demographic Information of Iowa

According to the most recent census, the population of Iowa is 2,926,324 consisting of 53.4% metropolitan and 46.6% non-metropolitan residents. The majority of population is of White ethnicity-92.1%, followed by Hispanic or Latino-3.1%, Black or African American-2.2%, Asian-1.5%, two or more races-0.9%, American Indian and Alaska Native-0.3%, and Native Hawaiian and Other Pacific Islander-0.05%. Bachelor's degree or higher is held by 22.2% and high school diploma or higher is held by 88.1% of Iowans (State Library of Iowa, 2004). Manufacturing, followed by services, trade, and government are the major sources of personal income. Agriculture is a leading industry in Iowa (The Official Iowa Tourism Web Site, n.d.). Currently, there are 1,529 public schools enrolling 491,000 PK-12 students. Minority students comprise 9.7% of the total student population in Iowa. Approximately 2% of Iowan students are English-
language learners (GreatSchools, 2004). As illustrated by the demographic data, Iowa is a quite homogeneous state with a predominantly white English-speaking population. The largest city in Iowa is its capital Des Moines with 198,682 residents (The Official Iowa Tourism Web Site, n.d.).

Demographics of This Study

This section describes basic demographics such as gender, locale, and school-type. Twelve schools that completed the pre/posttest CATES were assigned to the experiment group among the 38 participating schools in the 2003 ICWF. For the control group, an effort to identify a demographically equivalent control group was made in order to increase the generalizability of the findings, and statistical power analysis was used to come up with the minimum number of subjects needed to detect a one percent change after attending the ICWF. The analysis suggested that 310 subjects would be needed when alpha is set at 0.05. Based on the statistical power analysis, 12 schools were identified that met the specific criteria (district, locale, and school type) equivalent to the experimental group. Only three of 12 matched groups returned the pretest CATES. Table 1 shows the total number of participants \((N = 316)\) in the study: 274 experimental group (12 schools), and 42 control group (three schools). The ratio of the gender distribution among the attendee group was roughly equal, but that of the non-attendee group was slightly higher in females than males (see Table 1). Table 2 shows school type and locales of schools in the study.
Table 1

*Total Number of Participants (N = 316)*

<table>
<thead>
<tr>
<th></th>
<th>Experimental (n = 274)</th>
<th>Control (n = 42)</th>
<th>TOTAL (N = 316)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>P</td>
<td>f</td>
</tr>
<tr>
<td>Male</td>
<td>136</td>
<td>49.6</td>
<td>19</td>
</tr>
<tr>
<td>Female</td>
<td>138</td>
<td>50.4</td>
<td>23</td>
</tr>
</tbody>
</table>

*Note.* f = frequency, P = percentage, N = total number of participants.

Table 2

*School Type and Locales by Experimental and Control Group (N = 15)*

<table>
<thead>
<tr>
<th>School type</th>
<th>Experimental (n = 12)</th>
<th>Control (n = 3)</th>
<th>TOTAL (N = 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Private</td>
<td>Public</td>
<td>Private</td>
</tr>
<tr>
<td>Locales</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid-size</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Small Town</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Urban Fringe</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Town</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>7</td>
<td>1</td>
</tr>
</tbody>
</table>

*Note.* N = total number of schools.
Descriptive Statistics

Several factors (i.e., gender, locale, school type) are commonly used as independent variables in the field of environmental education, and Musser and Malkus (1994) suggested that further study employing these variables in different research environments is needed. The mean scores for the non-equivalent 50 participants' pre/posttest are presented below and the pre/posttest mean scores of 274 participants in the experimental group are also provided.

The posttest mean scores for the 35 participants improved compared to the pretest scores: pretest, $M = 71.37$ ($SD = 9.08$), posttest, $M = 76.49$ ($SD = 9.06$) in the experimental group, but the pre/posttest mean scores for the control group did not show much improvement: $M = 71.33$ ($SD = 9.73$), $M = 72.87$ ($SD = 10.30$).

For the experimental group, 18 male and 17 female students' posttest mean scores were slightly higher than the pretest mean scores (see Table 4a). However, the posttest mean scores of six male students in the control group improved compared to the pretest mean scores, but nine female students' posttest mean scores dropped slightly (see Table 5).

There was a slight improvement on the posttest mean scores compared to the pretest mean scores in the experimental group ($N = 274$): pretest, $71.35$ ($SD = 9.08$), posttest, $75.11$ ($SD = 10.58$) (see Table 6a). The pre/posttest mean scores for factors such as gender, locale, and school type in the experimental group ($N = 274$) are presented below (see Tables 6a, 6b, 6c, 6d).

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Table 3

*Mean and Standard Deviation for Pre/Posttest CATES Scores in the Non-Equivalent Groups (N = 50)*

<table>
<thead>
<tr>
<th></th>
<th>Experimental&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Control&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Pretest</td>
<td>71.37</td>
<td>9.08</td>
</tr>
<tr>
<td>Posttest</td>
<td>76.49</td>
<td>9.06</td>
</tr>
</tbody>
</table>

*Note.* <sup>a</sup>n=35, <sup>b</sup>n=15. *M* = mean, *SD* = Standard Deviation.

Table 4a

*Mean and Standard Deviation for Pre/Posttest CATES Scores by Gender in the Non-Equivalent Experimental Group (N = 35)*

<table>
<thead>
<tr>
<th></th>
<th>Pretest CATES</th>
<th>Posttest CATES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Male</td>
<td>18</td>
<td>72.50</td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
<td>70.18</td>
</tr>
</tbody>
</table>

*Note.* *n* = number of sample, *M* = mean, *SD* = Standard Deviation.
Table 4b

Mean and Standard Deviation for Pre/Posttest CATES Scores by School Type in the Non-Equivalent Experimental Group (N = 35)

<table>
<thead>
<tr>
<th>School Type</th>
<th>Pretest CATES</th>
<th>Posttest CATES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n M SD</td>
<td>M SD</td>
</tr>
<tr>
<td>Private</td>
<td>7 70.57 10.94</td>
<td>76.43 10.45</td>
</tr>
<tr>
<td>Public</td>
<td>28 71.57 8.77</td>
<td>76.50 8.89</td>
</tr>
</tbody>
</table>

Note. n = number of sample, M = mean, SD = Standard Deviation.

Table 5

Mean and Standard Deviation for Pre/Posttest CATES Scores by Locale in the Non-Equivalent Control Group (N = 15)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Pretest CATES</th>
<th>Posttest CATES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n M SD</td>
<td>M SD</td>
</tr>
<tr>
<td>Male</td>
<td>6 67.33 10.61</td>
<td>72.50 12.85</td>
</tr>
<tr>
<td>Female</td>
<td>9 74.00 8.67</td>
<td>73.11 9.08</td>
</tr>
</tbody>
</table>

Note. n = number of sample, M = mean, SD = Standard Deviation.
### Table 6a

*Mean and Standard Deviation for Pre/Posttest CATES Scores among the Participants in the Experimental Group (N = 274)*

<table>
<thead>
<tr>
<th></th>
<th>Pretest CATES</th>
<th></th>
<th>Posttest CATES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Experimental group</td>
<td>274</td>
<td>71.35</td>
<td>9.08</td>
<td>75.11</td>
</tr>
</tbody>
</table>

*Note.* $n$ = number of sample, $M$ = mean, $SD$ = Standard Deviation.

### Table 6b

*Mean and Standard Deviation for Pre/Posttest CATES Scores by Gender among the Participants in the Experimental Group (N = 274)*

<table>
<thead>
<tr>
<th>Gender</th>
<th>Pretest CATES</th>
<th>Posttest CATES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M</td>
</tr>
<tr>
<td>Male</td>
<td>136</td>
<td>70.70</td>
</tr>
<tr>
<td>Female</td>
<td>138</td>
<td>71.97</td>
</tr>
</tbody>
</table>

*Note.* $n$ = number of sample, $M$ = mean, $SD$ = Standard Deviation.
Table 6c

*Mean and Standard Deviation for Pre/Posttest CATES Scores by Locale among the Participants in the Experimental Group (N = 274)*

<table>
<thead>
<tr>
<th>Locale</th>
<th>n</th>
<th>Pretest CATES</th>
<th>Posttest CATES</th>
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<tbody>
<tr>
<td></td>
<td>n</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Midsize</td>
<td>77</td>
<td>71.05</td>
<td>10.16</td>
</tr>
<tr>
<td>Small town</td>
<td>8</td>
<td>70.88</td>
<td>7.94</td>
</tr>
<tr>
<td>Rural</td>
<td>77</td>
<td>70.97</td>
<td>9.31</td>
</tr>
<tr>
<td>Urban-fringe</td>
<td>112</td>
<td>71.84</td>
<td>8.28</td>
</tr>
<tr>
<td>Total</td>
<td>274</td>
<td>71.35</td>
<td>9.08</td>
</tr>
</tbody>
</table>

*Note. n = number of sample, M = mean, SD = Standard Deviation.*

Table 6d

*Mean and Standard Deviation for Pre/Posttest CATES Scores by School Type among the Participants in the Experimental Group (N = 274)*

<table>
<thead>
<tr>
<th>School Type</th>
<th>n</th>
<th>Pretest CATES</th>
<th>Posttest CATES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Private</td>
<td>56</td>
<td>70.80</td>
<td>9.57</td>
</tr>
<tr>
<td>Public</td>
<td>218</td>
<td>71.49</td>
<td>8.97</td>
</tr>
</tbody>
</table>

*Note. n = number of sample, M = mean, SD = Standard Deviation.*
Summary of Results in Response to Research Hypothesis

Research Question 1. Will children who participate in the Iowa Children's Water Festival (ICWF) improve their attitudes and behaviors toward the environment, as operationalized by the CATES, compared to children who do not participate in the ICWF?

Null Hypothesis 1. There will be no significant differences on the posttest CATES score between children who participate in the ICWF and children who do not participate in the ICWF.

Alternative 1. Children who participate in the ICWF will have significantly higher posttest CATES scores compared to children who do not participate in the ICWF.

The indicated test for comparison of the two non-equivalent groups with pretest data is the analysis of covariance or ANCOVA. In the ANCOVA the posttest scores (CATES) were ultimately regressed on group membership (control vs. experimental) controlling for noise (i.e., pretest scores and an interactional variable). There were 15 members of the control group who completed both the pre/posttest CATES. Due to the disproportionately large number of experimental subjects who also completed both the pre/posttest CATES, 35 were randomly selected systematically by picking every eighth member from the anonymous subject list. Thus the ANCOVA regression included a total number of 50 subjects. An N of 50 with three independent variables is of sufficient size to detect medium to small effect sizes with minimal shrinkage of $R^2$. Before the ANCOVA was conducted, several exploratory tests
were applied to the data to detect possible interactional effects and/or significant group differences that might confound the results of the ANCOVA or make the results difficult to interpret. Before conducting inferential statistics, normality of the data was tested. An internal consistency test for the CATES at pretest for all subjects \((N = 316)\) yielded a magnitude of 0.73. The pretest distribution of the CATES for all subjects \((N = 316)\) was not significantly skewed. Alpha was set at .05 by convention. By \(t\)-test, there were no significant differences between the two groups (controls = 15, randomly selected experimentals = 35) on pretest CATES score, the baseline (see Table 7a).

Table 7a

<table>
<thead>
<tr>
<th></th>
<th>Experimental(^a)</th>
<th>Control(^b)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(M)</td>
<td>(SD)</td>
<td>(M)</td>
<td>(SD)</td>
</tr>
<tr>
<td>Pretest CATES</td>
<td>71.35</td>
<td>9.08</td>
<td>72.12</td>
<td>8.93</td>
</tr>
</tbody>
</table>

Note. \(^a{n = 274}\). \(^b{n = 42}\).

\(^*p <.05\).

In a one-way analysis of variance for the all experimental subjects at pretest \((N = 274)\) there were no significant differences in scores dependent on locale, gender, or school type (see Tables 7b, 7c, 7d).
Table 7b

One-Way Analysis of Variance of Pretest CATES Scores by Locale in the Experimental Group (N = 274)

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest CATES test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>46.34</td>
<td>3</td>
<td>15.45</td>
<td>0.19</td>
<td>0.91</td>
</tr>
<tr>
<td>Within Groups</td>
<td>22471.72</td>
<td>270</td>
<td>83.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>22518.06</td>
<td>273</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. **p < .01.*

Table 7c

Gender Differences in Pretest CATES Scores in the Experimental Group (N = 274)

<table>
<thead>
<tr>
<th></th>
<th>Male(^a)</th>
<th>Female(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Pretest CATES</td>
<td>70.71</td>
<td>9.65</td>
</tr>
</tbody>
</table>

*Note. \(^a\)n = 136. \(^b\)n = 138. \(^*\)p < .05.*
Table 7d

School Type Differences in Pretest Scores in the Experimental Group (N = 274)

<table>
<thead>
<tr>
<th></th>
<th>Private&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Public&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Pretest CATES</td>
<td>70.80</td>
<td>9.57</td>
</tr>
</tbody>
</table>

Note. <sup>a</sup>n = 56. <sup>b</sup>n = 218.

*p < .05, two-tailed.

In the total control group (i.e., those who took at least the pretest CATES) (N = 42), there was no significant difference on pretest CATES score hypothesized as dependent on gender but there was a statistically significant difference when the pretest CATES scores were hypothesized to depend on local and type of school (see Tables 7e, 7f, 7g).

Table 7e

Gender Differences in Pretest CATES Scores in the Control Group (N = 42)

<table>
<thead>
<tr>
<th></th>
<th>Male&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Female&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Pretest CATES</td>
<td>70.47</td>
<td>8.72</td>
</tr>
</tbody>
</table>

Note. <sup>a</sup>n = 19. <sup>b</sup>n = 23.

*p < .05.
Table 7f

getLocaleDifferences in Pretest CATES Score in the Control Group (N = 42)

<table>
<thead>
<tr>
<th></th>
<th>Rurala</th>
<th>Large-Townb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Pretest CATES</td>
<td>69.90</td>
<td>8.13</td>
</tr>
</tbody>
</table>

Note. ①n = 30. ②n = 12.

* p < .05.

Table 7g

School Type Differences in Pretest CATES Score in the Control Group (N = 42)

<table>
<thead>
<tr>
<th></th>
<th>Privatea</th>
<th>Publicb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Pretest CATES</td>
<td>77.67</td>
<td>8.69</td>
</tr>
</tbody>
</table>

Note. ①n = 12. ②n = 30.

* p < .05.
Then, in order to detect possible interactions among the factors of gender, locale, and school type, a factorial ANCOVA was conducted and two-way interactions were included (see Table 7h). There were no main effects for any of the three categorical independent variables but there was an interactional effect for the variable gender*school type (see Table 7h).

Table 7h

_Factorial ANCOVA of the Posttest CATES Scores on the Five Factors (N = 50)_

<table>
<thead>
<tr>
<th>Factor or Covariate</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pretest</td>
<td>864.19</td>
<td>12</td>
<td>864.19</td>
<td>9.76*</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2. Group</td>
<td>3.31</td>
<td>1</td>
<td>3.31</td>
<td>0.04</td>
<td>0.85</td>
</tr>
<tr>
<td>3. Gender</td>
<td>0.57</td>
<td>1</td>
<td>0.57</td>
<td>0.01</td>
<td>0.94</td>
</tr>
<tr>
<td>4. Locale</td>
<td>223.42</td>
<td>3</td>
<td>74.47</td>
<td>0.84</td>
<td>0.48</td>
</tr>
<tr>
<td>5. School type</td>
<td>148.13</td>
<td>1</td>
<td>148.13</td>
<td>1.67</td>
<td>0.20</td>
</tr>
<tr>
<td>6. Group*Gender</td>
<td>41.00</td>
<td>1</td>
<td>41.00</td>
<td>0.46</td>
<td>0.51</td>
</tr>
<tr>
<td>7. Gender*Locale</td>
<td>417.14</td>
<td>2</td>
<td>208.57</td>
<td>2.36</td>
<td>0.11</td>
</tr>
<tr>
<td>8. Gender*School type</td>
<td>372.95</td>
<td>1</td>
<td>372.95</td>
<td>4.21*</td>
<td>0.04</td>
</tr>
<tr>
<td>9. Locale*School type</td>
<td>49.97</td>
<td>1</td>
<td>49.97</td>
<td>0.56</td>
<td>0.46</td>
</tr>
</tbody>
</table>

*Note. R² = 0.37.*

*p < .05.
Finally the ANCOVA was executed as presented above and tested the null hypothesis that there would be no difference in posttest CATES scores between those children who attended the Iowa Children's Water Festival ($N = 35$) compared to those who did not attend ($N = 15$). The variables were entered in stepwise fashion. When controlling for pretest CATES scores and the detected interactional variable gender*school type, group membership was not significant (see Table 7i). The null hypothesis could not be rejected.

Table 7i

**Stepwise ANCOVA of Posttest CATES Scores Dependent on Group Membership ($N = 50$)**

<table>
<thead>
<tr>
<th>Step Variable</th>
<th>$R$</th>
<th>$R^2$</th>
<th>Adj.$R^2$</th>
<th>$R^2$ change</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Pretest</td>
<td>0.44</td>
<td>0.19</td>
<td>0.17</td>
<td>0.19*</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2. Gender*School Type</td>
<td>0.44</td>
<td>0.19</td>
<td>0.16</td>
<td>0.002</td>
<td>0.76</td>
</tr>
<tr>
<td>3. Group</td>
<td>0.44</td>
<td>0.19</td>
<td>0.14</td>
<td>0.000</td>
<td>0.94</td>
</tr>
</tbody>
</table>

*Note. *$p < .05.$*
Results of Qualitative Inquiry

The follow-up interview was conducted to investigate the second research question. The findings of the qualitative inquiry involved open-ended interview questions. Interview questions were designed with the twofold purpose: (a) identifying whether participation in the ICWF entailed any attitudinal and behavioral changes with regard to water protection and conservation among 5th grade students, and (b) identifying whether the factors argued to be critical for environmental education programs (family involvement, hands-on activity, teacher's enthusiasm, teacher's role-modeling, and internal locus of control) had any association with children's ratings of the educational experiences they had at the ICWF and with their levels of attitude and behavior changes.

Research Question 2. Will there be an impact on the children's attitude/behavior such as detectable or self-reported changes, and what factors get involved in sustaining new behavioral changes?

Summary of Major Questions and Responses

Question 1. Do you remember any of the educational activities given in the festival?

Congruent themes demonstrating knowledge gain by the respondents are underlined in the following statements.

1. I learned that there is different stuff in the water, like different chemicals.
2. I learned that your brain has about 80% of water. You can only survive about two days without water, but you can survive up to 10 days without food.
3. **All living-things need water**, and there is actually water underneath the ground such as rivers, streams, creeks, and all that.

4. **What they do to filter out the water** before it gets to you.

5. That is **good for you to ensure not to pollute it**, and not to throw your garbage out into creeks. And it can do bad stuff to it.

6. A lot of things. I don't really remember.

Five of six respondents pointed out that they had learned new information about environment protection during the ICWF. Apparently, the majority of the respondents pointed to specific information that they had learned at the ICWF. Such responses indicated that not only did students gain new knowledge, but they were also able to retain the new information for a time period between the day of the event and the day of the interview (six month period).

**Question 2.** Have you changed any of your activities after the water festival (e.g., taking shorter shower, and turning the faucet off while brushing your teeth)?

Congruent themes indicating pro-environmental behaviors are underlined in the following statements.

1. I turn the water off when brushing my teeth; I always turn off the water; and, I try to take a short shower.

2. Not really. I turn the faucet off while brushing my teeth, and I did that before coming to the water festival, too. I take shower about 5 minutes and I, normally, don't need one.
3. I always shut off the water while brushing my teeth. I actually, kind of, took a shorter shower before the water festival, and it all depends on how I feel.

4. I don't leave the water running when I am doing dishes any more. I've always shut it off because my mom always told me so.

5. Yes, when I am brushing my teeth, I shut off the facet, and I've changed this after the water festival.

6. Yes, I just left it going before coming to the water festival, but now I turn off the water when I brush my teeth. And, I used to take really a long shower, but now I only take like 10 minutes or so.

All the respondents pointed out that they exercised pro-environmental behaviors, particularly regarding water conservation. Such behaviors include shutting off the facet while brushing teeth or doing dishes and taking a shorter shower. Three of six participants claimed that they altered their behavior as a result of participating in the ICWF. Other respondents indicated that they used to exercise pro-environmental behaviors before and continued to do so after participating in the event.

Question 3. Do you remember any of the educational activities given in the festival?

Congruent themes indicating information recall are underlined in the following statements.

1. I think I remember one. It was like a doctor guy, the magician.

2. I remember few.
3. I remember the magician and the game. One began where you answered questions about what you knew about the water.

4. Lunch session. There was a guy who talked about how they tested the water for, like certain chemicals in the water, and what they put in your water and how it gets to your house.

5. Yes, I sort of remember them. We went to a place, and he showed us about the water and what nutrients it had. We played some water games that we passed water from one person to another.

6. Yes, I liked the one professor who was teaching us about rocks.

All the respondents to some degree recalled specific information of some activities they learned during the festival, but they could not recall all the activities.

Question 4. What was the most fun educational activity? And why?

In the following statements, phrases pointing to students’ individual preferences of activities at the ICWF are underlined.

1. I liked the one that he would put some stuff in the water, and it would turn colors. And, he would know what was in it. I liked the trivia game.

2. I would say that it has to be the trivia game because it was fun. It was just cool how colors would turn when you put something in the water.

3. I would probably say the magician, because he did tricks and stuff.

4. I liked the trivial pursuit game we played. Because it was, kind of, fun being with other kids from different schools, and it was like a test that how much you
remember. And, I liked Chad because he explained how he cleaned up the trash in the river, and he talked about many interesting stuff that I did not know.

5. The Indian one, because it was fun and kind of explained it.

6. I don't have the favorite classroom activity one, but I liked the exhibit hall, a building with whole bunch of different projects that was part of the water festival.

Five of six respondents reported liking one activity the most. Although one respondent stated that there was no favorite classroom activity, but he favored the exhibit hall containing various hands-on projects that was the part of the festival. Although most of the students interviewed favored different activities, all of them appeared to prefer the types of educational strategies that utilized active participation techniques (i.e., games) and involved the element of unknown or unexpected (i.e., trivia activity and magician's tricks).

Question 5. What was the least fun educational activity? And why?

Underlined statements in the following section demonstrate students’ individual disfavor of certain activities at the ICWF.

1. I liked most of them, but the one I did not like was the treasure hunt. It was kind of hard because we had to write a lot of stuff down.

2. I did not like the classroom presentations at all. They were okay.

3. I would probably say that the one we learned about how much water and sugar in the bottles and stuff. It was too complicated. It was really too much information at one time.

4. Well, most of them I got in was pretty much fun.
5. We went to the science show-magic show, and I could not really hear. We really up in the auditorium, so I could not see.

6. I don't actually remember anything that I didn't like, because I liked them all.

All but one respondent reported disliking the classroom presentations at the festival because he knew most of them before coming to the festival through class projects and personal interest on the subject of water protection and conservation. The least favorite activities as well as the reasons for not liking them were different from student to student. Two respondents complained that some activities were too complicated and hard to do, which consequently caused their dissatisfaction with those particular activities. One student pointed that physical inconveniences was the main reasons for disliking a particular activity. One student could not hear very well and another student did not like water being sprayed around. At least one student interviewed claimed enjoying all the activities at the ICWF.

Summary of Major Themes

As suggested by the literature on the types of learning environment and instructions conducive to pro-environmental attitude formation and behavior change the following factors contribute to the success of environmental education programs designed for young children: (a) Family involvement, (b) Hands-on activity, (c) Teacher's enthusiasm, (d) Teacher's modeling, and (e) Internal locus of control. Probing questions directed at investigating the role of these five factors in the participants' educational experience were asked during
the qualitative interview followed six months after their participating in the ICWF. Students' responses with regard to the five factors contributing to the success of education programs are analyzed in the following section.

Phrases illustrating the degree of family involvement in students' environmental experiences are underlined in the following statements.

1. After the water festival, I just told them how fun it was and what we did.
2. I talked to mom and dad and told them where I went to.
3. I told them about water recycling a lot, and it is probably used over and over so many times that we cannot count on how many times has it been reused.
4. I talked to mom about what I did there.
5. After the water festival, I talked to my parents about how water comes to the house, and how it is treated and all that.
6. I did not really talk to them.

Five of six respondents reported having family conversations about the ICWF after their participating in the event. These five students shared their experiences at the festival and discussed water issues with their family members. One respondent, however, claimed not having any particular family discussions about water protection and conservation after attending the event.

Respondents were asked to identify whether the activities they were engaged in during the festival were mostly hands-on based. Underlined statements illustrate students' responses to this particular question.

1. He talked and did some experiments.
2. It was more hands-on type. I like doing stuff.
3. It was kind of hands-on.
4. Kind of both.
5. Hands-on activities.
6. It was sort of hands-on because you had to use different kinds of rocks.

Four of six students answered that classroom presentations were based on hands-on activities and two answered that they were both hands-on and presenters’ talk.

Statements below demonstrate students’ perceptions of teacher’s enthusiasm about the ICWF prior to the event. Respondents were asked to recall what type of information about water resources they were provided by the teacher before going to the festival.
1. We were just told what we are going to be doing.
2. Mostly about what would be in the water. We went over different water facts.
3. We talked about how water works and how we clean the water and stuff. It was actually part of our class unit and kinds of for the water festival.
4. We talked about what they put in the drinking water and what normally would be in the drinking water, and some science stuff about the drinking water.
5. We talked about the water recycling.
6. I don’t remember.

Despite the fact that all six respondents were students of one and the same teacher, their answers regarding water discussions initiated by the teacher
prior to attending the ICWF varied. Two respondents recalled going over water content and other facts about water. One student said that discussions about water were part of the section they were studying at the time, and therefore, they talked about water filtration. Another student remembered having conversations about water recycling. Yet, one respondent claimed not having remembered any information about water provided by the teacher prior to the festival.

Participants' responses to the question whether their teacher encourages recycling or not are underlined in the statements below.

1. **Yes**, she always tells us to recycle.
2. **Yes**, she recycles.
3. **Yes**, she always recycles.
4. It kind of depends what it is. **We do recycling.**
5. **Yes**. She does recycling.

All six respondents answered affirmatively to the question whether their teacher encouraged recycling.

Students were prompted to react to a hypothetical situation. They were asked what they would do if their local creek were polluted to the degree where it was impossible to swim or fish there any longer. Underlined statements illustrate participants' beliefs that they personally can do something to change the situation.
1. Maybe, we must stop using chemicals, and make farmers have pits for animal run-off, and test water.

2. Probably, I will try to help clean up the lake.

3. I will try to stop polluting and pick up things like trash around the river or do something. Yes, it will take a lot of work, though.

4. I will try to help clean it up. I think if you really try to get it clean with other people, you can get rid of it and prevent it.

5. Then, we go to the swimming pool.

6. We cannot use that water, but we can dig a well into the little pocket of river that is underground. Of course, an individual cannot solve the problem because problems will still be there but we can try to stop polluting. And, we can also try to clean the water, even though there still, probably, pollution is going on. We must go through whole system of cleaning the pollution.

Five of six respondents said that they personally would try to do something to change the situation. Three students, in particular, elaborated on the specific actions that could be undertaken to clean up the polluted lake. One respondent mentioned controlling farming waste, another participant tried to explain how to clean up the whole system by digging a well into a pocket of river, and another student said that picking up trash around the river would also help minimizing the pollution problem. While such responses might point to varying degrees of students' understanding of water pollution problems they illustrate
participants’ concern with the issue of environmental protection and suggest that students believe that their own actions can affect the environment.

**Summary of Qualitative Inquiry**

A qualitative inquiry was conducted to investigate the participants’ long-term effect of the attitudinal/behavioral changes six months after their attendance in the ICWF. Open-ended interview questions were used to answer the research question. Six students from a central Iowa, rural elementary school that completed both the pre/posttest CATES were interviewed. Responses to the major questions indicated that such findings as knowledge gain, new behavioral changes, and retaining specific information occurred after the children’s participating in the ICWF. The major themes also suggested that not only those factors like knowledge gain and behavioral changes are critical in the continuum of the behavioral change, but also other factors, for example, family involvement, teacher’s enthusiasm and role-modeling, student’s internal locus of control on environmental issues, and a curriculum that is hands-on are essential to reach the ultimate goals of environmentally responsible behaviors (ERBs). Although interview results reported positive findings, but students participating in the ICWF had different experiences depending on their background knowledge, personality type, learning style, and other factors that shape individual’s unique knowledge.
CHAPTER 5

CONCLUSIONS, RECOMMENDATIONS, AND DISCUSSION

The purpose of this study was to investigate the impact of the Iowa Children’s Water Festival on selected Iowa fifth graders’ attitudes and behaviors toward the environment. This study evaluated fifth graders’ attitudinal and behavioral changes toward the environment before and after their participating in the 2003 Iowa Children’s Water Festival (ICWF). To fulfill the purpose of the study, two research questions were posed and a hypothesis was tested. This chapter includes the following subsections: (a) conclusions, (b) recommendations for further research, and (3) discussion.

Conclusions

1. For the non-equivalent group of \( N = 50 \), participants’ environmental attitudes toward the environment slightly improved compared to that of non-participants, but the improvement was not found to be significant.

2. This study found that there was a moderate association between the participant and non-participant’s baseline attitudes toward the environment and the posttest attitudes (3 weeks interval).

3. There was not found any association between attendance of the ICWF and children’s attitudes toward the environment, as measured by the CATES instrument.

4. The CATES instrument might be not valid in measuring specific environmental attitudes related to water protection and conservation.
5. Although female participants' and non-participants' attitudes were found to be more pro-environmental compared to their male counterparts, such differences were not significant.

6. The geographical locales in this study were not a significant factor. A possible explanation might account for the state of Iowa's generally rural environment with few metropolitan areas.

7. Responses to the major questions of the qualitative inquiry indicated that knowledge gain, new behavioral changes, and retaining specific information occurred after the children's participating in the ICWF.

8. The major themes of the literature on the types of learning environment and instructions conducive to pro-environmental attitude formation and behavior change are also supported by the interview results that factors like family involvement, teacher's enthusiasm and role-modeling, student's internal locus of control on environmental issues, and a curriculum that is hands-on are essential to reach the ultimate goals of the environmentally responsible behaviors.

Recommendations

1. A similar study that includes more comparative control groups might be needed to increase the generalizability of the findings to different settings.

2. Due to potential threats to the internal validity, it is advisable to conduct a similar study that administers pre/posttest in different times of the year.

3. A similar study should be conducted employing different instruments that investigate children's attitudes toward the environment.
4. A future study should incorporate more schools that are equivalent to the composition of the experiment group.

5. A future study should investigate relationships among such variables that were identified as success factors: ownership, empowerment, teacher's enthusiasm and role-modeling, school curriculum, and family involvement.

Discussion

Two research questions were investigated in this study. The first research question addresses the quantitative findings, and the second research question delineates the results of the interview findings. Similarities and differences of the first and second research questions are discussed in the last section of this chapter.

Part I. Quantitative Findings

Statistical Conclusion Validity

Commonly identified threats to statistical conclusion validity are the following: low statistical power, violated assumptions, fishing and the error rate problem, reliability of measures, and reliability of treatment implementation (Cook & Campbell, 1979). To reduce Type II error, the power analysis was used to identify a minimum number of participants for the study. The power analysis suggested at least 310 participants in order to detect a one percent change due to the attendance of the ICWF when alpha was set at .05. This study includes a sample size of 316, and this number is big enough to detect the statistical validity.
for the sample size. Before testing the null hypothesis, normality of the data and certain assumptions were closely examined.

Internal Validity

Selection-Instrumentation. For the purpose of standardization of the survey implementation, an instructional sheet was provided to the participating teachers describing specific procedural steps in administering the survey instrument, but it doesn't ascertain reducing error in implementing the instrument due to variability of teacher's experiences, time of the day, physical environment. Thus, the variability may be resulted in increasing error variance or decreasing detection of the true differences.

Selection-Testing. Selection-testing might be a threat when taking the pretest could have affected the results of the posttest, or children in the experimental and the control group might have learned different information from the pretest. To reduce the selection bias, the ANCOVA was used to statistically control for baseline differences. Furthermore, more statistical control was achieved through controlling for gender, school type, and locale. Due to controlling confounding factors above, the 'selection bias' threat of 'selection-history', 'selection-maturation, and 'selection-testing' was reduced.

Selection-Regression. Only those schools that completed both pre/posttests were selected for the analysis; and, therefore, this study design eliminated schools that only returned either a pretest or a posttest. This might result in limiting the sample to schools with certain characteristics (e.g., private
rather than public, with a smaller class size, and teachers who are more aware of and enthusiastic about environmental issues). As it is argued in the literature, teacher's enthusiasm and role-modeling are among the significant success factors in the environmental education program. Thus, pre/posttest study design might have eliminated teachers who are less environmentally literate; and, consequently, children from these schools might have been excluded from the sample. Therefore, schools participating in this study might have scored higher on the environmental scale compared to their non-attending counterparts.

**Construct Validity**

Although the CATES might be a valid instrument measuring not only children's general but also specific attitudes toward the environment, as indicated by Musser and Malkus (1994), mono-operation bias has been a concern in the initial phase of this research. Particularly, it has been questioned whether the CATES is a valid instrument in detecting the impact of the ICWF on such specific attitudes toward the environment as water protection and conservation. To triangulate the findings of the quantitative results and to investigate the potential long-term effects of the children's attendance of the 2003 ICWF, a qualitative interview was also conducted. Evaluation apprehension might be a threat to the internal validly of this study. It is possible that some children in this study are apprehensive about what the positive, socially accepted attitudes toward the environment might be.
External Validity

According to the registration information obtained by the ICWF Steering Committee, 5th grade teachers of 38 elementary schools in Iowa returned their registration forms agreeing to participate in the 2003 ICWF. To increase the generalization of the findings, the researcher purposively classified the 38 participating schools according to such factors as district, school type, grade level (5th grade only), and number of students; and the equivalent control schools ($n = 37$) were then drawn based on the cluster. To determine the appropriate sample size from the sampling model, the statistical power analysis suggested a minimum number of 460 participants in order to detect a one percent change due to attending the ICWF, when alpha is set at .01. Subsequently, 230 participants were needed in each group. For the purpose of enhancing the chance of participation among the control group, number of participants was tripled ($n = 930$). The requested time frame for the pre/posttest was the following: Pretest-first week of May, 2003; Posttest-last week of May, 2003. Since this was a pre/posttest, evaluative study, only schools who returned both the pre/posttest were included in the analyses: 12/38 experimental group; 3/12 control group. This study was conducted a quite homogenous, rural state with a predominantly white population, and the largest city- Des Moines- with less than 200,000 residents; and, this study was limited to the selected Iowan 5th grade children’ s attitudes and behaviors toward the environment. Therefore, the findings of this
study do not reflect children's attitudes/behaviors of different geographical regions or other heterogeneous states.

**Part II. Qualitative Findings**

Will there be an impact on the children's attitude/behavior such as detectable or self-reported changes, and what factors get involved in sustaining new behavioral changes?

The findings of the qualitative inquiry involved open-ended interview questions. Interview questions were designed with the twofold purpose: (a) identifying whether participation at the ICWF entailed any attitudinal and behavioral changes with regard to water protection and conservation among 5th grade students and (b) identifying whether the factors argued to be critical for environmental education programs (family involvement, hands-on activity, teacher's enthusiasm, teacher's modeling, and internal locus of control) had any association with children's ratings of the educational experiences they had at ICWF and with their levels of attitude and behavior change. Six 5th grade students from one school were interviewed six months after participating in the ICWF. Participants' responses to the open-ended interview questions revealed that most students were able to recall specific information they learned at the ICWF six months after the event. When asked what they learned about water at the ICWF, five of six respondents named specific knowledge (i.e., water content, importance of water for living beings, process of water filtration, etc.) that they had not known prior to participating in the event. Such findings suggest that not
only did students gain new knowledge, but they were also able to retain the new information for a time period of six months between the day of the event and the day of the interview. And, since knowledge is one of the important variables that Hungerford and Volk (1990) view as a precursor to bringing about behavioral changes, interview findings project some optimism that ICWF positively impacts pro-environmental attitude formation consequently leading to behavior alteration.

While knowledge is important in the process of shaping pro-environmental behaviors of young children, it is not the only factor that determines success of the environmental education purpose. Thus, Hungerford and Volk (1990) claim that ownership or personal commitment to environmental issues largely affects individual’s engagement in environmentally responsible behavior. In this regard, all six interviewed students reported turning the water off when brushing teeth or washing dishes and taking shorter showers. In fact, three out of six participants claimed that they altered their behavior as a result of participating in the ICWF. Other respondents indicated that they used to practice pro-environmental behaviors before and continued to do so after participating in the event. Shutting the faucet off when brushing teeth or washing dishes and reducing the amount of time for taking a shower might serve as indicators of students’ personal commitment to the issues of water protection and conservation. Although only three out of six respondents stated that they altered their behavior as a result of the ICWF and other three participants claimed practicing pro-environmental behaviors even before attending the event, such responses apparently illustrate
an increased level of awareness of environmental issues among the participants. Thus, being aware of the particular actions that an individual might undertake on a daily basis to conserve water resources helped students alter their own behaviors.

On the basis of the literature review, five factors critical for the effectiveness of environmental education programs (i.e., family involvement, hands-on activity, teacher's enthusiasm, teacher's modeling, and internal locus of control) were considered when designing open-ended interview questions. Participants' responses were analyzed to determine whether these factors were associated with students' ratings of the ICWF and whether any of these factors alone or in a combination were correlated with attitudinal and behavioral change as reported by the respondents. When asked to recall the least favorite educational activity at the ICWF, most of the respondents were hesitant and many of them answered that they liked most of activities presented during the event. Such responses indicate that interviewed students rated their experience at the ICWF rather positively. Most of the respondents also thought that hands-on type of activities prevailed at the festival. And, when asked to recall the most favorite activity, all the participants reported enjoying the types of educational strategies that utilized active participation techniques (e.g., games) and involved the element of unknown or unexpected (e.g., trivia activity and magician's tricks). Lecture-based classroom presentations, too complicated assignments, and
activities presenting physical inconveniences reportedly caused dissatisfaction among the students.

A family environment where pro-environmental attitudes and behaviors are modeled by parents and family members is considered as one of the critical components of successful environmental education (Bredekamp, 1987; Furman, 1990; Marsters & Associates, 2002). This study interview questions were focused on identifying the level of family involvement in the discussions of the environmental issues as well as pro-environmental behavior patterns in the family prior to children's participation in the ICWF. Participants' responses revealed different water conservation and protection behavior patterns practiced in the family. However, analysis of students' responses illustrated that those children who were engaged in family discussions about the environmental issues raised at the ICWF and told about activities presented at the festival after participating in the event were more likely to practice pro-environmental behaviors (e.g., turning the water off when brushing teeth or doing dishes) even before attending the ICWF. Thus, for example, four of six respondents reported having discussions about water treatment, recycling, and filtration as well as discussions of the activities presented at the festival. Three of these four students also indicated that they did not alter their behavior directed at water conservation because they used to shut off the facet when brushing teeth and take a short shower even before attending the ICWF. One student simply mentioned to his parents where they went on the day of the event. The same
student claimed changing her daily activities as a result of attending the ICWF and trying turning off the water when brushing teeth instead of letting it run as she used to do before. One student, on the other hand, reported engaging in family discussions about water treatment, but still claimed changing her behavior to a more pro-environmental mode after participating in the ICWF. Therefore, while students’ responses to the open-ended interview questions indicate some relationship between family discussions of environmental issues and practice of pro-environmental behaviors, family involvement is not the only predicting factor of pro-environmental behavior of younger children.

Along with family involvement and preference of hands-on activities, such factors as teacher’s enthusiasm and teacher’s modeling are argued to be significant in shaping children’s environmentally responsible behaviors (Furman, 1990). All six respondents to the open-ended interview questions noted that their teacher modeled pro-environmental behavior by encouraging recycling and discussed water-related issues with the students prior to attending the festival.

Finally, internal locus of control, signifying that individuals believe that they are capable of changing the environment around them and, therefore, they are willing to participate in actions to do so is identified by Hungerford and Volk (1990) as an essential factor in sustaining environmentally responsible behaviors. An interview question prompting students to react to a hypothetical situation suggesting that their local source of water was dangerously polluted was targeted at detecting whether the respondents perceived the focal point of
control over water protection as internal or external. Five of six respondents said that they personally would try to do something to change the situation. Three students, in particular, elaborated on the specific actions that could be undertaken to clean up the polluted lake. Thus, one respondent mentioned controlling farming waste, another participant tried to explain how to clean up the whole system by digging a well into a pocket of the river, yet another student said that picking up trash around the river would also help minimizing the pollution problem. While such responses might point to varying degrees of students' understanding of water pollution problems, they illustrate the participants' concern with the issue of environmental protection and suggest that students believe that their own actions can affect the environment.

Overall, participants' responses to the open-ended interview questions suggest that attending the ICWF has enhanced their knowledge and understanding of the water-related issues and in some cases has encouraged behavior change manifested in such daily actions as turning the water off when brushing teeth or washing dishes and reducing time for taking a shower. Such factors as family involvement, hands-on activities, teacher's enthusiasm, teacher's modeling, and internal locus of control all appear to have an effect on students' ratings of their experiences at the festival and positively correlate with the levels of attitude and behavior change by the participants.
Similarities and Differences of the Findings

Some differences were found between the findings of the quantitative study and the qualitative interview. The main analysis of the quantitative study showed that there was no statistical difference in the children's attitudes toward the environment whether schools participated in the ICWF or did not participate. While there was an observed improvement of the posttest CATES scores among schools that participated in the event, this improvement was not found to be significant. The interview results, on the other hand, revealed various positive findings such as: (1) Participants' adoption of certain pro-environmental behaviors, like shutting the faucet off while brushing their teeth and taking a shorter shower, (2) Most students were able to recall specific information, and (3) Most students named specific knowledge gained at the festival like water content, importance of water for living beings, process of water filtration, etc.

Despite improved posttest CATES scores, however, a caution should be made in fully asserting that improved children's attitudinal changes toward the environment were solely because of the participation in the event. Wilson (1993) suggested that grade 4-6 children's attitudes can fluctuate in a short period of time due to such factors as physical maturity, psychological and emotional changes, intervention threats, and test effects. Similarly, Leeming and colleagues (1993) aptly point out that improved attitudes might be affected by other external factors including: participants' effect, school curriculum, and sampling bias.
Improved posttest scores and positive shifts in attitudes and behaviors, nevertheless, might not serve as a valid predictor for the long-term effects of the attitudinal and behavioral commitment in relation to environmental protection and conservation. One of the explanations could lie in the fact that since there is no single behavioral change model that clearly explains the process of adaptation of pro-environmental attitudes and behaviors, these findings might not directly lead to the long-lasting, positive environmentally responsible behaviors. In addition, conclusions about children's positive attitudinal/behavioral changes were limited to the responses of six students from a rural school, making it difficult to generalize the findings of the qualitative inquiry to different settings.

In summary, behavioral change is a complex process that is intertwined with various external factors. Therefore, it is not an easy task to develop an environmental education program that would entail uniform behavioral changes of the participants. Since there are no common grounds for the process of human behavioral change, this study was not focused on delineating how attitudes lead to behavioral changes, but rather it examined the extent of attitudinal and behavioral changes before and after participating in the ICWF, over the six month time period. This study was limited to examining the entry level variables of Hungerford and Volk's ECB model. In order to investigate the complete circle of the behavioral impacts, different levels (i.e., ownership variables and empowerment variables) should be integrated as a part of the investigation.
REFERENCES


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Wisconsin Department of Public Instruction. (1994). *A guide to curriculum planning in environmental education.* Madison, WI.

Dear District Superintendent,

My name is Sang-Min Kim and I am a doctoral student of the College of Education at the University of Northern Iowa. Currently I am working as a research assistant at the University under the supervision of Dr. Catherine Zeman, Assistant Professor of the Health Division, and Director of the Recycling and Reuse and Technology Transfer Center at UNI. In addition, I am also a member of the Iowa Children’s Water Festival education committee, which is chaired by Mr. James Caldwell of the U.S. Geological Survey in Iowa City.

In close collaboration with the ICWF Education Committee and my research advisor, I am preparing a research study for my doctoral dissertation on “Selected Iowa Children’s General Attitudes toward the Environment.” In order to measure the children’s attitudes toward the environment, we need to administer environmental attitude surveys (pre/post) in your school with your consent. These attitude surveys (pre/post) are designed to be delivered to 5th grade students by the classroom teacher. Participation is completely on a voluntary basis.

The purpose of this letter is the following: (1) to request your support to participate in the pre-post environmental attitude surveys, (2) to inform you that what we intend to measure.

One thing I would like to clarify is that this evaluative research will be used both for the ICWF (in a large part for the improvement of the ICWF itself), and partly for my dissertation data.

The details of the research procedure, preferred pre/post survey time periods, and specific instructions are provided on the next page.

Your participation and cooperation is crucial to continuously improve the quality of the ICWF and for purposes of completing a doctoral dissertation. Again, thank you for your cooperation.
Parental information sheets, parental and child consent forms, a copy of the survey and instructions are enclosed.

If have any questions, please contact Sang-Min Kim.

Dr. Catherine Zeman  
WRC 239  
University of Northern Iowa  
Cedar Falls, IA 50614-0241  
E-mail: catherine.zeman@uni.edu  
Phone number: 319-273-7090

Sang-Min Kim  
WRC 224B RRTTC  
University of Northern Iowa  
Cedar Falls, IA 50614-0241  
E-mail: kims0919@uni.edu  
Phone number: 319-222-6201

Sincerely  

Catherine Zeman  

Sincerely

Sang-Min Kim
Dear Classroom teachers,

My name is Sang-Min Kim and I am a doctoral student of the College of Education at the University of Northern Iowa, and I am writing this letter to you on behalf of the University of Northern Iowa and the Iowa Children’s Water Festival. I would like to thank you and your class for participating in the 2003 Iowa Children’s Water Festival.

Currently I am working as a research assistant at the University under the supervision of Dr. Catherine Zeman, Assistant Professor of the Health Division, and Director of the Recycling and Reuse and Technology Transfer Center at UNI. In addition, I am also a member of the Iowa Children’s Water Festival education committee, which is chaired by Mr. James Caldwell of the U.S. Geological Survey in Iowa City.

To ensure improvement of the ICWF, evaluations of the classroom presentations and educational materials have been informally conducted since the beginning of the Iowa Children’s Water Festival in 1997. In close collaboration with the ICWF education committee and my research advisor, I am preparing a comprehensive and summative evaluation for the ICWF in terms of children’s educational output and the effectiveness of the classroom presentation. Specifically, we are going to measure the extent of fifth graders’ attitude toward the environment and the effectiveness of the classroom presentations.

In order to measure the children’s attitude toward the environment and water education issues, we need to administer environmental attitude surveys (pre/post) in your class with both your and the parents’ consent. These attitude surveys (pre/post) are designed to be delivered to your students by you, the classroom teacher. Participation is completely on a voluntary basis.

The purpose of this letter is the following: (1) to inform you and your class of what we intend to measure, (2) to request your support to participate in the pre-post environmental attitude surveys.
One thing I would like to clarify is that this evaluative research will be used both for the ICWF (in a large part for the improvement of the ICWF itself), and partly for my dissertation data.

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WRC 224B RRTTC
University of Northern Iowa
Cedar Falls, IA 50614-0241

Phone number: 319-222-6201
E-mail: kims0919@uni.edu

Sincerely

Sang-Min Kim
Dear parents and legal guardians,

My name is Sang-Min Kim and I am a doctoral student of the College of Education at the University of Northern Iowa, and I am writing this letter to you on behalf of the University of Northern Iowa and the Iowa Children’s Water Festival. I would like to thank you and your child to participating in the 2003 Iowa Children’s Water Festival.

Currently I am working as a research assistant at the University under the supervision of Dr. Catherine Zeman, Assistant Professor of the Health Division, and Director of the Recycling and Reuse and Technology Transfer Center at UNI. In addition, I am also a member of the Iowa Children’s Water Festival Education Committee, which is chaired by Mr. James Caldwell of the U.S. Geological Survey in Iowa City.

To ensure improvement of the ICWF, evaluations of the educational presentations and educational materials have been informally conducted since the beginning of the Iowa Children’s Water Festival in 1997. In close collaboration with the ICWF education committee and my research advisor, I am preparing a comprehensive and summative evaluation for the ICWF in terms of children’s educational output and the effectiveness of the educational presentations. Specifically, we are going to measure the extent of the fifth graders’ attitude toward the environment and the effectiveness of the educational presentations.

In order to measure the effectiveness of the ICWF and the children’s educational gain, particularly, the extent of fifth graders’ attitude change toward the environment and water education issues, we are requesting your permission to allow your child to participate in the research process. His/her participation ensures the educational gains for upcoming fifth graders, future attendees, and the ICWF itself.

Additional details about the survey are attached.
Your participation and cooperation is crucial to continuously improve the quality of the ICWF and for the development of my dissertation work. Again, thank you for your cooperation.

If have any questions, please contact Sang-Min Kim.

WRC 224B RRTTC
University of Northern Iowa
Cedar Falls, IA 50614-0241

Phone number: 319-222-6201
E-mail: kims0919@uni.edu

Sincerely

Sang-Min Kim
Instructional sheet

I. Time Period

• Before May 5, please send forms home with students and have their parents and the student complete and sign the forms.

• Pretest
  ✓ Preferred pre-festival survey time period
    ▪ May 5th – May 9th

• Posttest
  ✓ Preferred post-festival survey time period
    ▪ May 26th – May 30th

II. Checklist

Please

• Send forms home with students and have their parents and the student sign the forms prior to May 5th, 2003. * Forms are:
  ➢ (1) A letter to the parents and legal guardians
  ➢ (2) UNI Human Participants Review Informed Consent

• Do not administer the attitude survey to those students whose parents and legal guardians’ consent form is not signed.

• Do not administer the attitude survey to the children who have not signed the children’s consent form.

• Explain to children that there will be no discomfort or discrimination against those who do not participate in the survey.

II. The survey (pre/post) procedure

a) Before administering the attitude survey, please explain the following to the children:
1. For each question, children are told to choose which of the two groups of children (the group described on the left side of the word but or the group described on the right side of the word but) they are like.

2. Once they have made this decision, tell the children to put a check mark in the big box if they are a lot like the described children or a check mark in the small box if they are only a little like the children described in the statement.

b) During the attitude survey, if necessary read the questions to the children.

c) After administering the attitude survey, please bring the completed survey with you to the ICWF and turn these in at the time of the registration. Please mail the post-festival attitude survey to the following address.

Sang-Min Kim
WRC 224 RRTTC
University of Northern Iowa
Cedar Falls, IA 50614

Phone number: 319-222-6201

E-mail: kims0919@uni.edu
APPENDIX C

QUESTIONNAIRES
## Children’s Attitudes Toward the Environment—Musser and Malkus (1994)

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<tbody>
<tr>
<td>1.</td>
<td>Some kids like to leave water running when they brush their teeth.</td>
<td>but</td>
<td>Other kids always turn the water off while brushing their teeth.</td>
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<td>2.</td>
<td>Some kids use both sides of the paper when they draw or write.</td>
<td>but</td>
<td>Other kids use only one side of the paper when they draw or write.</td>
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<td>3.</td>
<td>Some kids think we should throw things when we’re done with them.</td>
<td>but</td>
<td>Other kids think we should recycle things.</td>
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<td>4.</td>
<td>Some kids think dams on rivers are bad because they hurt plants and animals.</td>
<td>but</td>
<td>Other kids think dams on rivers are good because they prevent floods.</td>
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<td>5.</td>
<td>Some kids like to bring home plants or bugs they find outside.</td>
<td>but</td>
<td>Other kids like to look at plants or bugs outside but they never bring them home.</td>
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<td>6.</td>
<td>Some kids don’t like to make bird feeders or bird houses.</td>
<td>but</td>
<td>Other kids like to make bird feeders or bird houses.</td>
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<td>7.</td>
<td>Some kids think outdoor lights should be turned off at night because they use electricity.</td>
<td>but</td>
<td>Other kids think outdoor lights should be left on at night because they keep us safer.</td>
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<td>8.</td>
<td>Some kids think people are more important than animals.</td>
<td>but</td>
<td>Other kids think people and animals are equally important.</td>
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<td>9. Some kids are concerned about the rain forest.</td>
<td>but</td>
<td>Other kids aren’t concerned with about the rain forest.</td>
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<td>10. Some kids think we should build more landfills to hold our garbage.</td>
<td>but</td>
<td>Other kids think we should find other ways to deal with our garbage.</td>
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<td>11. Some kids like visiting national parks.</td>
<td>but</td>
<td>Other kids don’t like to go to national parks.</td>
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<td>12. Some kids don’t worry about animals becoming extinct.</td>
<td>but</td>
<td>Other kids worry about animals becoming extinct.</td>
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<td>13. Some kids throw things away when they are done with it.</td>
<td>but</td>
<td>Other kids reuse thinks or give them to other people to use.</td>
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<td>14. Some kids think we should use chemicals and fertilizers in our gardens.</td>
<td>but</td>
<td>Other kids think we shouldn’t use chemicals and fertilizers in our gardens.</td>
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<td>15. Some kids pick up trash and throw it away.</td>
<td>but</td>
<td>Other kids don’t like to pick up smelly trash.</td>
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<td>16. Some kids don’t sort their trash.</td>
<td>but</td>
<td>Other kids sort their trash and recycle it.</td>
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<td>17. Some kids like to lover where there are lots of plants and animals.</td>
<td>but</td>
<td>Other kids like to live where there are lots of people.</td>
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<td></td>
<td>Some kids touch or catch wild animals.</td>
<td>but</td>
<td>Other kids never tough or catch animals they find outside.</td>
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<td></td>
<td>Some kids don’t like to carpool because they don’t like being crowded in the car.</td>
<td>but</td>
<td>Other kids like to carpool even if it is a little crowded.</td>
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<td>Some kids are excited about solar energy.</td>
<td>but</td>
<td>Other kids don’t care about solar energy.</td>
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<td></td>
<td>Some kids believe people should be able to live wherever they want.</td>
<td>but</td>
<td>Other kids believe that people should be careful not to destroy animals’ homes.</td>
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<td>Some kids worry about air pollution.</td>
<td>but</td>
<td>Other kids don’t worry about air pollution.</td>
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<td></td>
<td>Some kids think we should be able to hunt all wild animals.</td>
<td>but</td>
<td>Other kids think that animals need protection.</td>
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<td></td>
<td>Some kids turn off the lights when they leave.</td>
<td>but</td>
<td>Other kids leave the lights on.</td>
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<td></td>
<td>Some kids get their parents to drive them places they want to go.</td>
<td>but</td>
<td>Other kids ride their bikes or walk when they can.</td>
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</tbody>
</table>
INTERVIEW QUESTIONS

1. Do you remember any of the educational activities given in the festival?
2. Were the classroom presentations hands or lecture type?
3. What kinds of things did you talk to your teacher before coming to the festival?
4. What kinds of issues did you talk to your teacher after the festival?
5. What kinds of issues did you talk to your parents and grandparents or your brothers and sisters?
6. What kinds of things did you talk to your parents and grandparents or your brothers and sisters?
7. Does your teacher recycle papers and encourage you to use both sides of the paper?
8. Does your teacher recycle papers and encourage you to use both sides of the paper?
9. If Minerva creek is polluted, so you can not go swimming or fishing, what are you going to do? Do you think you can get it clean? Why? Why not?
10. Do you recall this project?
11. One of the UNI professors told you about how Indians believe about the water. Do you recall?
12. Did you finish a homework called “myth about water” from a professor from UNI?
13. Have you had a chance to talk about the water story with your parents?
14. What kinds of things did you learn about water and environmental protection in the water festival?
15. What was the most fun educational activity? And why?
16. What was the least fun educational activity? And why?
17. Have you changed any of your activities about water and environmental protection after the festival?
18. Do you turn the water off while brushing your teeth?
APPENDIX D

HUMAN PARTICIPANTS REVIEW LETTERS
Invitation to Participate: Your child has been invited to participate in a research project conducted through the University of Northern Iowa. The University requires that you give your signed consent to allow your child to participate in this project. The following information is provided to help you make an informed decision about whether or not to allow your child to participate.

Nature and Purpose: This study is designed to investigate fifth graders’ attitudes toward the environment.

Explanation of Procedures: During the 1st week of May, teachers will administer a survey questionnaire regarding attitudes toward the environment to your fifth grade student. The survey consists of 25 questions, and normally it takes about 20 minutes or less for the fifth graders to complete with the help of the classroom teacher. The same survey will be administered during the last week of May to the fifth grade students following their attendance at the ICWF. Your child’s classroom teacher will administer the survey and return the completed surveys to UNI. Your child will be assigned a participant number and will not be identified.

Discomfort and Risks: This survey inquires about the fifth graders’ attitude toward the environment; and risks are minimal. This questionnaire is not designed to investigate any physical, psychological, social, legal, or economic conditions of the fifth grade student but to inquire about their attitudes regarding the environment.

Benefits: There is no financial or any other type of compensation as a result of participating this study.
Confidentiality: The data will provide information about students' attitudes toward the environment that will be used to enhance environmental education programs. Classroom teachers will administer the survey. Each student will be assigned a participant number to insure confidentiality. The UNI researcher will see only this participant number nor your child name, address or any other child identities.

Right to Refuse or Withdraw: This study is based on your child's willingness to voluntarily participate, and this study does not use any types of coercive methods to encourage the participation. Before the teacher administers the survey, or during the survey, your child is totally free to withdraw from participation. By doing so, your child will not be penalized or lose benefits to which he/she is otherwise entitled.

Questions: If you have questions about the study, please contact Mr. Sang-Min Kim at 319-222-6201 or his dissertation chairperson Dr. Catherine Zeman at the Department of HPELS, University of Northern Iowa 319-273-7090. You can also contact the office of the Human Participants Coordinator, University of Northern Iowa, at 319-273-2748, for answers to questions about rights of research participants and the participant review process.

Agreement:

I am fully aware of the nature and extent of my child's participation in this project as stated above and the possible risks arising from it. I hereby agree to allow my son/daughter to participate in this project.

(Signature of parent/legal guardian) (Date)

(Printed name of parent/legal guardian) (Printed name of child participant)
Project Title: The Impact of the Iowa Children’s Water Festival on the Children’s Attitudes and Behaviors toward the Environment

Name of Principal Investigator(s): Sang-Min Kim

I, ______________, have been told that one of my parents/guardians has given his/her permission for me to participate in a survey about the Iowa Children’s Water Festival. I will complete the survey before I attend the festival and after I attend the Iowa Children’s Water Festival.

I understand that my participation is voluntary. I have been told that I can stop participating in this survey at any time. If I choose to stop or decide that I don’t want to participate in this project at all, nothing bad will happen to me. My grade will not be affected in any way.

________________________   ____________________
Name                      Date
Date: April 30, 2003

To: Sang-Min Kim
3002 Jennings Drive
Cedar Falls, IA 50613

From: Dr. Mary E. Losch, Chair
UNI Human Participants Review Committee
(Institutional Review Board)

Title: The extent of Iowan 5th graders' attitudinal changes toward environment after attending Iowa Children's Water Festival

Re: ID# 02-0274

Based on your modifications, your project "The extent of Iowan 5th graders' attitudinal changes toward environment after attending Iowa Children's Water Festival," has been deemed minimal risk and reviewed by the IRB through the expedited review procedure authorized by 45 CFR 46.110. For your project, the applicable expedited category referenced in 45 CFR 46.110 of the federal regulations is:

Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

You may begin enrolling human research participants in your project. If you modify your project in a way that increases the physical, emotional, social, or legal risk to the participants or you change the targeted participants, you should notify the Human Participants Review Committee in the Graduate College Office before continuing with the research. Additionally, your project must be reviewed annually. You will receive a notification and continuing review form approximately 10 months from now asking for an update on your project.

If you have any further questions about the Human Participants Review policies or procedures, please contact me at mary.losch@uni.edu or David Walker, the Human Participants Committee Administrator, at 319.273.6148 or email david.walker@uni.edu. Best wishes for your project success.

cc: Institutional Review Board
Catherine Zeman
APPENDIX E

MEAN DIFFERENCES OF THE PRE/POSTTEST AMONG THE EXPERIMENTAL GROUP IN THE CATES
Mean Differences of the Pre/Posttest among the Experimental Group in the CATES (n = 274)

<table>
<thead>
<tr>
<th>Q.</th>
<th>Pre</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1. Some kids like to leave water running when they brush their teeth.</td>
<td>3.10</td>
<td>0.06</td>
<td>4.85*</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>3.43</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q2. Some kids use both sides of the paper when they draw or write.</td>
<td>2.82</td>
<td>0.99</td>
<td>4.72*</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>2.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q3. Some kids think we should throw away things when we’re done with them.</td>
<td>2.81</td>
<td>0.07</td>
<td>4.84*</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>3.17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q4. Some kids think dams on rivers are bad because they hurt plants and animals.</td>
<td>2.12</td>
<td>0.08</td>
<td>3.45*</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>2.39</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q5. Some kids like to bring home plants or bugs they find outside.</td>
<td>3.04</td>
<td>0.07</td>
<td>3.05*</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>3.27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q6. Some kids don’t like to make bird feeders or bird houses.</td>
<td>2.59</td>
<td>0.08</td>
<td>2.93*</td>
<td>0.00</td>
</tr>
<tr>
<td>Post</td>
<td>2.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q7. Some kids think outdoor lights should be turned off at night.</td>
<td>2.49</td>
<td>0.08</td>
<td>2.09*</td>
<td>0.03</td>
</tr>
<tr>
<td>Post</td>
<td>2.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q8. Some kids think people are more important than animals.</td>
<td>3.48</td>
<td>0.06</td>
<td>0.63</td>
<td>0.53</td>
</tr>
<tr>
<td>Post</td>
<td>3.51</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q9. Some kids are concerned about the rain forest.
Pre 2.84 0.07 3.10* 0.00
Post 3.06

Q10. Some kids think we should build more landfills to hold our garbage.
Pre 3.27 0.07 0.11 0.91

Q11. Some kids like visiting national parks.
Pre 3.23 0.06 -0.12 0.91
Post 3.22

Q12. Some kids don’t worry about animals becoming extinct.
Pre 3.24 0.67 2.13* 0.03
Post 3.38

Q13. Some kids throw things away when they are done with them.
Pre 2.57 0.07 4.72* 0.00
Post 2.90

Q14. Some kids think we should use chemicals and fertilizers in our gardens.
Pre 2.53 0.07 3.38* 0.00
Post 2.78

Q15. Some kids pick up trash and throw it away.
Pre 2.82 0.06 2.40* 0.01
Post 2.98

Q16. Some kids don’t sort their trash.
Pre 2.45 0.08 3.98* 0.00
Post 2.76

Q17. Some kids like to live where there are lots of plants and animals.
Pre 2.85 0.08 1.15 0.25
Post 2.94

Q18. Some kids touch or catch wild animals.
Pre 2.24 0.07 -2.74* 0.00
Post 2.04

Q19. Some kids don’t like to carpool because they don’t like being crowded in the car.
Pre 2.57 0.07 3.70* 0.00
Post 2.84

Q20. Some kids are excited about solar energy.
Pre 2.66 0.07 1.45 0.15
Post 2.80
<table>
<thead>
<tr>
<th>Question</th>
<th>Pre</th>
<th>Post</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q21. Some kids believe people should be able to live wherever they want.</td>
<td>3.24</td>
<td>3.24</td>
<td>0.10</td>
<td>0.92</td>
</tr>
<tr>
<td>Q22. Some kids worry about air pollution.</td>
<td>3.16</td>
<td>3.20</td>
<td>0.58</td>
<td>0.56</td>
</tr>
<tr>
<td>Q23. Some kids think we should be able to hunt all wild animals.</td>
<td>3.30</td>
<td>3.36</td>
<td>1.04</td>
<td>0.30</td>
</tr>
<tr>
<td>Q24. Some kids turn off the lights when they leave.</td>
<td>3.25</td>
<td>3.29</td>
<td>0.57</td>
<td>0.57</td>
</tr>
<tr>
<td>Q25. Some kids get their parents to drive them places they want to go.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* *p* <.05