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# The Impact of a One-Half Day Environmental Education Program on Elementary Students

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# THE IMPACT OF A ONE –HALF DAY ENVIRONMENTAL EDUCATION PROGRAM ON ELEMENTARY STUDENTS

By

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# THE IMPACT OF A ONE – HALF DAY ENVIRONMENTAL EDUCATION PROGRAM ON ELEMENTARY STUDENTS

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The hypothesis of this research is that elementary students benefit from the Kalamazoo Nature Center's (KNC) one-half day inquiry program, based upon data collected using a Likert scale instrument. The earth science inquiry program at KNC is intended to enhance student attitude about the natural environment. There are two primary components to the research. First, data were collected through a pre-/post-survey from elementary students who participated in the Kalamazoo Nature Center's one half-day environmental education program. The survey was based on the Test of Science Related Attitudes (Fraser, 1981). Second, data were analyzed to assess student attitudes and beliefs before and after the program. Data results suggest no significant change in student attitudes or beliefs as a result of the one-half day inquiry-oriented environmental science experience. This research may help identify positive ways to implement environmental educational programs that model student outcomes.

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# CHAPTER I

# INTRODUCTION

This project focused on changes in attitudes and beliefs among elementary students who were engaged in a one-half day program devoted to environmental education. The purpose of this project was to study the effects of this brief, but intense, program on elementary students' attitudes and beliefs. It was unique in that the project's focal point was within the learning context of the Kalamazoo Nature Center (KNC). The study integrated several variables that influence attitudes and evaluated them through a science survey scale. The question asked throughout this study was: Do students' attitudes and beliefs about the environment change as a result of a one-half day program at KNC? The research was also intended to complement and accompany other studies that also "intended to investigate and evaluate the present status of, and recent trends in, the teaching of the subject at elementary levels" (Lidstone & Stoltman, 2002, 309), because attitudes and beliefs affect knowledge of the environment and the human condition in general.

This study attempted to complement other studies focusing on environmental education interventions. Most studies suggest that environmental education's focus is typically on community participation with little attention devoted to programs for teachers and students. McKeown-Ice's (2000) survey of formal teacher training programs regarding environmental education found that, in general, students had limited access to environmental education content and methods. According to McKeown-Ice, many schools required preservice teachers to take coursework in the natural and social sciences.

However, because environmental science as a discipline is not taught at the elementary level, less than one third of the responding institutions gave students a background in environmental issues (Powers, 2004). This is why the question of emphasis and impact of one-half day courses on the teaching of the earth and environmental sciences to elementary students was investigated. Perhaps if there were more similar programs available, the teaching of the earth and environmental sciences to elementary students would be enhanced. It is well documented that the way science is taught reinforces students' attitude toward science (Rutherford & Ahlgren, 1991). This researcher believes this applies to beliefs about the environment as well.

Effective environmental preservation and conservation depends on an educated population. Without environmental education opportunities such as those at the Kalamazoo Nature Center, elementary students may not adequately develop positive attitudes and beliefs towards and about the environment. Without positive attitudes and beliefs developed over time, there might not be interest in protecting an outdoor environment to be enjoyed by future generations. Less protection of the outdoor environment might decrease the number of potential residents coming to the region. Less environmental awareness and fewer chances for the outdoor environment to be conserved are believed to have negative consequences. Promoting the environmental education of elementary students within Kalamazoo County could result in an enhanced attitude and belief toward and about the environment as well as the importance of outdoor recreation sites. Kalamazoo's Vision Council has already forecasted that the City of Kalamazoo will need additional outdoor recreation sites as students under the age of 20 represent 29.9% of the total population (Vision Council, 2005).

The Council also forecast that future demand for recreation facilities for mature families will increase (Vision Council, 2005). Positive attitudes and beliefs among residents may result in a community that is more involved and knowledgeable about their future environment. Therefore, the elementary student population is an important group to focus on for enhancing the attitudes and beliefs within the community. As reported by Brundtland (1987), securing the common future will involve new energy and openness, fresh insight, and an ability to look outside the narrow bounds of local or national frontiers. The young are better at this than adults.

Despite known positive relationships between learning and attitude, achievement oriented educational environments tend to ignore students' overall perceptions of and attitudes toward a subject (Rodriguez, 2004). The present study is distinctive because it focused on research of student attitude and belief about the environment within contextual learning about environmental concepts and issues at KNC. More specially, the students at KNC who participated in environmental programs were expected to develop an enhanced or more positive attitude and belief toward and about the environment than if they did not participate.

This assessment of students' attitudes and beliefs will provide baseline data on environmental attitudes in 2005-2006. Kalamazoo, like many other locations, has a major stake in maintaining an attractive environment in order for its residents to positively perceive their surroundings. This study can help those interested in promoting environmental policies and plans for elementary schools and educational institutions. It will also help target certain groups that may need more education regarding environmental concepts, along with getting them more involved in the environment.

Organization of Thesis

Chapter 2 discusses the pertinent literature associated with this study. Topics include perceiving one's natural surroundings, environmental attitude, measuring one's beliefs about and attitude towards one's environment, and enhancing those attitudes and beliefs through instruction. Chapter 3 presents the methodology for this study. Within this chapter, the study site, data collection procedure and analysis tests are described. Chapter 4 provides the analyses of data. Chapter 5 summarizes the entire research project and suggests ideas for future research stemming from this project.

# CHAPTER II

# LITERATURE REVIEW

## Attitude and Belief

The focus of this study is on the concept of environmental attitudes and beliefs "as opposed to factual knowledge" (Rickinson, 2001, 275). Attitude and belief can be a complex phrase with many different views. It can involve concepts such as environment, which influences perception, which, in turn, influences environmental attitude. Attitude can have an effect on one's achievement. For this reason it is important to establish a meaning of the term 'environment', the term 'environmental attitude', as well as the phrase 'attitudes and beliefs'. These three concepts guided this study. Environment is described as everything physical, social, and cultural that influences and affects one's outlook and development. Environmental attitude is defined as the disposition that affects how someone perceives and interprets environmental conditions, which in turn influences and affects one's outlook and personal development (DeChano, 2006). Perception of the environment is considered a mental construct resulting from how things and events are seen or perceived (Golledge & Stimson, 1997), or in other words, how a learner makes sense of nature or an environmental program (Rickinson, 2001). Emel (1994) has affirmed that the study of environmental perception in geography places emphasis on the diverse ways in which one's understanding of their surroundings influences their performance within the environment. The focal point of the present study was placed on how elementary students' attitudes toward and beliefs about the environment are changed when given a treatment such as an environmental program.

DeChano (2006) has acknowledged perception as an immediate action leading to instantaneous behavior that is dependent upon stimuli that are accommodated at once. It is this immediate perception and more specifically, the attitude toward and beliefs about the environment that was measured by the present researcher before and after an educational treatment for elementary aged students attending the Kalamazoo Nature Center (KNC).

Attitudes and beliefs may be positive, negative, or some gradation between the categories. Brookfield (1969) believes that when people operate in an environment, they base their decisions as they perceive, or see, the environment. Furthermore, Golledge and Stimson (1997) state that if an individual is not sensitive and responsive to the environment, he or she would not be able to satisfy his or her needs, communicate with others, or derive pleasure from his or her surroundings. For this reason, the present researcher believes it is important to study the attitudes and beliefs of a sample of Kalamazoo County's elementary-aged students to determine if learning opportunities in environmental education affect student attitudes and beliefs toward and about the environment.

Based on the Constructivist Approach, the individual contributes greatly to the process of perception, as well as attitude and belief, because of past experiences (Von Secker & Lissitz, 1999). A study by Rickinson (2001) found that students' perception, in addition to attitude and belief, might be shaped by socio-economic setting, gender, experiences of nature, and exposure to images and ideas within the media. Each of which may influence one's beliefs. Personal beliefs appear to influence the attributes of what is perceived (Golledge & Stimson, 1997). Cycleback (2003, 2005) asks: Positive

achievement arising from a belief is not proof that the belief is correct, but does positive belief, which is influenced from one's perception, show the way to positive achievement? Environmental belief forms the basis of our knowledge about the environment and environmental attitudes. If environmental belief and attitude can be enhanced, it may be likely that one will become an environmentally positive individual. Golledge and Stimson (1997) declare that learning affects how much something is perceived and understood by a person, and the person's attitude helps determine how well they understand the relevance of it. Therefore, attitudes have been recognized as an important factor in predicting individual differences in environmental educational application, learning, and achievement (Evans, 1965). However, the attitude and belief one has towards the environment is difficult to measure and to interpret.

There are several schools of thought when it comes to measuring one's belief of and attitude towards the environment. Krech, Crutchfield and Ballackey (1962) and Walker and Fraser (2005) confirmed that attitude is really a combination of three things: 1) affective - related to one's feelings associated with something (good or bad); 2) behavioral - related to the action one takes in response to something; and 3) cognitive - one's evaluative belief or thinking related to something's value. Amedeo and Golledge (1975) stressed that cognitive processes, such as perceiving, learning, and forming attitudes, operate to enable a person to be aware of, or know an environment. Therefore, the difference between affective and cognitive is that affective is characterized by emotion involving feelings more than understanding. Cognition is the process of knowing that entails recognizing and processing information. Fishbein and Ajzen (1975) introduced another method for measuring attitude. It incorporated the same underlying

idea of Krech et al. (1962) and Walker and Fraser (2005), but they argued that the measure of attitude should be primarily about what is happening at the present time without any prior background influence. Behavioral and cognitive factors should be measured individually and not require a relationship among the three components.

The present researcher intended to measure the way one's feelings and thinking that are associated with something, and to examine other related factors. Through reviews of empirical investigation of attitudes towards science during childhood, individual studies have explored many factors that influence a child's attitude and belief toward and about the environment. As described by Francis and Greer (1999), research often considers achievement (Fraser, 1982; Germann, 1988), age (Hadden & Johnstone, 1983), individualized curriculum (Sherwood & Herron, 1976), instructional strategy (Story & Brown, 1979; Hess & Schrigley, 1981), relationship with teachers (Hasan, 1985), and influences of teachers and learning environments (Haladyna, Olson, & Shaughnessy, 1982; Fraser & Fisher, 1982). The researcher of the present study examined several of these influences by measuring attitude and belief through a science related attitude scale.

The elementary student's attitude and belief toward and about the environment can be linked with common factors that may influence those attributes. Figure 1 summarizes factors that may influence student attitude and belief. First, the community and environment in which the student lives and interacts may greatly influence attitude and belief. Second, students may take part in an environmental program at a nature center, which may influence their attitude and beliefs. Third, teachers of these students, whom students interact with five days a week, may influence students' attitude toward and beliefs about the environment. Regional environmental education programs

incorporating science objectives and offered to teachers, may be passed to elementary students and influence their attitude toward and beliefs about the environment. It is the second factor, students taking part in a nature center program that the researcher of this study investigated more closely.

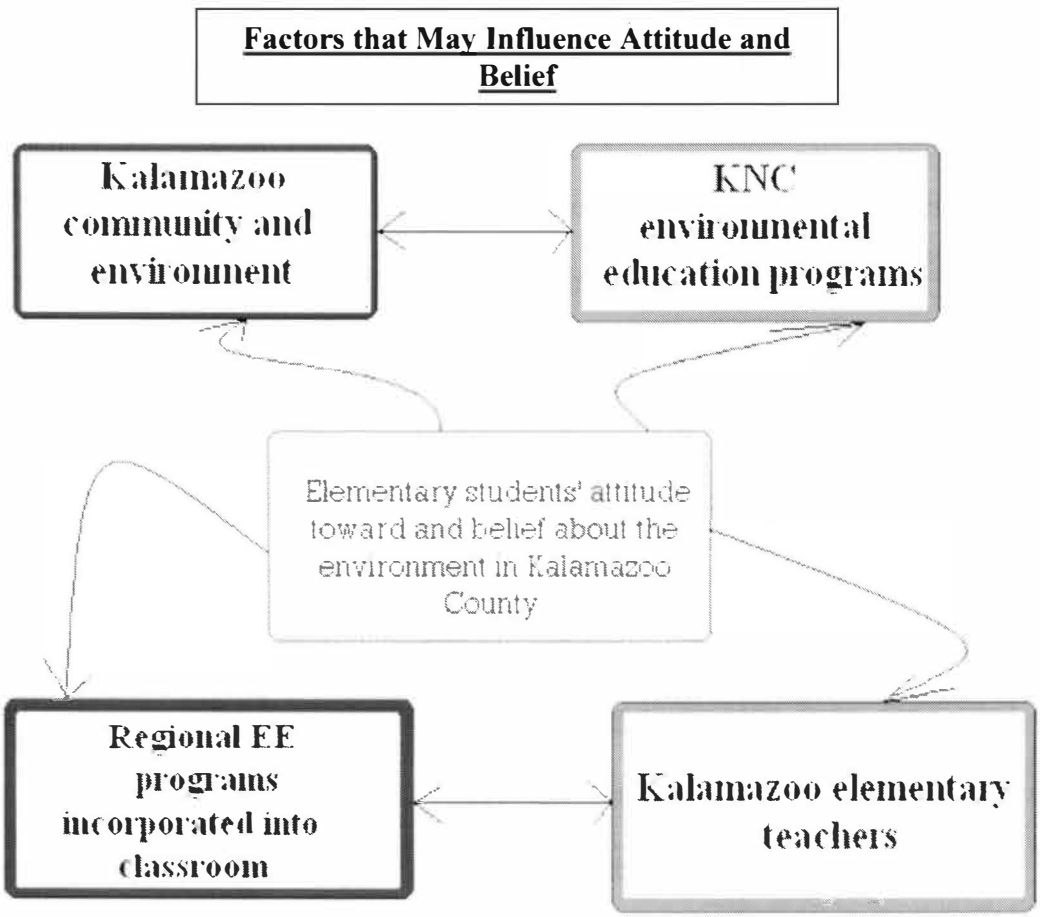


Figure 1: Influences on student Attitude and Belief in the Kalamazoo Region

Enhancing Environmental Attitudes and Beliefs through Instruction

It is believed that students who are taught about the environment at an early age grow to be more responsible and have a more positive attitude toward and belief about the environment as they grow older (Oonyu, 1998). Oonyu (1998) states that a strong

foundation of ethics and love of environment can be encouraged in students at an early stage in their school experience. Studies on classroom educational interventions in the United States (Ramsey, 1993; Ramsey & Hungerford, 1989; Ramsey, Hungerford & Tomera, 1981; Koballa, Jr.& Crawley, 1985 ) show that formal environmental education emphasizing issue investigation and action training promoted students' responsible environmental behavior (Hsu, 2004). Thus, a student who actively participates in solving environmental problems is more inclined to have respect for the environment after experiencing the connections between the worldview and other less environmentally focused experiences designed specifically for environmental education.

Kerney (1984, 41) stressed that the student may have a worldview that "consists of basic assumptions and images that provide a more or less coherent, though not always accurate, way of thinking about the world". A worldview contains not only experimental knowledge, but also attitudes toward the subject matter, epistemological and metaphysical foundations, sociological considerations, emotional states and a host of other cognitive and effective outlooks (Keys, 2004). Cobern (1989, 1993, 1994, 1996, 2000) suggests that the worldview is an important part of what the student brings into the classroom. The worldview and the learning environment are important in developing positive educational outcomes about the environment (Keys, 2004).

The ways in which the learning environment is organized and topics are presented to students affect their understanding. Barraza and Cuaron (2004) stress that the way that students learn environmental issues are important in the process of understanding ecological concepts. However, relatively little is known about this process. There have been research studies on the environmental understanding and misunderstanding of

younger aged students (Glazer, Vrtacnik, & Bacnik, 1998; Palmer, Suggate, & Matthews, 1996; Strommen, 1995). Still, only a small number of studies were undertaken using science-based education that focused on environmental science topics and investigating the attitudes of students following the science programs (Lyons & Breakwell, 1994; Uzzell, Rutherford, & Whistance, 1995; Simmons, 1998). There are even fewer studies that attempted to understand young people's attitudes and beliefs resulting from environmentally based learning experiences such as at the Kalamazoo Nature Center (KNC).

The understanding of environmental perceptions that influence attitudes is important because it suggests a precursor to pro-environmental behavior (Chan, 1996). Also, teachers need to identify and draw on students' opinions about the environment in order to achieve success in education (Kwan & Miles, 1998). Students need to have well designed educational experiences about the environment in order to gain the advantage of a healthier environment. Environmental education has been proposed as the most effective long-term solution to addressing environmental problems (Oonyu, 1998).

Teachers should have access to environmental educational resources to better equip and enhance students' awareness, attitude and belief toward and about the environment. Increased environmental education programs researched by Barraza and Cuaron (2004) revealed that prior to such programs, students had a low to moderate level of environmental awareness and a low to moderate level of environmental literacy. In order for students to show signs of improved literacy, programs need to be adjusted and academic approaches need to be added. Fishbein and Ajzen (1975) and Wee, Fast, Shapardson, Harbor and Boone (2004) suggested that educational systems and academic

approaches, such as field studies monitoring, inquiry based laboratories, model based laboratories, an increase in nontraditional science teaching, and the use of student-centered inquiry, may influence students' perceptions and their interest in and attitudes toward science and the environment.

The development of effective environmental practices and policies in schools and the community should be considered in order to promote environmental knowledge, literacy, and enhanced attitude and belief toward and about the environment within the population. Educational programs with a strong orientation toward the environment are believed to be more valuable in helping students become both knowledgeable and positive in their attitude toward and belief about the environment and knowledge of environmental concepts (Barraza & Cuaron, 2004).

Researchers have observed that students who participate in earth-science programs develop a sensitivity and overall positive attitude toward their environment (Yerks & Haras, 1997). According to a study on the analysis of attitudes of students toward environmental education by Kyridis, Mavrikaki, Tsakiridou, Daikopoulos and Zigouri (2005), elementary school aged students exposed to environmental programs have realized the importance of environmental education and been sensitized to environmental issues. Other researchers agree that practical experiences help develop sensitivity for the environment.

Environmental education programs in schools and through other interventions bear a great responsibility in developing people's interest in the environment by teaching them to assess the impact of, and find solutions to, environmental problems. This may also lead to a future generation of well-trained professionals who promote and support

sustainable development (Kyridis et al., 2005). Furthermore, research shows that attempts should be made to develop sustainability through an interdisciplinary approach, which is a characteristic of environmental education (Wee et al., 2004). This approach integrates all academic disciplines in achieving broad applications and knowledge of environmental concepts.

It seems as if elementary-aged students are expected to learn successfully in their later education, then short term, intense environmental education using interdisciplinary approaches seems appropriate, such as those used at KNC. In addition, Hsu (2004) suggested that if there were more environmental programs offered one of the major goals of environmental education would be achieved: an environmentally literate citizenry actively participating in solving environmental problems.

The relationship between environmental knowledge and environmental attitude has not been fully determined in the research. Gigliotti (1990) stated that current research demonstrates that environmental education has produced citizens who are sensitive towards the environment, but who have a lack of basic environmental knowledge. That observation regarding knowledge has been observed by other researchers as well (Blum, 1987; Bohl, 1976; Hausbeck, Milbrath, & Enright, 1992; DeChano, 2006). Heimlich et al. (2004) suggested that lack of environmental knowledge stems from the lack of mandates for environmental education, and that environmental education is not a required topic of study like chemistry or English. McKeown-Ice (2000, 9) states the lack of knowledge is "because environmental education is not institutionalized; its presence in the curriculum is at the mercy of the continued employment of one person. This leaves environmental education in a precarious position. Other educational disciplines are in

stronger positions". Additionally, DeChano (2006) found that none of the students in Chile, England, Switzerland, or the United States who were surveyed on environmental knowledge and attitude achieved an overall satisfactory knowledge score based on a National Environmental Education & Training Foundation (NEEFT) study by Coyle (2004) and other U.S.-based assessments on environmental knowledge (Germann, 1988; Gigliotti, 1990; Blum, 1987; Joyce & Farenga, 1999). However, all of the students attained statistically significant mean scores for environmental attitude. This suggested a significantly more positive attitude toward the environment despite a low level of knowledge. DeChano (2006, 22) concluded that the absence of a "cohesive environmental education curriculum may have pre-empted learning about the environment and the issues surrounding it as a unified programme". This was consistent with the observation from McKeown-Ice's (2000) study on environmental education in the United States, in which she reported the greatest challenge in incorporating environmental education into a teacher's professional development is political because it is both the state's and nation's responsibility to drive programs. Without the political support, environmental education initiative will fail to reach fruition.

Today's teacher must work to improve students' attitudes and beliefs towards and about the environment. Frequently students hold incorrect perceptions about Earth-system relationships and the way human activities impact these systems (Fortner, 2001). It is important for the teacher to have deep knowledge of the concepts from the curriculum and to strive to improve environmental education in the school and broader community. This may simultaneously promote one's positive science learning as an unintended outcome. Environmental education for all and for a lifetime should be put into

practice. The cultivation of a responsible environmental citizenry may become a consequence (Hsu, 2004).

# CHAPTER III

# METHODOLOGY

## Study Site Kalamazoo County

Kalamazoo County accounts for roughly 2.4% of the total population of Michigan, which has a population of 10,112,620 (U.S. Census Bureau, 2005). It is currently ranked ninth in population out of Michigan's eighty-three counties. Of the 93,479 households in Kalamazoo County, 30.4% have students under the age of 18 (U.S. Census Bureau, 2005). In 2005, the median household income was $42,022 (U.S. Census Bureau, 2005). The proportion of total population for whom poverty status was designated was 12% and for the population of students below the age of 18, it was 12.3% (U.S. Census Bureau, 2005). The percentage of 10-13 year olds in Kalamazoo County was 5.1 % (Michigan CGI, 2006). Figure 2 shows the number of residents in five age categories from birth to 24 years.

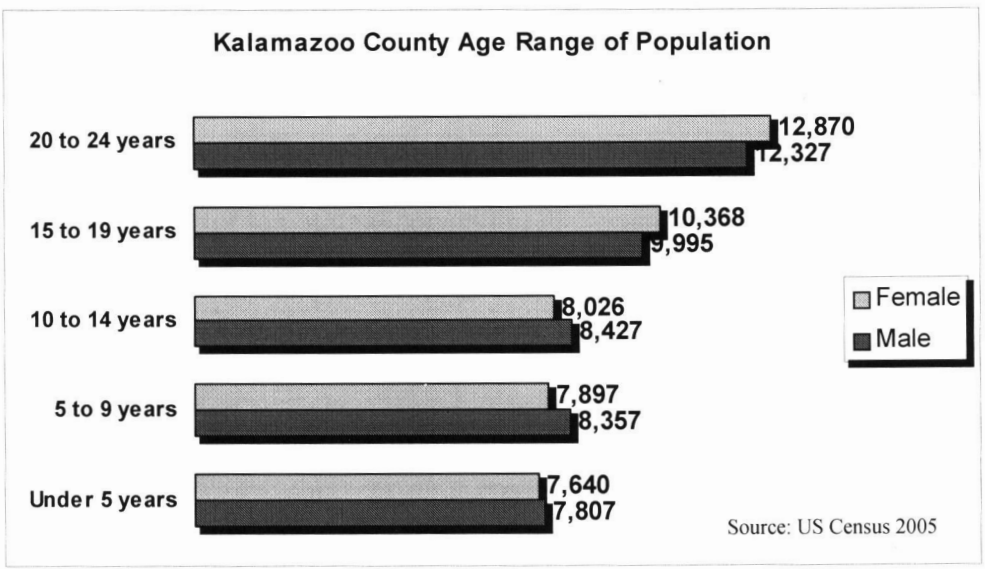


Figure 2: Age Ranges of Kalamazoo County Residents in 2004 (U.S.Census, 2005)

Kalamazoo Nature Center

Kalamazoo Nature Center (KNC) is located in northern Kalamazoo County (Figure 3). It includes 1,100 acres of beach-maple forests, wetlands and prairies. The center was established in 1960 and is headquartered in an interpretative center designed by Alden B. Dow. The building was constructed two years after the land was authorized as a preserve. In 1997, the organization renovated the Interpretative Center using a non-polluting (groundwater) geothermal system/water-loop, electric heat pump system to heat the facility. They also constructed a computer controlled heating/cooling/lighting systems to improve energy efficiency. The floors were replaced with an all-natural, non-petrochemical/cork product called Marmoleum. KNC reuses and recycles its waste products. KNC has also employed local artists and fabricators to plan ways to save on fossil fuels. A sod roof on the north slope of the greenhouse models an alternative insulation. Kalwal-like insulated light transmitting panels are used to replace roof (glass) in the greenhouse. Also, the lobby flooring tiles at the entrances are made from recycled tires. KNC is also working with Kalamazoo County Parks in the construction of a pedestrian/bike pathway that will connect the center with downtown Kalamazoo (Kalamazoo Nature Center, 2006).

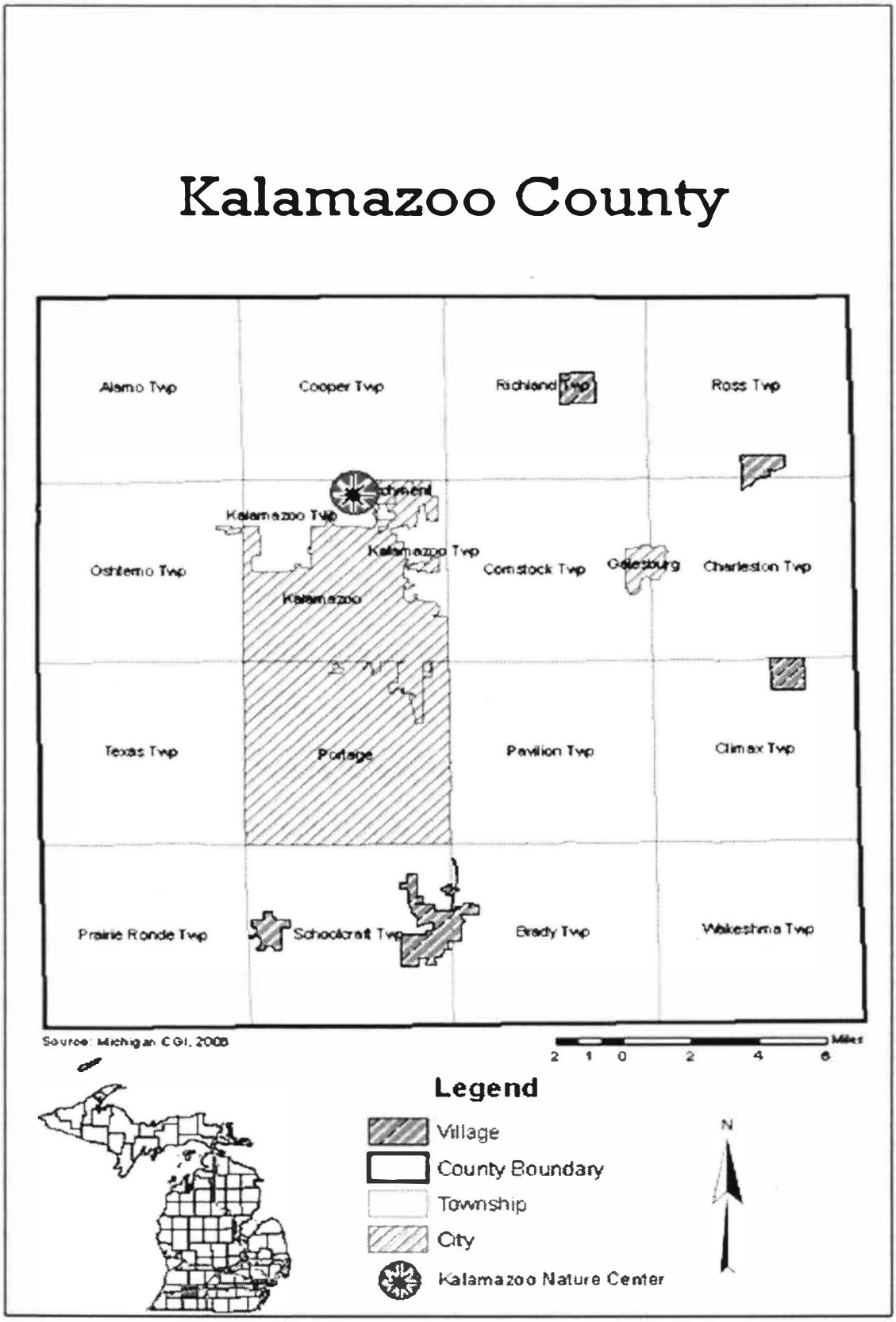


Figure 3: Relative Location of KNC in Kalamazoo County

KNC's mission is to "inspire people to care for the environment by providing experiences that lead them to understand their connection to the natural world" (Kalamazoo Nature Center, 2006). KNC offers a wide-range of programs in education such as groundwater, soil, wildlife, research, and conservation. Many are made possible from donations and membership fees. School and youth programs enhance KNC's presence in making their mission known by connecting kids and nature.

The KNC offers courses that serve students as well as experienced adults in order to enhance the community's knowledge of the environment. The researcher discussed with the nature center staff members the types of courses that are offered at KNC and the possibility of researching the effects of these programs on elementary students' attitude toward and belief about the environment. It was agreed to focus the research effort on the one-half day programs that KNC offers to elementary students. The effects on the attitudes and beliefs of the students attending the short courses were interesting for two reasons. First, attitudes and beliefs influenced by the program would identify those important outcomes with students. The one-half day program is a frequent model at KNC. The researcher maintains that establishing a pre-program attitude and belief score and comparing it to a post-program attitude and belief score will reveal the impact of the non-formal science program at KNC.

Approximately 98,108 Kalamazoo County residents visit KNC annually (Kalamazoo Nature Center, 2006). Of the visitors, 53,242 are youth and school based groups including Nature's Way Preschool, off-site school and library programs for kids, home school students, and local chapters of the Girl and Boy Scouts of America. Many Kalamazoo Public School students participate in the programs at KNC.

Use of a Mixed Methods Research Model

The purpose of this study was to examine the changes in student's attitudes and beliefs toward the environment resulting from KNC environmental education programs for 9 to 13 year old students who participated. The research setting did not permit the manipulation of the variables in the treatment or the time devoted to the environmental education lesson. Data collected were both quantitative and qualitative; therefore a mixed methods research model was selected for the analyses of data from the small sample (Tashakkori & Teddlie, 1998).

A mixed research model focuses on collecting and analyzing both quantitative and qualitative data in a single study (Creswell, 2003). The quantitative portion of this study was the pre- and post-survey the students completed. The qualitative portion was the exploratory focus group discussions with the students taking part in the environmental program. Combining the qualitative and quantitative methods was expected to permit additional interpretations and findings (Frechtling & Westat, 1997). Also, as mentioned above, a mixed methods approach permitted the researcher to modify or expand the evaluation design and/or the data collection methods as deemed feasible. Greene, Caracelli and Graham (1989) state this is possible when the use of mixed methods uncovers inconsistencies that alert the researcher to the need for re-examining the data collection framework and analysis procedures (Frechtling & Westat, 1997).

The final reason for the use of mixed methods research design was that there is a growing consensus among evaluation experts that both qualitative and quantitative methods have a place in this type of research. Frechtling and Westat (1997) state that both formative and summative evaluations are enriched by a mixed methods approach.

They permit the researcher to examine the development of the project and make changes in the way the project is carried out, in addition to accomplishing the stated goal. The results of the study may show the level to which the program at the KNC affected the students' attitudes and beliefs towards and about the environment.

## Data Collection Instrument

The data collection instrument (Appendix A) was a specially designed survey based on the Test of Science Related Attitude (Fraser, 1981). The Likert Scale survey was also similar to studies conducted by Lever at Social Indicators Research (SIR) (Lever, 2000). The visual analog-type response used by the survey asks the respondent for a rating of the item on a continuum that is anchored at either end by opposite responses (Macnee, 2004). Students were asked to circle the appropriate number to indicate the level of enjoyment that different situations cause for him or her, ranging from "strongly agree" to "strongly disagree" (Fraser, 1981). This type of response scale was used for two main purposes: 1) examining the relationship between the environment and attitude and belief; and 2) probing the interests among students (Waugh, 2003; Gardner, 1995; Libarkin, 2001; Libarkin & Garcia, 2000; Jacobson, 1987). The reliability of the instrument used in this thesis was determined and is discussed in the next chapter. One's responses on an attitude and belief survey may not be predictive of science related behaviors in the long term because of situational variables and additional factors such as additional experience, further studies, etc. (Fishbein & Ajzen, 1975). It is for this reason that the present researcher will analyze the immediate attitude and belief of the

environment from the students at KNC to better understand the process in the short term in order to attain the possibility of suggesting better ways of learning in the long term.

Data Collection

Within this study, there were three essential steps leading up to the data collection. They were: 1) obtaining approval from the KNC and school principals and teachers; 2) obtaining approval for Human Subjects Institutional Review Board of Western Michigan University; and 3) obtaining parental/guardian permission.

The researcher contacted the environmental educators(s) of KNC's programs as well as the appropriate principals and teachers of the students at their respective schools with the plan for the research. Once given the teachers' permission to explain the study to students in the classroom, the discussions with KNC staff and principal of the school ensued. A consent form was provided to each student's parents or legal guardians (Appendix B) for both the treatment and control groups being surveyed. It explained the research project, the student participation in the study, and when the pre and post-survey would occur. Students from KNC were requested to return the permission slip the same day the collection of the data was to take place. On this day, the researcher arrived at KNC to explain the survey process to the students. In order to be sure that each student's participation was verifiable, the name of the child and name of the parent/guardian were listed on the consent form. Once all permissions were obtained the data collection period began.

Approval to survey elementary-age students was obtained from the Human Subjects Institutional Review Board of Western Michigan University (Appendix C). The

researcher solicited groups for this study from KNC's environmental programs with permission from the KNC (Appendix D). The researcher solicited a control group from an elementary school in Kalamazoo County for this study with permission from the undisclosed principle of the undisclosed elementary school (Appendix E). The name of the specific school was kept anonymous at the request of the school administrator.

Students were asked to complete a survey prior to beginning the one-half day program at KNC. This survey took place at Cooper's Glen classroom inside the Interpretive Center at KNC. The researcher insured that the participants understood the survey by orally explaining how to mark responses and working on a practice question together before students began the survey. The researcher encouraged students to answer all the questions on the survey. However, questions could be left blank. Participating students were requested not to write their names anywhere on the survey in order to assure anonymity. There were no questions on the survey that would disclose identity. In addition, none of the information requested from the students was of a sensitive nature (the names and/or addresses were not asked for). No special arrangement or identification for students with special needs was necessary for the treatment or data collection.

The class was given fifteen minutes to complete the survey. Students were informed that they would respond to the same items at the end of the one-half day program at KNC. Students without a permission slip were told to read over their program materials which were provided by KNC staff. This same procedure for data collection was employed at the conclusion of the KNC one-half day program in order to evaluate how the treatment (KNC program) affected student attitudes and beliefs.

Sample Selection

Due to the small sample size, using inferential statistics was not appropriate. The core value of statistical methodology is its ability to assist in making inferences about a population based on observations of a smaller subset of that population (a sample randomly selected) (Creswell, 2003). In order for this to occur, the sample must be similar to the target population in all-relevant aspects and certain aspects of the measured variables must conform to assumptions, which underlie the statistical procedures to be applied (Helberg, 1995).

In this study, the sample consisted of students between the ages of 9 and 13. The assumption about the sample was that these students were learning earth-science concepts in the same sequence that other students are being taught, guided by the Michigan Science Curriculum Framework (Michigan Department of Education, 2006). Elementary school-aged students were chosen for the research because they have certain characteristics. Young and Maggs (1987) confer that students at this age have inquisitive and creative minds; they want to explore, touch and experiment with things in their environment. Those particular processes and actions were similar to what the elementary students would experience in the program at KNC.

On January 12th, 2006, the researcher visited two classes at KNC. The morning class lasted from 9:00AM to 11:30AM and the afternoon class lasted from 1:00PM to 3:30PM. Each class had a different group of students. The program took place in a classroom inside the Interpretive Center at KNC. The instructor presented the topic of the white-tailed deer and its habitat. Students were given the opportunity to view photos of deer, discuss how many were on KNC grounds and analyze and interpret the various

characteristics of deer as a species in an environment. At the conclusion of the KNC instructional treatment of one-half day, the researcher distributed the post-evaluation instrument to the elementary students.

On March 5th and March 10th, 2006, the researcher administered the pre- and post-survey respectively to a fifth grade class at an elementary school in Kalamazoo County. The students served as a control group to ascertain if any learning effect occurred as a result of responding to the pre-survey. Regular instruction occurred between the 5th and 10th of March. The lessons during the week focused on plant and animal cells. The lessons were textbook-based with a supplementary lesson using a microscope along with constructing a plant or animal cell from candy pieces, markers, and crayons. The same procedure for the post-survey was followed on Friday of the same week. The survey was kept anonymous. The same procedure was used to gain consent for student participation as was used at KNC (Appendix B). Students in the elementary school without permission slips were not surveyed and sat quietly during the survey response time.

## Data Analysis

The individual items in the survey were coded by the values 1 through 5 to reflect the responses of each student (Appendix A). All survey items except 7, 9, and 12 required a positive response to exhibit a positive attitude and belief toward and about the environment. Items 7, 9, 12 required a negative response in order to exhibit a positive attitude and belief toward and about the environment. All data were coded and input into a spreadsheet for further analysis. Items 7, 9, and 12 were reverse-scaled before computing the Wilcoxon so that there was clearly negative and positive polarity. Each

response was coded so that the highest value 1 (Strongly Agree) indicated a positive reaction to the item and 5 (Strongly Disagree) indicated a negative reaction to the item. Survey responses were numerically coded in a similar way except for responses to items 7, 9, and 12 which were coded in reverse.

Means and standard deviations were calculated to gain an overall perspective of each respondent group. The Wilcoxon test was used to determine if a statistically significant difference occurred between the pre- and post-survey for either KNC or the control groups. If the p-value from this test indicated a statistically significant difference in scores, then it could be stated that the program did enhance the students' attitudes toward and beliefs about the environment.

# CHAPTER IV

# RESULTS AND DISCUSSION

## Reliability of Survey Instrument

The method used to establish reliability of the Likert scale is called an estimate of internal consistency, or reliability. The coefficient Alpha, initially proposed by Cronbach (1951), tested the premise that student scores on a test or survey instrument would have a range of values that may be used to estimate the internal consistency of the instrument (Mehrens & Lehmann, 1991). Mehrens and Lehmann (1991) proposed that in estimating internal consistency of a survey instrument such as the one used in the current study, it is reasonable to assume that had another set of similar questions been asked or the same survey administered to the same students after a period of time, the results would have been comparable. Prior to the computation of the coefficient alpha internal consistency estimate of reliability, items 7, 9, and 12 on the survey were reverse-scaled so that one end of the scale was always the high value end. The estimate of internal consistency provides an intra-item correlation for all students who responded to the survey for the pre-survey and again as a second estimate for the post-survey.

The coefficient alpha for the survey was 0.864 using Cronbach's Alpha statistical procedure (Table 1). The coefficient suggests that the researcher can have confidence that had the same instrument been administered to a similar group of students, variations in the response pattern could be expected to be stable and not fluctuate wildly. The survey instrument was judged to have adequate reliability (0.864) to compare pre- and post-results to be the effects of treatment rather than the instability of the survey instrument.

Table 1: Cronbach's Coefficient Alpha

| | | N | % |
|---|---|---|---|
| Cases | Valid | 34 | 100.0 |
| | Excluded(a) | 0 | .0 |
| | Total | 34 | 100.0 |

a. List-wise deletion based on all variables in the procedure.

**Reliability Statistics**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| 0.864 | 0.864 | 12 |

**Summary Item Statistics**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| 1 | 1.6176 | 0.88813 | 34 |
| 2 | 1.6176 | 0.85333 | 34 |
| 3 | 1.6765 | 1.00666 | 34 |
| 4 | 2.3235 | 1.38653 | 34 |
| 5 | 3.0588 | 1.43424 | 34 |
| 6 | 1.5588 | 0.74635 | 34 |
| 7 | 1.6471 | 1.04105 | 34 |
| 8 | 2.2353 | 1.07475 | 34 |
| 9 | 2.7059 | 1.31494 | 34 |
| 10 | 1.8824 | 0.97746 | 34 |
| 11 | 2.1471 | 1.01898 | 34 |
| 12 | 1.5000 | 0.99240 | 34 |

Estimates of covariance used in the analysis

KNC Classes

Table 2 shows the mean score for each item on the survey as well as the overall mean score for all survey items.

Table 2: Data Summary for Kalamazoo Nature Center Groups

| Mean Survey Scores | | | | |
|---|---|---|---|---|
| Item | AM pre-survey | AM post-survey | PM pre-survey | PM post-survey |
| 1** | 1.6 | 1.5 | 1.9 | 2.1 |
| 2** | 1.6 | 1.6 | 1.7 | 1.8 |
| 3** | 1.4 | 1.4 | 1.8 | 2.0 |
| 4** | 2.0 | 2.3 | 3.1 | 3.1 |
| 5** | 2.6 | 3.0 | 2.8 | 2.9 |
| 6** | 1.6 | 1.2 | 1.4 | 1.9 |
| 7* | 4.7 | 4.1 | 4.0 | 4.0 |
| 8** | 2.7 | 2.5 | 2.1 | 2.1 |
| 9* | 3.1 | 3.0 | 3.3 | 3.3 |
| 10** | 1.9 | 1.5 | 2.2 | 1.8 |
| 11** | 2.0 | 2.1 | 2.0 | 2.0 |
| 12* | 4.7 | 4.4 | 4.2 | 4.1 |
| Average | 2.5 | 2.4 | 2.5 | 2.6 |

*Original scores range from 1 to 5 with the ***higher*** scores indicating a more positive attitude and belief.
** Original scores range from 1 to 5 with ***lower*** scores indicating a more positive attitude and belief.
This does not include the reversal of score values used in the analyses

There were overall positive attitudes and beliefs toward and about the environment as represented by the students enrolled in the Kalamazoo Nature Center (KNC) program. The mean scores for all responses except items 12, "I would enjoy school more if there were no science lessons," an indicator of belief, and 7, "Science lessons bore me," an indicator of attitude, were clustered more towards the positive end of the scale (Table 2). The values for those items were positive at the positive high end of the scale after reversal. The mean score for item 9, "Talking to friends about science after school would be boring," an indicator of belief, was neutral. The groups in both the morning and afternoon environmental programs at KNC expressed generally positive attitudes and belief toward the program and the environment (Table 2).

Items 4, "School should have more science lessons each week," and 5, "I would like a science book as a present," both indicators of attitude, had mean scores between 2 and 3 and were interpreted as neutral. Two items, 2, "Science lessons are fun," and 6, "Finding out new things is important to me," both indicators of belief, had consistent scores of 1, suggesting a strong agreement and positive belief. Items 3 and 10 had mean scores of 1, strongly agree and 2, agree; further indicating a predisposition toward positive beliefs.

Table 3 shows an evaluation of responses of the students at KNC. The morning group at KNC expressed five positive responses. The afternoon group expressed one positive response. Item 5 expressing "I would like a science book as a present" received a negative response from both morning and afternoon session of students at KNC. Item 12, "I would enjoy school more if there were no science lessons" also received negative responses from both morning and afternoon students. On the other hand, item 10, "Science helps make life better" received a positive response from both morning and afternoon groups.

Table 3: Evaluation of AM and PM Kalamazoo Nature Center Program Students

| Item # | A or B | Item | Polarity of the Item | Importance of Item to Research Question What the Mean Value Suggests | Change |
|---|---|---|---|---|---|
| 1 | A | I like to find out why something happens by doing an experiment rather than by being told. | AM: positive response PM: negative response | AM: Enhanced attitude in hands-on problem solving. PM: Suggests the students in class would rather hear something instead of doing something. | AM: + PM: - |
| 2 | B | Science lessons are fun. | AM: no change PM: negative response | AM: Suggest no change in beliefs about learning environmental concepts. PM: Negatively decreased beliefs about learning | AM: 0 PM: - |
| 3 | B | I am curious about the world in which I live. | AM: no change PM: negative response | AM: Suggest no change in belief about figuring out new environmental things. PM: Environmental lesson taught narrowed the beliefs about environmental cognitive | AM: 0 PM: - |
| 4 | A | School should have more science lessons each week. | AM: negative response PM: no change | AM: Suggests students feel amount of science classes attended is just right. PM: Lesson taught did not spark environmental enlightenment. | AM: - PM: 0 |
| 5 | A | I would like a science book as a present. | AM: negative response PM: negative response | AM and PM class: Suggests students "want" something other than a science book for a present. | AM: - PM: - |
| 6 | B | Finding out new things is important to me. | AM: positive response PM: negative response | AM: Lesson taught connected personally. PM: Displayed most significant negative response in class. Markedly felt subject was "important" enough. | AM: + PM: - |
| 7 | A | Science lessons bore me. | AM: positive response PM: no change | AM: Displayed largest postive response in class. Children enjoyed time with instructor. PM: Suggest no change in attitude toward a lesson in science. | AM: + PM: 0 |
| 8 | A | I like to listen to people whose opinions are different from mine. | AM: positive response PM: no change | AM: Suggest students became more open-minded towards the subject. PM: Subject taught did not pique anticipation in hearing something different. | AM: + PM: 0 |
| 9 | B | Talking to friends about science after school would be boring. | AM: negative response PM: no change | AM: Students did not feel like talking about the concept discussed during program with friends afterwards. PM: Suggests no change in beliefs. | AM: - PM: 0 |
| 10 | B | Science helps make life better. | AM: positive response PM: positive response | AM and PM: Suggests students believe more that environmental science helps make life easier to live. | AM: + PM: + |
| 11 | A | The material covered in science lessons is interesting to me. | AM: negative response PM: no change | AM: Subject taught became less enjoyable. PM: Suggest no change in disposition towards the environmental concepts discussed. | AM: - PM: 0 |
| 12 | B | I would enjoy school more if there were no science lessons. | AM: negative response PM: negative response | AM and PM: Students felt that school would not be as enjoyable if no science lessons or environmental concepts were discussed. | AM: - PM: - |
| | A = Attitude B = Belief | | | | |

The morning group had slightly higher scores on the survey at the start of the class than did the afternoon group. On the other hand, the afternoon group's scores improved more than the morning group's scores of attitude and belief, therefore exhibiting a greater overall change.

Table 4 presents the results of the Wilcoxon test for the morning group at KNC. Two students had tied scores and were disregarded in calculations for the test as recommended when using the Wilcoxon Test. The Wilcoxon analyses estimates if the proportions of mean values differ significantly from 0.50 and if so, the mean of the positive and negative ranks are tested for significance of the difference between them (Green, Salkind & Akey, 1997). The Wilcoxon test determine that the difference in the pre- to post-survey means were not statistically significant (Z = -0.768, p=0.442) for the morning group at KNC.

Table 4: Wilcoxon Signed Ranks Test for AM Group

| | | N | Mean Rank | Sum of Ranks |
|---|---|---|---|---|
| Post-survey – pre-survey | Negative Ranks | 4(a) | 5.00 | 20.00 |
| | Positive Ranks | 6(b) | 5.83 | 35.00 |
| | Ties | 2(c) | | |
| | Total | 12 | | |

a. Post-survey < Pre-survey
b. Post-survey > Pre-survey
c. Post-survey = Pre-survey

| | Post-survey – Pre-survey |
|---|---|
| Z | -.768(a) |
| Asymp. Sig. (2-tailed) | 0.442 |

a. Based on negative ranks.
b. Wilcoxon Signed Ranks Test

Table 5 presents the results of the Wilcoxon test for the afternoon group at KNC. Five students had tied scores and were disregarded in calculations for the test. The

Wilcoxon test revealed no statistical significance in the pre to post survey scores for the afternoon group (Z = -1.364, p=0.172).

Table 5: Wilcoxon Signed Ranks Test for PM Group

| | | N | Mean Rank | Sum of Ranks |
|---|---|---|---|---|
| Post-survey – Pre-survey | Negative Ranks | 1(a) | 6.00 | 6.00 |
| | Positive Ranks | 6(b) | 3.67 | 22.00 |
| | Ties | 5(c) | | |
| | Total | 12 | | |

a. Post-survey < Pre-survey
b. Post-survey > Pre-survey
c. Post-survey= Pre-survey

| | Post-survey – Pre-survey |
|---|---|
| Z | -1.364(a) |
| Asymp. Sig. (2-tailed) | 0.172 |

a. Based on negative ranks.
b. Wilcoxon Signed Ranks Test

## Control Group

The students at an elementary school in Kalamazoo County were used to test for reliability of the survey instrument. Due to the small sample at KNC, the elementary school sample was included in the Cronbach Alpha reliability test. Table 6 presents the pre and post-survey means for the students in the control group at the elementary school (n = 22).

Table 6: Pre and Post Means: Elementary School Control Group

| | Mean Survey Scores | |
|---|---|---|
| Item | Pre-survey | Post-survey |
| 1** | 1.4 | 1.4 |
| 2** | 1.6 | 1.6 |
| 3** | 1.9 | 2.2 |
| 4** | 2.1 | 2.4 |
| 5** | 3.6 | 3.6 |
| 6** | 1.6 | 1.5 |
| 7* | 4.3 | 4.4 |
| 8** | 1.9 | 1.7 |
| 9* | 3.1 | 3.0 |
| 10** | 1.6 | 1.8 |
| 11** | 2.4 | 1.6 |
| 12* | 4.5 | 4.3 |
| Average | 2.5 | 2.5 |

* Original scores ranging from 1 to 5 with the ***higher*** scores indicating a more positive attitude and belief.

** Original scores range from 1 to 5 with ***lower*** scores indicating a more positive attitude and belief.

This does not include the reversal of score values used in the analyses.

# CHAPTER V

# EXPLANATIONS AND RECOMMENDATIONS

## Summary

The hypothesis for this study was on whether the environmental attitudes and beliefs of elementary students change as a result of the Kalamazoo Nature Center's one-half day science inquiry program. The pre- and post-survey results did not reveal a statistically significant difference between the scores of either group of students participating in the Kalamazoo Nature Center (KNC) program. Therefore, the null hypothesis is accepted. However, there were some notable things about the research and data that are subsequently described.

Rickinson (2001) states attitude surveys are insufficient as a means of working towards meaningful understandings of the environment. On the other hand, it is important for research to try to understand students' experiences and beliefs in order to adapt environmental concepts to the social and physical context of school life (Wals, 1994). It is for this reason that the current study targeted students' attitudes and beliefs to help bridge the gap between what it is already understood and what else can be done to enhance environmental education.

The analysis of the mean scores and a visual comparison of the changes in the scores between the morning (AM) and afternoon (PM) classes at KNC (Table 2) revealed that the morning class did appear to be slightly more positive. This was observed at the conclusion of the KNC program. When examining the pre- and post-survey means on an item-by-item basis two out of the twelve responses remained the same, five increased,

and five decreased for the morning class. The afternoon class had six responses decrease, five items remained the same and one increased. The afternoon class attained a less positive score on the survey.

Possible Explanations for Research Results

Students' attitudes and beliefs toward the environment that were sampled at KNC did not change following the environmental treatment, the one-half day program. However, the researcher did identify environmental educational item responses that had slightly changed following the program. There are probably several explanations that may be suggested for the absence of a positive change among students.

The KNC lessons were concentrated on the white-tailed deer and its habitat. The survey items addressed more global concepts and information. Content that was more connected between the knowledge of the deer habitat and the survey may have been necessary. For example, how does the white-tailed deer impinge on the student personally, or how would affect life if the deer went extinct?

Another reason for this slight change may be the weakness in the design of the study. Twelve students in each of the morning and afternoon groups participated in the study. This was a small sample size. The time period of the program may not have been long enough to cause a significant change in attitude or belief toward and about the environment. A longer program would possibly have made a more notable impact. The timing of the data collection was also an important part of the study design. The time period between the program and the post-survey measures may not have been adequate for the intended effects that were being measured to be revealed. Perhaps if the survey

was administered a week or two after the program, the ideas and concepts that were taught may have had an impact. The survey involved twelve short items to be answered. The initial draft of the survey should have been more thoroughly field tested before finalizing the twelve items on the survey. This may have improved the sensitivity of the responses and the concepts and content examined on the survey.

Rutherford and Ahlgren (1991) propose that the way science is taught strengthens student attitudes toward science. Students may not have changed attitudes and beliefs because of the particular way the subject matter was taught. It is possible the students did not respond directly to the inquiry teaching style and were not able to adjust to it in the one-half day session. It also may be possible that the students did not fully understand the questions on the survey. For example, one item asked if a student would like a science book as a present. A child may think of a present as something he/she would like to play with instead of something interesting or useful.

## Future Studies

The researcher has several suggestions for future research projects. One is to improve the current survey method and repeat the research. Items on the survey could be added or current items modified. There were no items measuring student participation within in the environment. Items could be added to determine students' attitudes towards and beliefs about taking care of their environment. They might include activities such as raking leaves, identifying certain types of plant or flower species while out walking or participating within local environmental clean-up projects. Future research might also utilize a survey that is more contiguous with a longer program or longer lapse time

between treatment and post survey. Also, future research may survey students at KNC or other nature centers in addition to, within the school classroom who receive the same instructional treatment with the out-of-doors component being the only difference.

## Discussion

Fishbein and Ajzen (1975) report that student attitude toward science is developed over time from an accumulation of science classroom experiences. Educators should strive to establish a solid foundation through the accumulation of those aforementioned science experiences for the effective transfer of environmental concepts to students. It is also widely recognized that human interactions are at the heart of the school experience, and that we have to consider meaning from all perspectives including that of the learners themselves (Rutherford & Ahlgren, 1991). It is believed by this researcher that environmental education is germane to community needs. Furthermore the communities' teachers may provide one means to accomplish the goal for the effective transfer of environmental concepts to students. Clubs and societies in schools dealing with environmental matters need to be supported. This is important because they may be effective in encouraging the development of positive attitudes and beliefs about the environment (Oonyu, 1998).

Results from this study and past research from the National Research Council (2000) make the recommendation that environmental education should emphasize learning through inquiry. KNC programs utilized activities such as exploring real world phenomenon (the white-tailed deer), planning (classroom discussion) and conducting investigation, gathering evidence and examination (observing evidence in the deer

habitat) as well as expressing conceptual knowledge in keeping with national science standards.

Aside from the present research being reported, the researcher believes that a discussion specific to attitudes and belief's not incorporated in KNC's program in 2006 during their one-half day program may enhance learning outcomes. Although further research focusing on students' use of technology in the classroom is needed, (Anderson & Helms, 2001) students' knowledge, attitudes toward and beliefs about the environment may be enhanced by utilizing digital imagery (Clements, 1997). This may increase the students' desire to participate and gain a feeling of ownership within the program (Rivet & Schneider, 2004). It has been demonstrated that this type of student ownership may positively influence students' attitude in addition to affecting student beliefs about science (Wee et al., 2004). Many researchers believe digital imagery can also increase student interest by connecting science to their everyday lives which the students at KNC could convey by comparing and contrasting their outdoor experiences to their indoor classroom instruction (American Association for the Advancement of Science, 1993; Joyce & Farenga, 1999; Clements, 1997).

Moyer (1975), states that understanding does not automatically lead to strong attitudes. However, changed attitudes and beliefs may assist in the understanding of the environment. Creative and interested teaching will help students develop attitudes leading to improved understanding, appreciation and care of the environment. Also experience through hands-on activities is more likely to result in the promotion of understanding and knowledge, which may further help students understand the world. Students can create posters, photo collections and albums of their surroundings or create and perform class

presentations that help them develop and demonstrate this crucial understanding (Marx, Blomenfield, Krajcik & Soloway, 1997; Stratford, Krajcik & Soloway, 1998).

Most environmental attitudes are formed during childhood. Ford (2004) states that research indicates parks and other informal settings offer opportunities to enhance learning beyond formal education as well as enhance attitudes toward and beliefs about the environment. Kalamazoo County students should be given opportunities to visit nature centers and preserves. One suggestion of how this could happen is that schools and parks officials could develop an extensive program together, much like a study analyzed by Jacobson and Padua (1995), where the students completed tasks during and immediately after the environmental program. A teacher's guidebook to provide background information about the parks ecology and detailed instruction about the students' activities in the park would be important. It has been researched and stated that with similar programs between schools and parks, many participants have expressed that there are improved attitudes towards and beliefs about the environment (Jacobson & Padua, 1995; Ford, 2004; Hsu, 2004). Centers may also offer incentive to visit and participate because visits to natural areas often stimulate students' curiosity and interest, and outdoor educational experiences can provide emotional benefits and intellectual growth (Miles, 1986). Combining cognitive and affective (emotional) education during outdoor lessons may contribute to long-term behavior changes (Hungerford & Volk, 1990).

# REFERENCES

Amedeo, D., & Golledge, R. (1975/1986). *An introduction to scientific reasoning in geography*. Melbourne, FL: Krieger Publishing.

American Association for the Advancement of Science. (1993). *Benchmarks for science literacy (project 2061).* New York, NY: Oxford University Press.

Anderson, R., & Helms, J. (2001). The ideal of standards and the reality of schools: Needed research. *Journal of Research in Science Teaching,* 38(1), 3-16.

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

Blum, A. (1987). Students' knowledge and beliefs concerning environmental issues in four countries. *Journal of Environmental Education,* 18, 7-13.

Bohl, W.B. (1976). *A survey of cognitive and affective components of selected environmentally related attitudes of tenth and twelfth grade students in six Midwestern, four Southwestern and twelve Plains and Mountain states.* Unpublished doctoral dissertation, Ohio State University, Ohio.

Brookfield, H.C. (1969). On the environment as perceived. *Progress in Geography*, 1, 51-80.

Brundtland, G. (Ed.). (1987). *Our common future: The World Commission on Environment and Development*, Oxford, UK: Oxford University Press.

Chan, K.K.W. (1996). Environmental attitudes and behavior of secondary school students in Hong Kong. *The Environmentalist,* 16(4), 297-306.

Clements, D. (1997). Enviro-pix: Using digital cameras in the classroom. *Green Teacher,* 53, 30-31.

Cobern, W.W. (1989). *Worldview theory and science education research: Fundamental epistemological structure as a critical factor in science learning and attitude development.* Paper presented at the National Association for Research in Science Teaching, San Francisco, CA.

Cobern, W.W. (1993). *Worldview, metaphysics, and epistemology*. Paper presented at the National Association for Research in Science Teaching, Atlanta, GA.

Cobern, W.W. (1994). Worldview, culture, and science education. *Science Education International*, 5(4), 5-8.

Cobern, W.W. (1996). Worldview theory and conceptual change in science education. *Science Education*, 80(5), 579-610.

Cobern, W.W. (2000). *Everyday thought about nature*. Boston: Kluwer Academic Publishers.

Coyle, K.J. (2004). *Understanding environmental literacy in America.* Washington, DC: National Environmental Education & Training Foundation.

Creswell J. (2003) *Research design: Qualitative, quantitative, and mixed methods aproaches*. Thousand Oaks, London, New Delhi: Sage Publications.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297-334.

Cycleback, D.R. (2003, 2005). Positive achievement is often based on false beliefs. In *Conceits* (chap. 2). Retrieved March 28, 2006, from http://www.cycleback.com/conceits.html

DeChano, L.M. (2006). A multi-country examination of the relationship between environmental knowledge and attitudes. *International Research in Geographical and Environmental Education,* 15(1), 15-27.

Emel, J. (1994). Definition of environmental perception. In R.J. Johnston, D. Gregory & D.M. Smith (Eds.), *Dictionary of human geography: Third edition* (pp. 166-167). Cambridge, MA: Blackwell Publishers.

Evans, K.M. (1965). *Attitudes and interests in education.* London, UK: Routledge and Kegan Paul.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behaviour: An introduction to theory and research.* Reading, MA: Addison-Wesley.

Ford, M. (2004). Environmental education in the Condor Bioreserve: Correct status and recommendations for future work. *Journal of Sustainable Forestry,* 18(2/3), 257-275.

Fortner, R.W. (2001). Climate change in school: Where does it fit and how ready are we? *Canadian Journal of Environmental Education*, 6, 18-31.

Francis, L., & Greer, J. (1999). Measuring attitude towards science among secondary school students: The affective domain. *Research and Science & Technological Education*, 17(2), 219-230.

Fraser, B.J. (1981). *Test of Science-Related Attitudes (ToSRA).* Melbourne: Australian Council for Educational Research.

Fraser, B.J. (1982). How strongly are attitudes and achievement related? *School Science Review,* 63, 557-559.

Fraser, B.J., & Fischer, D.L. (1982). Effects of anxiety on science-related attitudes. *European Journal of Science Education,* 4, 441-450.

Frechtling, J., & Westat, L.S. (1997). *User friendly handbook for mixed method evaluations*. Washington DC: NSF Directorate for Education and Human Resources.

Gardner, P. (1995). Measuring attitudes to science: Unidemensionality and internal consistency revisited. *Research in Science Education,* 25(3), 238-289.

Germann, P.J. (1988). Development of the attitude toward science in school assessment and its use to investigate the relationship between science achievement and attitude toward science in school. *Journal of Research in Science Teaching,* 25, 689-703.

Gigliotti, L.M. (1990). Environmental education: What went wrong? What else can be done? *Journal of Environmental Education,* 22.

Glazer, S.A., Vrtacnik, M., & Bacnik, A. (1998). Primary school students' understanding of municipal waste processing. *Environmental Education Research,* 4(3), 299-308.

Golledge, R.G., & Stimson, R.J. (1997). *Spatial behavior: A geographic perspective.* New York, London: The Guilford Press.

Green, J.C., Caracelli, V.J., & Graham, W.F. (1989). Toward a conceptual framework for mixed-method evaluation design. *Educational Evaluation and Policy Analysis,* 11(3), 255-279.

Green, S.B., Salkind, N.J., & Akey, T.M. (1997). *Using SPSS for Windows: Analyzing and understanding data.* Upper Saddle River, NJ: Prentice Hall.

Hadden, R.A., & Johnstone, A.H. (1983). Secondary school pupils' attitudes to science: The year of erosion. *European Journal of Science Education,* 5, 309-318.

Haladyna, T., Olson, R., & Shaughnessy, J. (1982). Relations of student teacher and learning environment variables to attitude toward science. *Science Education,* 66, 671-687.

Hasan, O.E. (1985). An investigation into factors affecting attitudes toward science of secondary school students in Jordan. *Science Education,* 69, 3-18.

Hausbeck, K.W., Milbrath, L.W., & Enright, S.M. (1992). Environmental knowledge, awareness and concern among 11$^{th}$-grade students: New York State. *Journal of Environmental Education,* 24, 27-34.

Heimlich, J.E., Braus, J., Olivolo, B., McKeown-Ice, R., & Barringer-Smith, L. (2004). Environmental education and preservice teacher preparation: A national study. *Journal of Environmental Education,* 35(2), 17-21.

Helberg, C. (1995). *Pitfalls of data analysis.* Washington DC: ERIC Clearinghouse on Assessment and Evaluation. (ERIC Document Reproduction Service No. ED410231)

Hess, C.M., & Schrigley, R.C. (1981). A study of the effect of three models of teaching on metric knowledge and attitude. *Science Education,* 65, 131-138.

Hsu, S.J. (2004). The effects of an environmental education program on responsible environmental behavior and associated environmental literacy variables in Taiwanese college students. *The Journal of Environmental Education,* 35(2), 37-48.

Hungerford, H., & Volk, T. (1990). Changing learner behavior through environmental education. *Journal of Environmental Education,* 21, 8-21.

Jacobson, S.K. (1987). Conservation education programmes: Evaluate and improve them. *Environmental Conservation,* 14(3), 201-206.

Jacobson, S.K., & Padua, S.M. (1995). A systems model for education in parks. In S.K. Jacobson (Ed.), *Conserving wildlife: International education and communication approaches* (pp. 3-15). New York, NY: Columbia University Press.

Joyce, B.A., & Farenga, S.J. (1999). Informal science experience, attitudes, future interest in science, and gender of high-ability students: An exploratory study. *School Science & Mathematics*, 99(8), 431-437.

Kalamazoo Nature Center. (2005-2006). Retrieved December 20, 2005 and January 18th, 2006, from http://www.naturecenter.org.

Kerney, M. (1984). *WorldView*. Novato, CA: Chandler and Sharp Publishers, Inc.

Keys, R. (2004). *The interaction between an Orthodox Christian worldview and environmental attitudes and beliefs: For the purpose of developing better instructional practice in support of environmental/ecological attitudes and knowledge.* Unpublished Doctoral Dissertation, Mallinson Institute of Science Education, Western Michigan University, Kalamazoo, MI.

Koballa, Jr. T.R., & Crawley, F.E. (1985). The influence of attitude on science teaching and learning. *School Science and Mathematics,* 85(3), 222-231.

Krech, D., Crutchfield, R.S., & Ballackey, E.L. (1962). *Individual in society.* New York, NY: McGraw-Hill.

Kwan, T., & Miles, J. (1998). In the words of students and young people: The opinions and concerns about their environments of some Brisbane school students. *Australian Journal of Environmental Education,* 14, 11-18.

Kyridis, A., Mavrikaki, E., Tsakiridou, H., Daikopoulos, J., & Zigouri, H. (2005). An analysis of attitudes of pedagogical students towards environmental education in Greece. *International Journal of Sustainability in Higher Education,* 6(1), 54-64.

Lever, J.P. (2000). The development of an instrument to measure quality of life in Mexico City. *Social Indicators Research*, 50(2), 187-208.

Libarkin, J. (2001). Development of an assessment of student conception of the nature of science. *Journal of Geoscience Education,* 49(5), 435-442.

Libarkin, J., & Garcia, C. (2000). Evaluation of science attitude and understanding as a function of student characteristics. *Geological Society of America,* 32(7), 353.

Lidstone, J., & Stoltman, J. (2002). International understanding and geographical education. *International Research in Geographical and Environmental Education,* 11(4), 309-312.

Lyons, E., & Breakwell, G.M. (1994). Factors predicting environmental concern and indifference in 13-16 year olds. *Environment and Behavior,* 26(2), 223-238.

Macnee, C. (2004). *Understanding nursing research: Reading and using research in practice*. Philadelphia, PA: Lippencott Williams & Wilkins.

Marx, K.W., Blumenfeld, P.C., Krajcik, J.S., & Soloway, E. (1997). Enacting project-based science. *Elementary School Journal,* 97(4), 341-358.

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

Mehrens, W.A., & Lehmann, I.J. (1991). *Measurement and evaluation in education and psychology.* Chicago: Holt, Rinehart & Winston.

Michigan Department of Information Technology. (2006). *Michigan Center for Geographic Information.* Retrieved October 2005-January 2006, from http://www.michigan.gov/cgi

Michigan Department of Education (2006). *Michigan curriculum science benchmarks.* Retrieved March 14, 2006, from
http://www.michigan.gov/documents/Updated_Science_Benchmarks_27030_7.pdf

Miles, J. (1986). Wilderness as a learning place. *Journal of Environmental Education,* 18, 33-40.

Moyer R.H. (1975). An investigation of factors influencing environmental attitudes. *School Science and Mathematics*, 3, 266-269.

National Research Council. (2000). *Inquiry and the national science education standards*. Washington DC: National Academy Press.

Oonyu, J.C. (1998). Applicability, constraints, and opportunities for the effective implementation of environmental education in Uganda's primary schools. *Journal of Environmental Education and Information,* 17(3), 287-298.

Palmer, J.A., Suggate, J., & Matthews, J. (1996). Environmental cognition: Early ideas and misconceptions at the ages for four and six. *Environmental Educational Research,* 2(3), 301-329.

Powers, A. (2004). Teacher preparation for environmental education: Faculty perspectives on the infusion of environmental education into preservice methods courses. *The Journal of Environmental Education,* 35(3), 3-11.

Ramsey, J.M. (1993). The effects of issue investigation and action training on eighth-grade students' environmental behavior. *The Journal of Environmental Education,* 24(3), 31-36.

Ramsey, J.M., & Hungerford, H.R. (1989). Effects of issue investigation and action training on environmental behavior in seventh grade students. *The Journal of Environmental Education,* 20(4), 29-34.

Ramsey, J.M., Hungerford, H., & Tomera, A. (1981). The effects of environmental action and environmental case study instruction on the overt environmental behavior of eighth-grade students. *Journal of Environmental Education,* 13, 24-30.

Rickinson, M. (2001). Learners and learning in environmental education: a critical review of the evidence. *Environmental Education Research,* 7(3), 207-320.

Rivet A., & Schneider R. (2004). Exploring the role of digital photography to enhance student inquiry in a local ecosystem. *Journal of Computers in Mathematics and Science Teaching,* 23(1), 47-65.

Rodriguez, P. (2004). *Using ToGRA to assess student's attitudes toward geography.* Geography education specialty group student paper competition II paper presented at American Association of Geography Conference, Texas State University, Texas.

Rutherford, J.F., & Ahlgren, A. (1991). *Science for all Americans.* Oxford, UK: Oxford University Press.

Sherwood, R.D., & Herron, J.D. (1976). Effect on student attitude: Individualized IAC versus conventional high school chemistry. *Science Education,* 60, 471-474.

Simmons, M.R. (1998). *A study of high school students' attitudes toward the environmental and completion of an environmental science course.* Washington DC: U.S. Department of Education, Educational Resources Information Centre. (ERIC Document Reproduction Service No. ED 423119)

Story, L.E., & Brown, I.D. (1979). Investigation of children's attitudes towards science fostered by a field-based science methods course. *Science Education,* 63, 649-654.

Stratford, S.J., Krajcik, J., & Soloway, E. (1998). Secondary students' dynamic modeling processes: Analyzing reasoning about, synthesizing and testing models of stream ecosystems. *Journal of Science Education and Technology,* 7(3), 215-234.

Strommen, E. (1995). Lions and tigers and bears, oh my! Children's perceptions of forests and their inhabitants. *Journal of Research in Science Teaching,* 32(7), 683-698.

Tashakkori A., & Teddlie C. (1998). *Mixed methodology combining qualitative and quantitative approaches.* Thousand Oaks, CA: Sage Publications.

United States Census Bureau. (2005). Retrieved October-December 2005, from http://www.census.gov

Uzzell, D.L., Rutherford, A., & Whistance, D. (1995). Questioning values in environmental education. In Y. Guerrier, N. Alexander, J. Chase & M. O'Brien (Eds.), *Values and the environment: A social science perspective*. Chichester, UK: John Wiley.

Vision Council. (2005). *Kalamazoo community profile report.* Retrieved September 12th, 2005, from http://www.visioncouncil.org/kzooplan/html/chapter_9b.htm

Von Secker, C.E., & Lissitz, R.W. (1999). Estimating the impact of instructional practices on student achievement in science. *Journal of Research in Science Teaching,* 36(10), 1110-1126.

Walker, S. L., & Fraser, B.J. (2005). Development and validation of an instrument for assessing distance education-learning environments in higher education: The distance education learning environments survey (DELES). *Learning Environments Research,* 8(3), 289-308.

Wals, A.E.J. (1994). Nobody planted it, it just grew!: Young adolescents' perceptions and experiences of nature in the context of urban environmental education. *Children's Environments,* 11(3), 177-193.

Waugh, R.F. (2003). Measuring attitudes and behaviors to studying and learning for university students: A rasch measurement model analysis. *Journal of Applied Measurement,* 4(2), 164-180.

Wee, B., Fast, J., Shapardson, D., Harbor, J., & Boone, W. (2004). Students' perceptions of environmental-based inquiry experiences. *School Science and Mathematics,* 104(3), 112-118.

Yerkes, R., & Haras, K. (1997). *Outdoor education and responsibility.* Charleston, WV: ERIC Clearinghouse Rural Education and Small Schools. (ERIC Document Reproduction Service No. ED414112)

Young, A.G., & Maggs, J.E. (1987). Issue based learning at primary school level. In A.V. Baez, G.W. Knamiller, & J.C. Smyth (Eds.), *The environment and science and technology education* (pp. 119-126). New York, NY: Pergamon Press.

# Appendix A

## Data Collection Instrument

## Science Perception Survey

Directions
The test contains a number of statements about science. You will be asked what you yourself think about these statements. There are no "right" or "wrong" answers. Your opinion is what is wanted.

For each sentence, draw a circle around:

1. If you strongly agree with the sentence
2. If you agree with this sentence
3. If you are not sure
4. If you disagree with the statement
5. If you strongly disagree with the statement

If you change your mind about an answer, cross it out and circle another one.

| | Strongly Agree | Agree | Not Sure | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| *Example: I look forward to science lessons* | *1* | *2* | *3* | *4* | *5* |
| I like to find out why something happens by doing an experiment ***rather*** than by being told. | 1 | 2 | 3 | 4 | 5 |
| Science lessons are fun. | 1 | 2 | 3 | 4 | 5 |
| I am curious about the world in which I live. | 1 | 2 | 3 | 4 | 5 |
| School should have more science lessons each week. | 1 | 2 | 3 | 4 | 5 |
| I would like a science book as a present. | 1 | 2 | 3 | 4 | 5 |
| Finding out new things is important to me. | 1 | 2 | 3 | 4 | 5 |
| Science lessons bore me. | 1 | 2 | 3 | 4 | 5 |
| I like to listen to people whose opinions are different from mine. | 1 | 2 | 3 | 4 | 5 |
| Talking to friends about science after school would be boring. | 1 | 2 | 3 | 4 | 5 |
| Science helps make life better. | 1 | 2 | 3 | 4 | 5 |
| The material covered in science lessons is interesting to me. | 1 | 2 | 3 | 4 | 5 |
| I would enjoy school more if there were no science lessons. | 1 | 2 | 3 | 4 | 5 |

# Appendix B

## Consent Form to Parents/Guardians

*Researcher Copy*

October 17, 2005

Dear Parent:

A study entitled "How Resources impact Student Perception" is being conducted by Dr. Lisa DeChano and David Pagel from Western Michigan University (WMU) in conjunction with the Kalamazoo Nature Center. This study examines the affects of resources available for teachers' impact elementary school students' perception of the environment. This project is being done as part of the thesis requirement for David Pagel. Your student's class has been chosen to participate in a study on student environmental perception.

***Children will be taught the content of environmental concepts whether they participate or not in this study.*** Children who are taught about the environment at an early age grow to be more responsible and have a better perception of the environment as they grow older because it is at this age that a strong foundation of ethics and love of environment can be encouraged in the child. By allowing your child to participate in this study, it will promote your child's responsible environmental behavior (a citizen who actively participates in solving environmental problems). The development of effective environmental practices and policies needs to be considered in order to promote environmental knowledge, literacy and enhanced perception within the population. Your child's participation in this study will enable for the development to happen.

The study entails that your student answer twelve questions via a questionnaire as a pre-test/post-test manner. The questionnaire asks your student to indicate their degree of their perception based on 12 broad-based environmental statements. Students will be asked to complete the questionnaire at the start of their program at the Kalamazoo Nature Center and again at the end of the program. It is anticipated that each student will complete the questionnaire in 10-15 minutes during a specified class time. We have provided chairs and a shaded area if outdoors, or a classroom with air conditioning or a fan if indoors, for students when completing the questionnaire to minimize any discomforts from standing or being in the sun.

***In order to analyze results between the pre-test and post-test, questionnaire numbers and student names will be recorded, but only the researchers will have access to this information.*** Please be assured that the administrated questionnaire is completely anonymous (participants are not asked to provide their name anywhere on the questionnaire) and their scores will *not* be reported to any of their Kalamazoo Nature Center instructors. In addition, no student will be singled out when reporting the results of these data to the Kalamazoo Nature Center or in any published literature that results from this study. This published literature will also be available at the Kalamazoo Nature Center for you to read at the completion of the study.

Please consider your student's participation in this important research. There is minimal *known* risk to participants and at no time will any individual's answers to the survey questions be provided to anyone but the collaborators of the research project. The second page of this letter is a consent form for your student. Please check the appropriate box, provide the student's name on the line, and sign the form. ***Please return the <u>Researcher Copy</u> to David Pagel and keep Parent/Guardian Copy for your own records. Without this consent form your student will not be able to participate in the study; however, they will still be able to participate in the Kalamazoo Nature Center's program.***

WESTERN MICHIGAN UNIVERSITY
H. S. I. R. B.
Approved for use for one year from this date:

NOV 22 2005

x _____
HSIRB Chair

***This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is older than one year.***

If you have any questions regarding this study, please do not hesitate to contact Dr. Lisa DeChano at 269-387-3536, David Pagel at 269-873-2142. You may also contact the Chair, Humans Subjects Institutional Review Board (387-8293 or the Vice President for Research (387-8298) if questions or problems arise during the course of the study. Thank you for considering this opportunity for your child to participate in academic research.

Sincerely,

Lisa M. DeChano, Ph.D. David Pagel

**Child Perception Survey**
**Parental Consent**

□ My child has permission to participate in this study.

□ My child does not have permission to participate in this study

Child's name: _____

Parent's Signature: _____

# Appendix C

## HSIRB Permission

WESTERN MICHIGAN UNIVERSITY
Human Subjects Institutional Review Board

Date: November 22, 2005

To: Lisa DeChano, Principal Investigator
David Page, Student Investigator for thesis

From: Mary Lagerwey, Ph.D., Chair

Re: HSIRB Project Number: 05-10-02

This letter will serve as confirmation that your research project entitled "How Effects of Resources Available for Teachers Impact Elementary School Perception of the Environment" has been approved under the expedited category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: November 22, 2006

Walwood Hall, Kalamazoo, MI 49008-5456
Phone: (269) 387-8293 FAX (269) 387-8276

# Appendix D

KNC Permission

Nature
Center

July 25, 2005

To Whom It May Concern:

David Christian Pagel has the Kalamazoo Nature Center's permission to provide pre and post test survey questions to select groups of visiting students. The time frame will be during the school year 2005-06.

Sarah Hopkins
School Programs Director

Phone 269.381.1574
Fax 269.381.2552
www.NatureCenter.org

7000 N. Westnedge Avenue
Kalamazoo, Michigan 49009-7599

# Appendix E

## Kalamazoo Elementary School Permission

School name removed under direction of the school principal

March 20, 2006

To Whom It May Concern:

I give permission for David Pagel to use [redacted] data in his thesis. The school and students cannot be identified by name, only by number.

Sincerely,

Sue Chartier
Principal