Graduate School Form 9
(Revised 10/07)

PURDUE UNIVERSITY
GRADUATE SCHOOL
Thesis/Dissertation Acceptance

This is to certify that the thesis/dissertation prepared

By Noah Chase Shields

Entitled "Elementary Students' Knowledge and Interests Related To Active Learning In A Summer Camp At A Zoo."

For the degree of Master of Science

Is approved by the final examining committee:

Neil Knobloch — 12-8-10
Chair

11-22-10

11-22-10

Approved by: ______________ 12/8/10
Head of the Graduate Program — Date

To the best of my knowledge and as understood by the student in the *Research Integrity and Copyright Disclaimer (Graduate School Form 20)*, this thesis/dissertation adheres to the provisions of Purdue University's "Policy on Integrity in Research" and the use of copyrighted material.

Neil Knobloch
Major Professor

This thesis ☐ is / ☑ is not to be regarded as confidential.

Neil Knobloch
Major Professor

Format Approved by:

______________ or ______________
Chair, Final Examining Committee — Department Thesis Format Advisor

Graduate School Form 20
(Revised 9/10)

PURDUE UNIVERSITY
GRADUATE SCHOOL

Research Integrity and Copyright Disclaimer

Title of Thesis/Dissertation:

"Elementary Students' Knowledge and Interests Related To Active Learning In A Summer Camp At A Zoo."

For the degree of Master of Science

I certify that in the preparation of this thesis, I have observed the provisions of *Purdue University Executive Memorandum No. C-22,* September 6, 1991, *Policy on Integrity in Research.**

Further, I certify that this work is free of plagiarism and all materials appearing in this thesis/dissertation have been properly quoted and attributed.

I certify that all copyrighted material incorporated into this thesis/dissertation is in compliance with the United States' copyright law and that I have received written permission from the copyright owners for my use of their work, which is beyond the scope of the law. I agree to indemnify and save harmless Purdue University from any and all claims that may be asserted or that may arise from any copyright violation.

Noah Chase Shields

Printed Name and Signature of Candidate

11/22/2010

Date (month/day/year)

*Located at http://www.purdue.edu/policies/pages/teach_res_outreach/c_22.html

ELEMENTARY STUDENTS' KNOWLEDGE AND INTERESTS RELATED TO ACTIVE LEARNING IN A SUMMER CAMP AT A ZOO

A Thesis

Submitted to the Faculty

of

Purdue University

by

Noah C. Shields

In Partial Fulfillment of the

Requirements for the Degree

of

Master of Science

December 2010

Purdue University

West Lafayette, Indiana

For my amazing family, whom without, this would not have been possible.

ACKNOWLEDGMENTS

Many outstanding individuals have assisted me in many ways throughout the progress and completion of this degree.

First and foremost, I would like to thank my mom for all her support and caring throughout my life. If it were not for her, I truly do not believe that I would have reached this moment in my life. It is because of her that I understand the value of education and hard work and how these things can open doors that you didn't even know were there.

To my committee chair and major advisor, Dr. Neil Knobloch, I would like to sincerely thank you for being so instrumental in making my experience outstanding. It was truly a pleasure to learn from and work with someone so passionate about what he does. I have learned a lot from our many discussions concerning my project, even though it felt like we were on a merry-go-round most of the time. I really appreciate the time and effort you took to guide me, a biochemist, through the field of educational research and social science. I will always value your advice and guidance throughout my professional life.

To my committee members, Dr. Colleen Brady and Dr. Aryn Dotterer, I would like to thank you for your guidance and discussions regarding my thesis and my academic and professional development. I have truly enjoyed working with both of you and hope that our professional relationships can continue into the future.

To Amber Frederick and my fellow staff members at Columbian Park Zoo, I would like to thank you for making our zoo an amazing place to work. I hope that the relationships that I have built there will continue through the rest of my life. I would also like to specifically thank the education department staff, whose cooperation and participation made my thesis possible. It was truly a pleasure to work alongside others who were as passionate about animals, the environment, and teaching.

To my fellow graduate students and department faculty and staff, I would like to thank each and every one of you for making our department a great place to be. Whether it is someone to vent to or needing someone to have some fun with, my fellow graduate students were there. It is amazing how close you can become to individuals you work with in just the matter of two years. It was an absolute pleasure and honor to work with each of you and I hope the relationships we have built will continue into the future and I wish you nothing but the best as you continue and succeed in all your future endeavors. For current graduate and new graduate students, here are a few words of wisdom. This whole process seems overwhelming and you will probably feel like quitting many times but it does get better and it is worth it in the end.

TABLE OF CONTENTS

Page

Page

Page

Page

Page

CHAPTER 5. CONCLUSION

APPENDICES

Page

LIST OF TABLES

Table Page

LIST OF FIGURES

ABSTRACT

Shields, Noah C. M.S., Purdue University, December 2010. Elementary Students' Knowledge and Interests Related to Active Learning in a Summer Camp at a Zoo. Major Professor: Dr. Neil Knobloch.

Active learning in an informal education context can increase student knowledge and interest in the academic content. If educators are able to influence situational interest and knowledge of students participating in informal science education program, it might be possible that this situational interest and knowledge will be taken back to students' formal classrooms and influence their interest to learn science in schools and classrooms. Increasing students' science knowledge and interest is becoming increasingly important in today's educational climate because many students are not pursuing careers in science because of a lack of knowledge and interest in the scientific endeavor.

The purpose of this exploratory study was to describe the relationships between active learning, the educator, and students' prior interest and experiences and the youth outcomes of science knowledge and interest at the end of a week-long zoo camp experience. This study took place over five weeks of a summer camp program at a small zoo in a small Midwest town including 96 participants from ages eight to eleven, their parents, and four camp educators. Students completed a pre- and post-test, while parents completed a single questionnaire at the end of the camp, and educators completed a demographics questionnaire and activity checklist throughout the week-long instructional

period. Because this was the first assessment of this kind for the zoo's summer camp program, assessment tools were designed to gather data regarding the dependent variables of student knowledge and interest and the independent variables of students' prior interest, prior knowledge, prior experience, gender, connection to learning, educators' experience, parents' value, and the average level of active learning.

There were four major conclusions of this study. First, students were similarly knowledgeable in general science before and after the summer zoo camp and half were interested in learning science in school and pursuing a career in science in the future. Second, students' interest in learning environmental science beyond the camp setting was related to their connection to the zoo-camp experience. Third, informal educators reported higher levels of active learning in the zoo camp if they were male, had more years of teaching experience, or had teaching experience in informal learning settings and no teaching experiences in formal educational settings. Fourth, boys had higher science knowledge before and after the camp compared to girls.

The results of this study suggest that zoo education programs may serve as important educational resources for local communities by helping students build science interest that translate back to formal schools and influence their interest in learning science, both as a student and later in life. In future studies, the relationships between students' connection to camp, learning science in school, and motivation to pursue a science career should be specifically scrutinized to determine if this translation is present. Longitudinal studies should be conducted to determine the long-term interests and motivations of students after they return to school from participating in zoo summer camps.

CHAPTER 1. INTRODUCTION

1.1. Introduction

Informal science education programs provide engaging learning experiences for students to learn science in contexts outside of school. Informal contexts may be situated in institutions such as zoos, aquariums, museums, and nature parks. These institutions have goals to build a foundation of knowledge and motivation that promote future responsible environmental behaviors. Some appropriate consumer choices include buying products made with recycled materials, appropriate pet choices such as keeping domestic animals as opposed to wild animals, and appropriate decisions about recycling like recycling plastic, glass, cardboard, etc. (Whitehead, 1995; Woodside & Kelly, 1995; Serrell, 1981). Many informal science institutions seek to accomplish these goals by incorporating active learning techniques and methods into their curricula for students to be more engaged in learning, yet little is known if these activities help students in building interest in and learning about science.

Informal science education programs, often known as conservation education programs, are typically popular programs within the local communities as ways for students to experience learning outside of the classroom. Teachers and school administrators have become aware of the positive outcomes these education programs provide their students. Some recognized positive effects on program participants include increased knowledge, increased personal responsibility, and an increased intent to act responsibly regarding the environment (deWhite & Jacobson, 1994; Jordan & Seeger, 2001).

Even though many informal education institutions are not mandated to adhere to state and national academic standards, many organizations make their programs relevant and marketable to local schools. Many of the science knowledge concepts that are taught by zoos, aquaria, and nature parks support national science academic standards, especially genetics and ecology (Burrill & Kennedy, 1997).

Some elementary students struggle to learn science. According to the Indiana Department of Education (2009), 65% of fifth grade students in Indiana passed the science portion of the Indiana Statewide Testing for Educational Progress-Plus (ISTEP+) exam. This is a concern because many of the top ten jobs within the next several years will rely heavily on a strong background in science (Coveny, 2010). Informal science programs have the potential to serve as great outside-the-classroom resources to local communities to supplement students' formal science education. The benefits of utilizing educational experiences outside of the classroom, especially in the area of science, are well documented (Cronin-Jones, 2000; Falk & Dierking, 1997; Price & Hein, 1991). These informal programs are in a position to serve an ever-growing need to learn science within the community.

The impacts of informal science education programs can serve as a domino effect. Increased interest in science developed by students in these education programs can lead to the development of a more positive attitude to learn science, which in turn, can influence students' attitudes towards science in a formal context (Fenichel & Schweingruber, 2010). Students that express a positive attitude toward learning science and science in general might be more likely to take learning outside of the classroom and learn on their own. Learning on their own, outside of the classroom, may lead to experiences that can shape individuals' career aspirations and personal actions and lead them down a pathway to science careers (Fenichel & Schweingruber, 2010).

Many informal science education programs provide students with opportunities to explore and build a foundation of knowledge and motivation that promote future responsible environmental behaviors such as appropriate consumer choices, appropriate pet choices, and appropriate decisions about including recycling as part of a daily routine. As the environment continues to deteriorate as a result of human actions, teaching age-appropriate environmentally responsible behaviors has become extremely timely and important (Brewer, 2001; Roth, 1990). Once students become aware of the environment around them, they can then begin to develop their own schema regarding their role in it (Roth, 1990).

1.2. Problem

The nature of informal learning is to provide students opportunities to explore, experience, and interact with others as they learn science in community-based settings outside of the formal classroom (National Research Council, 2009). Informal educators develop activities to get students interested and actively engaged in the learning experience, yet little is known to what extent students are actively engaged and how well they connect to the learning activity. Furthermore, few studies have documented the levels of student interest and knowledge as outcomes from informal science education programs such as summer zoo-based conservation education programs. Moreover, little has been done to investigate if there are differences in how students respond to active learning in informal science education program based on students' previous interests, gender, parents' expectations, and prior camp experiences. This study focused on identifying relationships that may exist between the active learning and student outcomes, as well as these independent variables and outcome variables.

1.3. Significance of the Study

The present study builds on the current literature by incorporating known key variables and relationships in formal contexts and applying them in an informal science education program at a zoo. If these key variables and relationships are shown to be valid in this context, they can then begin to be applied in other contexts and locations. Valid variables and relationships will allow training sessions to be developed for new and current staff to ensure that program design and implementation becomes more effective and efficient.

Informal science education programs in zoos, aquariums, museums, and nature parks are instructed in a variety of formats. Because there is not a presence of a state or national organization that coordinates these different facilities, most institutions carry out program development, curriculum design, and curriculum implementation differently from one another. There are, however, very broad objectives outlined by the North

American Association of Environmental Education (1999) that this organization has deemed appropriate and important for environmental education programs to include in each facilities educational objectives. Many of these broad objectives are incorporated into different facilities' educational objectives because they are so broad. Informal educational organizations largely create their own educational objectives because of lack of specific national guidelines and objectives.

It is well recognized and publicized that evaluation is an important aspect of program planning. Evaluation and assessment protocols allow informal science education institutions to determine if programs are meeting their objectives (Bennett, 1989). Results of these protocols can also allow possible solutions or ideas to be identified for program improvement. Currently, within the literature there is a recognized need to develop evaluation and assessment protocols to evaluate effective practices and achievement of learning outcomes (Bennett, 1989; Fien, Scott, & Tilbury, 2001; Jacobson,1991;).

Even with the recognized need to incorporate evaluation and assessment techniques into programs, there is a lack of effective utilization of these techniques. Many informal science education facilities at zoos, aquariums, museums, and nature centers lack personnel that are appropriately trained and efficacious to develop and utilize these types of techniques. Because there are no unifying national educational outcomes for these programs, there are not many age-appropriate assessments and evaluation protocols that can be applied in multiple contexts. Generalizability of any current assessment tools is limited because the populations served may be very different between institutions. There is not a high prevalence of published work in the literature regarding evaluation protocols. Many of the published studies in this informal area related to zoo, aquariums, museums, and nature centers discuss research studies and not necessarily evaluation tool development (Bogner, 1998; Dettman-Easler & Pease, 1991; deWhite & Jacobson, 1994; Eagles & Demare, 1999; Kruse & Card, 2004).

The results of this study can be incorporated in short and long-term program development. In the short term, the results of this study can be incorporated into the effective planning, design, and evaluation of new programs, improved educator training, and improved strategic targeting of local education needs of children in the surrounding community. On a broader level, the results and conclusions from this study can aid in the improvement of program planning, design, and evaluation, which will better serve the thousands of children reached nationally through zoo-based informal science education programs. Effective training programs for educators and volunteers will enable a greater number of properly trained individuals to better and more effectively serve the children they are teaching. As zoo-based programs are able to substantiate themselves as an educational resource for their local communities, they will be in a better position to apply for and receive local and national grants for program improvement and development. The increase in funding sources will allow for the hiring of new individuals with new ideas and the more effective training of those individuals which will better serve their local communities.

1.4. Purpose of the Study

The purpose of this exploratory study was to identify and describe variables and relationships between summer camp learning activities, the role of the educator, and youth variables such as prior interest in science and nature and prior camp experiences, and the students' achievement of the learning outcomes and the students' interest during week-long camp activities during five separate weeks in one age group (8-11 years old) over the course of summer 2010 at a small zoo, in a small Midwest city.

1.5. Research Questions for the Study

The following questions guided the study:

1. Was there an increase in science knowledge and were students interested in science at the end of a five day camp experience?
2. Is students' personal connection to camp activities related to the youth outcomes of science knowledge and interest?
3. Is the level of active learning related to the achievement of the youth outcomes of science knowledge and interest?
4. Are educators' educational and professional training related to the level of active learning in the activities they choose to implement in a camp?
5. Are students' prior interests in science and nature related to the youth outcomes of science knowledge and interest?
6. Are previous zoo experiences related to boys' and girls' science knowledge and interest to learn science in school and work in science careers?

7. Are parents' perceptions of camp value related to the youth outcomes of science knowledge and interest?

1.6. Assumptions Guiding the Study

The following assumptions were made by the researcher.

1. Students understand what the term science means.
2. Educators have a sufficient depth of knowledge in the content areas.
3. Students have some prior interest in animals and nature.
4. Students have had limited formal science instruction.
5. Students will be able to read at their grade level.
6. Educators implemented the lesson plans they designed for the week-long camp activities, and self-reported the level of active learning with accuracy.
7. Educator assistants followed the reporting protocol for observing the learning activities and reported consistently across the days and weeks of the summer camp.
8. The primary researcher held a positivist paradigm. A positivist researcher is seeking the facts about a phenomenon and works to distance the data from the subjective nature of the participants in that phenomenon (Patton, 2002).

1.7. Limitations of the Study

The following statements were limitations of the study.

1. Students self-selected to participate in the camp and were not representative of a larger population. Although the results are not generalizable beyond the participants of the local summer zoo camps, these participants could be representative of the previous three years for these summer camps (A. Frederick, personal communication, October 13, 2010).
2. Although desirable, facility, personnel and budget limitations did not permit a quasi-experimental research design that would assess the cause-effect relationships or impacts of the zoo camps. The pre-experimental research design did not have a comparison group or random assignment, therefore, the relationships that were reported are descriptive in nature and do not represent causality. This study reports "what is," and not "what influenced."
3. Although it is desirable to ask several questions per desired outcome, students in the age range of 6-11 years old have limited attention spans. Administering an instrument to young children is dependent on their attentiveness and their abilities to sit and focus on a given task. Young children's ability to focus their attention for any length of time determines the length of an evaluation instrument. Young children experience difficulty with sitting and focusing attention on one task for longer than 10-15 minutes on average.
4. Although a knowledge test is necessary to determine the amount of information gained from an education program, it is a formal assessment tool.

Implementing a formal assessment tool in an informal context during the summer further limits students' abilities in focusing on a given task, in this case taking a test, for any given length of time.

5. When involving conservation in any context, there exists socially desirable characteristics and behaviors. These characteristics and behaviors have become socially popular so parents and children may supply answers or opinions that they think the zoo educators are looking for since the educators include conservation messages in the programming and the programs happens in a zoo setting.
6. The primary researcher may have influenced the study, particularly the interpretation of the results because they were one of the educators designing and conducting the summer camps and has worked at the zoo in this capacity for two and half years. Researcher biases were minimized by collecting data confidentially and having a panel of experts review each component of the study.

1.8. Terms

Formal learning – This type of learning is best described as a traditional-style format that would be accustomed to a formal school setting such as elementary school. Formal learning is typically very structured and strictly guided by national and state standards (Malcolm, Hodkinson, & Colley, 2003).

Informal learning – This type of learning takes place in zoos, aquariums, and museums. It is much less structured and lends itself to the incorporation of activities not traditionally suited for a formal context such as touring exhibits and seeing live animals. Informal learning environments allow instructors to incorporate many more learner-motivated activities that are informed by the interests and relevance to the learner (Griffin, 1998; Falk & Dierking, 2000). These types of experiences are thought to enhance student inquiry, enjoyment, and relevance of science to the learner (Bell, Lewenstein, Shouse, & Feder, 2009).

Responsible environmental behavior – Responsible environmental behaviors are behaviors that are socially accepted as being kind to the environment. Such behaviors that Columbian Park Zoo emphasizes are appropriate pet choices, recycling, purchasing products that have been made with recycled materials, reduce the amount of things you use, and saving energy by turning off lights (Simmons, 1991).

Science knowledge – Science knowledge defined in this study was the declarative knowledge of basic science concepts defined by national learning standards.

Student interest – Student interest was defined as the interest that students have in learning about animals, nature, and science. This was determined by asking students at what levels were they interested in various topics and the extent of that interest (Schiefele, Krapp; Winteler, 1992) and the intrinsic value of expectancy-value motivation (Eccles & Wigfield, 2002).

Summer camps – A local zoo hosts a series of summer camps entitled "*Young Edventurer Camps.*" These summer camps are five day camps held at Columbian Park and involve a variety of themes. In summer 2010, there were 10 individual weeks of camps instructed. These camps are designed to be geared for different age groups. Approximately five week-long camps were taught at the 6-8 year old age range and approximately five week-long camps will be taught at the 8-11 year old age range. The curricula for summer camps involved science exploration activities such as microscopy work, dissection, DNA extraction, crafts such as bird feeders; and general activities such as activities outlined in national environmental education curriculum including Project Wild, Project WET, and Project Learning Tree. Only the five weeks of the 8-11 year old camps were included in this study.

CHAPTER 2. REVIEW OF LITERATURE

2.1. Purpose of the Study

The purpose of this exploratory study was to identify and describe variables and relationships between summer camp learning activities, the role of the educator, and youth variables such as prior interest in science and nature and prior camp experiences, and the students' achievement of the learning outcomes and the students' interest during week-long camp activities during five separate weeks in one age group (8-11 years old) over the course of summer 2010 at a small zoo, in a small Midwest city.

2.2. Research Questions for the Study

The following questions guided the study:

1. Was there an increase in science knowledge and were students interested in science at the end of a five day camp experience?
2. Is students' personal connection to camp activities related to the youth outcomes of science knowledge and interest?
3. Is the level of active learning related to the achievement of the youth outcomes of science knowledge and interest?
4. Are educators' educational and professional training related to the level of active learning in the activities they choose to implement in a camp?

5. Are students' prior interests in science and nature related to the youth outcomes of science knowledge and interest?
6. Are previous zoo experiences related to boys' and girls' science knowledge and interest to learn science in school and work in science careers?
7. Are parents' perceptions of camp value related to the youth outcomes of science knowledge and interest?

2.3. Introduction

This study was guided by one central theory of motivation. The expectancy-value theory of motivation was developed by Dr. Jacquelynne Eccles and colleagues and revolves around two central concepts: expectancy and value (Eccles, 1983; Eccles, Wigfield, Flanagan, Miller, & Reuman, 1989; Wigfield, 1994; Wigfield & Eccles, 1992). This theory was chosen because these two concepts are especially important when the decision is about participation in extracurricular programs that are away from school and are community-based such as informal science education programs in zoos, aquariums, and museums.

The expectancy-value theory of motivation underpinned the dependent variables included in this study: student knowledge and student interest. These variables were central to the program goals of an informal science education program at a local zoo.

2.3.1. Theoretical Framework

2.3.1.1. Expectancy-Value Theory of Motivation

The current expectancy-value theory of motivation was developed by Dr. Jacquelynne Eccles and colleagues from the original expectancy-value theory of motivation by Crandall in 1969 (Eccles, 1983; Eccles et. al., 1989; Wigfield, 1994; & Wiggles & Eccles, 1992). As described above, there are two central concepts involved in this theory: expectancy and value. The expectancy concept is expressed when an individual asks themselves, "Can I do this task?" (Eccles, 1983; Pintrich, 1988a, 1988b; Wigfield, 1994; Wigfield and Eccles, 1992). This question is central in the decision-making process for participation in many different activities especially extracurricular activities for children. In the case of many extracurricular activities, the child is given the opportunity to participate in this part of the decision-making process about beginning participation in a new activity along with the influence of their parents (Yoon, 1997). If the child does not feel that he or she can or want to participate in any given activity, the next concept in this theory does not need to be decided by the parent.

Parents must determine if there is any value in their child's participation in any given activity in order for them to give permission for their child's participation. For an individual to agree to participate in any given activity, they usually will ask themselves "Why should I do this task?" This question demonstrates the other key concept in the expectancy-value theory: task value. Task value is defined by the extrinsic or intrinsic value that an individual places on a specific task or activity. In other words, an individual must hold some importance in the end result of task or activity (Eccles, 1983; Pintrich, 1988a, 1988b; Wigfield, 1994; Wigfield & Eccles, 1992). Once they ask themselves this question and have already determined if they can do the task, they are exhibiting the full expectancy-value theory of motivation. The importance of expectancy and value in the decision to participate or not in a task and participation itself are known to influence achievement choices, performance in a task, effort put forth by an individual at the task and persistence of an individual in a task (Eccles, 1983; Wigfield, 1994; Wigfield & Eccles, 1992; Figure 1).

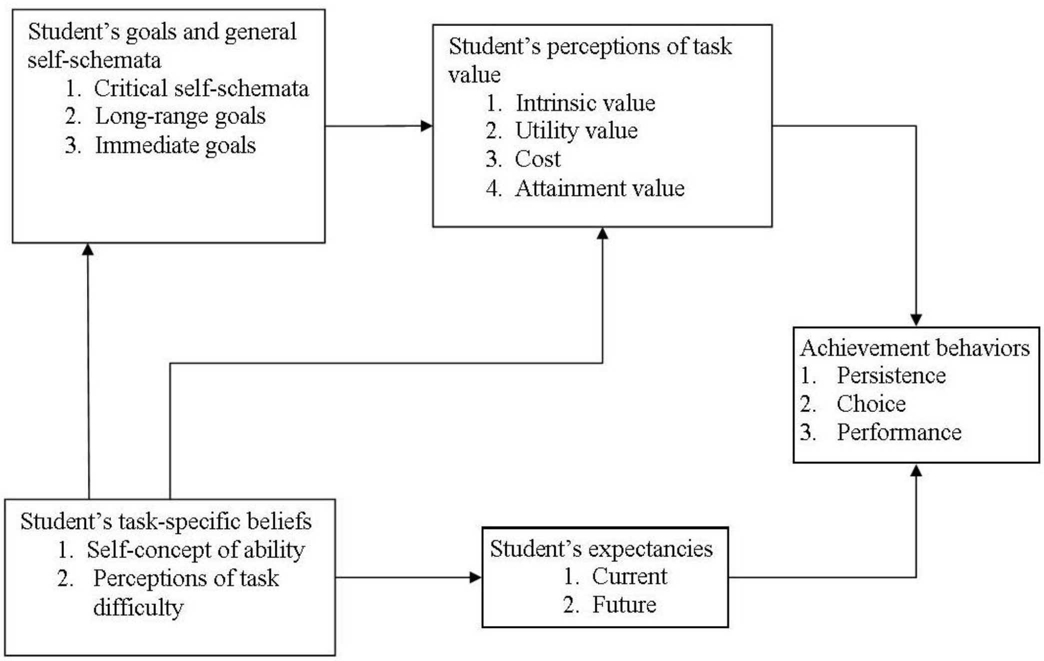


Figure 1: Model of achievement attitudes and behaviors (Eccles, 1983).

Expectancy-value theory has been extensively researched in the college classroom (Pintrich, 1988b; Pintrich, 1989; Pintrich & De Groot, 1990; Pintrich & Garcia, 1991) but much research has also been done in the elementary age-students, ages 6-11. Several studies have show that achievement related expectancies begin to become salient to children within the 6 ½ - 8 years of age range and even more so in the 9 ½ -11 years old range (Parsons & Ruble, 1972; Parsons & Ruble, 1977; Parsons, 1978; Ruble, 1975). This is an important time period in human development to focus on because many informal science education programs target this age group and try to build interest and knowledge about a variety of topics. As children grow and develop through childhood into adolescence, many of the attributions and perceptions that are developed earlier in life carry through to later stages in life (Denissen, Zarrett & Eccles, 2007; Eccles, Barber, Updegraff, & O'Brien, 1998).

Students' expectancies and task values have also been documented in affecting many other areas of learning such as deeper understanding and higher cognitive processes. When students have high task values and expectancy beliefs for any given task, they are more willing and able to utilize higher cognitive and metacognitive strategies such as summarizing, planning, and the self-monitoring of their work because they are more interested in learning and developing mastery in that task or activity. These newly employed strategies can results in students demonstrating a higher level of understanding and knowledge in that one area (Pintrich, 1989; Pintrich & De Groot, 1990, Pintrich & Garcia, 1991, Pintrich & Schrauben, 1992). This higher level of understanding and knowledge can lead to higher levels of task value and expectancies when students choose to pursue related tasks or activities.

Much of the current research with children's expectancy-value theory of motivation has taken place in the formal educational setting of a school classroom or other school-related activities such as sports and music. This research study situated this theory of motivation in an activity outside of the traditional classroom and away from any formal education context. Parks and zoos can provide community-based informal science education through summer camps, field trips and afterschool programs. Informal science education programs allow students to learn at their own pace in a very relaxed and non-traditional learning environment. Expectancy-value theory can guide researchers and practitioners, resulting in better understanding how to more effectively conduct informal science education programs.

Expectancy-value theory was chosen because the goals of many zoo educators include fostering interest in science and nature and allowing children to experience these concepts in a non-threatening environment where they can build an appreciation for science and nature that they can apply in other areas of their lives. This theory for this study was also chosen because of its relevance for understanding children's motivation in the context of out-of-school learning.

2.3.1.2. Schema Theory

Cognitive schema theory presents a concept that involves ways that people organize facts, senses, and experiences. According to this theory, everyone possesses a schema or an individualized way of organizing thoughts in order to interpret the world around them. These schemas allow individuals to determine what is wrong and right and where they fit into the environment around them (Bem, 1981; Carrel & Eisterhold, 1983).

Developing a personal schema occurs in everyone and it occurs as a process. This process has many steps of receiving information, processing information, and combining and reorganizing old information in order to gain a new interpretation of the environment. This process was outlined by Axelrod (1973; Figure 2).

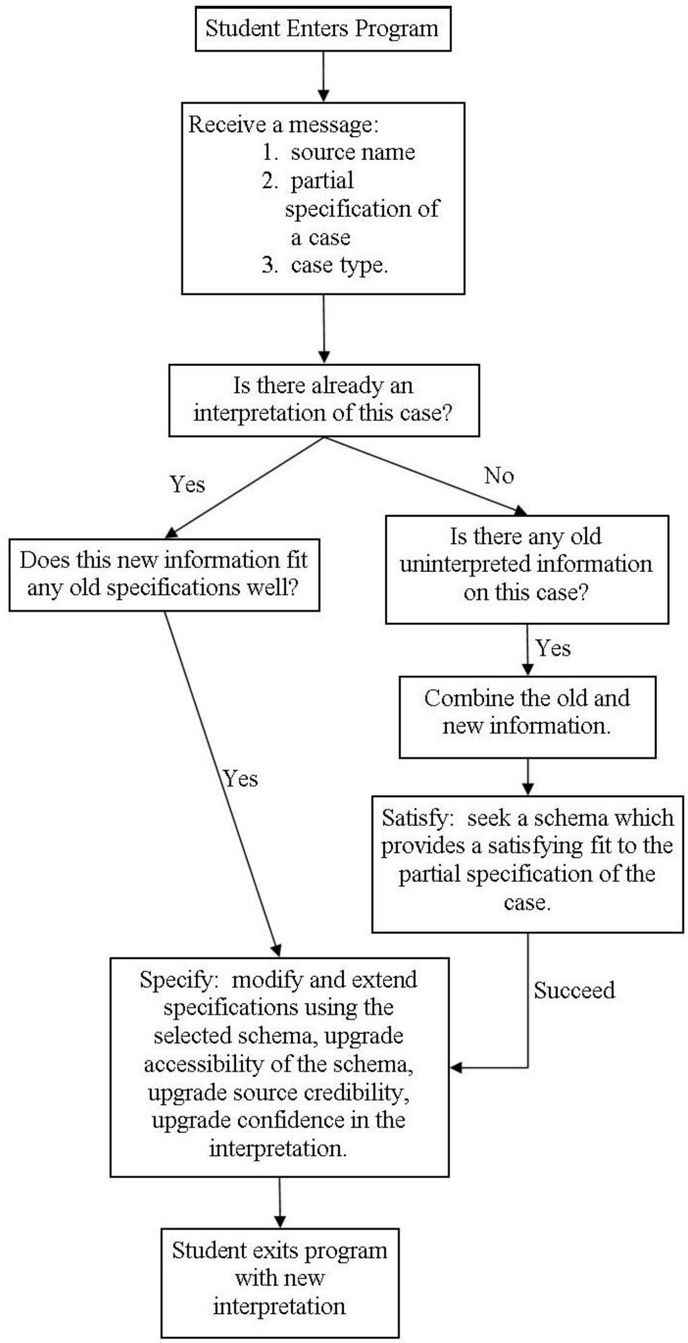


Figure 2: Process Model for Schema Theory (Axelrod, 1973).

As an individual progresses through a learning activity or other activities, he or she is cycling through this cycle in order to leave that activity with either a new interpretation or clinging onto an old interpretation. This cycle is known in the environmental education realm and is actively incorporated into many zoo education curricula. In environmental education, it is accepted that awareness of nature needs to happen first, and then proceed to learning concrete facts and information about nature. As one begins to build knowledge and understand the intricacies in nature, then concern begins to build which can then lead to an individual taking action (Roth, 1990). This last stage involving action is the ultimate outcome that zoo education programs seek to accomplish.

Schema theory has been used extensively in the understanding of gender roles (Bem, 1981; Bem, 1983) and is currently being utilized in different areas of learning. Schema theory has also been shown to be effective in teaching and learning new languages. There is a recognized importance of the understanding of background knowledge and cultural understanding in the learning of a new language. Students that have a pre-existing schema involving a positive or intimate perspective of another culture are better able to relate a new language to their own (Carrell, 1984; Melendez & Prichard, 1985; Pearson-Casanave, 1984).

Much of the current literature regarding schema theory applied this theory to concepts such as language and gender typing (Bem, 1981; Bem 1983; Carrell, 1984; Melendez & Prichard, 1985; Pearson-Casanave, 1984). Few studies were located that related schema theory to more academic concepts such as science and math. This study will apply this theory to learning science and nature in an informal context because zoo education programs try to build awareness and knowledge that can be incorporated into children's schema regarding their perceptions about science and the environment around them. It was proposed that if these concepts are introduced and incorporated into a child's schema at an early age, the child might continue to seek out new information regarding science and nature to further incorporate into their schema. This process could potentially yield to an adult that is able to make environmentally sound decisions and take action to rectify some of the environmental problems that humans have caused.

2.3.2. Summary

The expectancy-value theory of motivation and schema theory were both chosen to guide the research questions and variables in this study because they offered a plausible explanation of the context and motivation in which the educational programs at a small Midwest zoo are taught. The current study also yields the added benefit of applying these two theories in a non-traditional context that what is prevalent in the literature.

2.4. Conceptual Framework

Key concepts from the active learning theory, expectancy-value theory, and schema theory informed the conceptual framework of this study. The dependent variables were student knowledge and student interest. The independent variables incorporated into this framework were youth variables (prior interest in science and nature, gender, previous program experience, and parental expectations), the educator (academic and professional background), and camp learning activities (level of active learning involved and student connection to activities). The independent variables included in this study (level of active learning in learning activities, students' personal connection to learning activities, the educators' educational and professional background, students' prior interest in topic, students' gender, students' previous experience in zoo programs, and parental expectations of task value) were informed by several supporting theories including active learning, the role of the educator, and gender.

2.4.1. Operational Framework

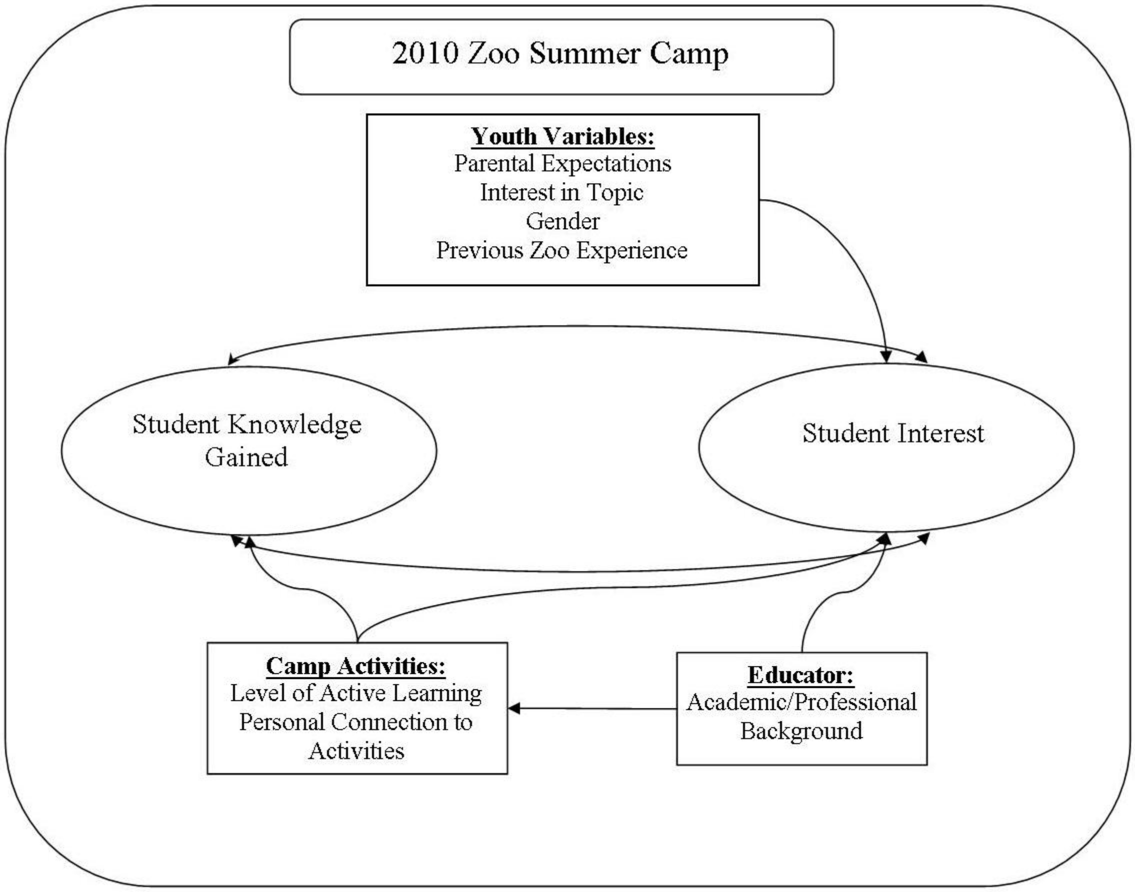


Figure 3: Operational Framework

2.4.2. Active Learning

The primary variables in this study were the contextual variables related to camp activities. These contextual variables were somewhat unique in zoo education programs. Many zoo education programs promote a relaxed environment where students are afforded opportunities to work with others, actively participate, and explore nature. Zoo educators are more easily able to incorporate different activities that allow students to exploring different scientific concepts in a variety of ways. The level of active learning involved in each camp learning activity and the students' personal connection to those learning activities or the intrinsic value in the context of five summer zoo camps were hypothesized to be positively related to student knowledge gained and student interest.

Active learning has traditionally had vague definitions until recently. According to Bonwell and Eison (1991), a very general definition of active learning involves any learning activity that engages students in higher learning processes that allow them to think and reflect on what they are doing. These learning activities discussed in Bonwell and Eison (1991) are learning activities that are traditionally employed in the classroom during the first introduction to the material and not learning activities that take place at home such as homework (Prince, 2004).

These learning activities included in the above definitions have been further refined to include five strategies of active learning that engage students with multiple senses: visual, social, verbal, kinesthetic, and real-time feedback (Knobloch, 2009). Educators can incorporate many learning activities that involve all five of the above concepts in a variety of ways. Zoo educators are able to utilize many different methods to incorporate multiple senses into their learning activities such as nature explorations outside, hands-on science experiments, and encounters with live animals, all of which directly tie-in with educational or learning outcomes of the programs.

There is a growing body of literature that is positively linking active learning to increased student knowledge. Student test scores increased during a study conducted by Ruhl, Hughes, and Schloss (1987), where the researchers introduced one technique of stopping lecture and having students compare notes before continuing. This technique was delivered with four populations of students with similar results. Groups that were offered the time to stop and compare notes had higher average test scores than did groups that were not offered this time. A similar study was conducted earlier by Di Vesta and Smith (1979) with very similar results. These two studies demonstrate that by introducing an active learning activity as simple as a brief discussion among peers regarding notes there was an increase in demonstrated knowledge gained.

Student engagement or connection to learning activities has been recognized as being an important aspect of active learning. The type of learning activity itself is just as important as including these active activities in an educational program (Di Vesta & Smith, 1979). For example, homework could be considered active learning because students are actively completing a learning activity but under the current working definition of active learning, homework would not necessarily be considered an active learning activity. These learning activities need to be designed to allow students ample opportunities to participate in meaningful thought (Wiggins &

McTighe, 1998). Several studies have shown that the type of activity is related to positive educational outcomes (Hake, 1998; Laws, Sokoloff, & Thornton, 1999; Redish, Saul, & Steinberg, 1997; Taraban, Box, Myers, Pollard, & Bowen, 2007). The variable of student connection to learning was also informed by Eccles (1983) and intrinsic value.

Many of the current studies regarding active learning and student engagement and connection to learning have taken place in formal classrooms regarding very structured curriculum. The current study sought to apply the theory of active learning to an informal science education program at a zoo. The level of active learning and connection to learning activities was hypothesized to be positively related to the student outcomes of knowledge gained and interest.

2.4.3. Educator Academic and Professional Background

Teachers serve as the primary vector through which students are introduced to new information and knowledge and because of this, the relationship between teachers and students is tremendously important. Teachers have the ability to foster and develop the love of life-long learning in their students or they have the ability to have the complete opposite affect. A positive relationship between teachers and students and the learning environment that they facilitate are known to be positively related to student outcomes of knowledge (Wright, Horn, & Sanders, 1997).

Zoo educators come from a wide range of educational and professional backgrounds. Many come from the biological sciences of biology, wildlife, biochemistry and ecology. The variety of educational backgrounds allows for individuals that have a high level of content knowledge to be hired to teach the science and nature concepts included in many zoo education programs. There is empirical support that the quality of the teacher is related to student outcomes (Hill, Rowan, & Ball, 2005; Nye, Konstantopoulos, & Hedges, 2004; Rockoff, 2004).

In the context of zoo education programs, the educator typically plays a large role in the design and implementation of curriculum. A zoo educator is charged with the responsibility of designing their own camp curriculum that meets learning objectives and decides which learning activities that will be included or excluded in that teaching plan. The educational and professional background of an educator has the potential to influence his or her choice of learning activities and was a secondary focus of the current study.

2.4.4. Youth Variables

The independent variable of youth variables was defined to include parent value, prior camp experiences, prior interest, and gender. These secondary variables were included in this study because they stand to serve as further information to zoo educators that would allow them to improve their programs to meet the many different needs of their audiences. First, parent expectations are important to consider when dealing with informal education programs that take place out-of-school because they are the primary decision maker in the decision for a child to participate or not. There are many things that are taken into consideration when a child wants to participate in an out-of-school activity and this participation depends somewhat on their parents' expectations of that activity (Davis-Kean, 2005; Mahoney & Eccles, 2007).

Some of these values that parents hold involve prior experiences in similar programs. If there was positive experience in a similar program, then the rationale for participating in that similar program would likely be positive as well. The expectancies as a result of a similar program such as another zoo camp or other informal science education program has the potential to influence the expectancies and values that a parental figure would hold for a another informal science education program (Eccles, 1983; Wigfield, 1994; Wigfield & Eccles, 1992). By understanding the expectancies and beliefs of participants' parents, zoo educators can better design programs that meet these variables to potentially make an even more successful program.

Many students that participate in informal science education programs, especially at zoos, have some prior interest in the topics that will be discussed during the program. With this prior interest in any given topic, children enter into these programs with their own expectancies, much like their parents. Their expectations could be related to participating in an activity that will give them time to be involved in something that they like, regardless if they see higher value in their participation. This expectancy of getting more time doing something they like or that interests them has the potential to keep students engaged in the learning process and allow them to participate in higher cognitive processes regarding the material presented. If zoo education programs are able to keep students interested in the material and increase that interest, that interest might be incorporated into students' expectancies and prompt them to make other positive decisions regarding science and nature later in their lives (Denissen, Zarrett & Eccles, 2007; Eccles et. al., 1998).

Within the age rage of 6 1/2 -11 years old is when one begins to notice sex differences in the level of expectancies and value related to achievement (Crandall, Armstrong, Boswell, Parsons, Brush, & Steel, 1980; Parsons & Ruble, 1977; Yoon, 1997). Before this time, girls and boys seem to demonstrate an equal level of expectancy beliefs but begin to differentiate around late childhood and demonstrate increased differences throughout early and late adolescence. These differences are exhibited in course enrollment, activity choice, and academic performance (Eccles, Midgly, Wigfield, Buchanan, Reuman, Flanagan, & Mac Iver, 1993; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Wigfield, Eccles, Yoon, Harold, Arbreton, & Blumenfeld, 1997). Informal science education programs conducted in zoos might have the potential to serve as an activity that increases interest and value in students of different sexes and allows them to feel that they can and want to continue learning about science and nature in a formal setting.

2.5. Zoo Education Literature Review

Throughout history, humans have been fascinated by the natural world around them and wanted to experience this world up close. Many wealthy individuals were able to do so in the past by purchasing and keeping wild, exotic animals as personal collections. This was a trend that was seen throughout the 1800's and began to experience a shift from individual ownership to public ownership in the late 1800's and early 1900's. At this time, private exotic animal collections were donated to city governments and opened for public access so all could experience the wonder of nature. Since this time, zoo and aquariums have been the focal point of many communities across the world.

As human knowledge grew about the natural world, so did the missions of zoological institutions. At one point in the early history of animal exhibition, zoos were considered places to come view wild, exotic animals in small cages and nothing more. Over the last 100 years, there has been a shift in paradigm regarding the role of zoos. Zoos now strive to not only exhibit exotic animal species but also exhibit their natural habitats and educate the public these things and their role in preserving it. All zoos accredited with the Association of Zoos and Aquariums in the United States have education as one of their pillars (Association of Zoos and Aquariums, 2010).

Zoos currently strive to educate the public about wild animals and wild places and many zoos hope to change visitor opinions and perceptions to eventually effect their actions toward the environment. These changes in behavior through conservation education programs occur through a variety of means including signs, exhibits, school programs, and camp experiences. Many of these programs incorporate hands-on learning activities that allow visitors or participants to actively engage in learning about conservation education (Lindemann-Matthies, 2001; Whitehead, 1995). Zoo education programming is designed for people from all walks of life and all ages but many zoos tend to focus on educating children. Children are the primary audience for many education programs in zoos because it is recognized that what perceptions and behaviors they develop during childhood will continue with them throughout their lives (Basile, 2000; Pomerantz, 1991). If conservation education programs at zoos are able to teach children about science and nature and promote appropriate behaviors, then some of these environmentally responsible behaviors might be adopted and carried with them throughout their lives (Serrell, 1981).

Conservation education programs at zoos have the potential to have a positive effect on environmental attitudes but it is not known how long an individual would need to participate in these programs or if these new positive attitudes would lead to positive environmentally responsible behaviors (Marshdoyle, Bowman, & Mullins, 1982; Pomerantz, 1991; Westphal & Halverson, 1985). Increasing an individual's attitude toward the environment after one, single program might not be sufficient to change that individual's behavior towards the environment. Many zoos are presented with a dilemma because most participants or visitors to these institutions and/or programs do not return for subsequent visits or programs. It is difficult to conduct longitudinal studies regarding this because participants would have to have consistent participation in a program over an undetermined amount of time.

There have been many studies that have looked at conservation education programs in formal schools and have concluded that there were limited positive outcomes for most participants (Eagles & Demare, 1999; Leeming, Porter, Dwyer, Cobern, & Oliver, 1997; Legault & Pelletier, 2000; Sutherland & Hamm, 1992). These authors cite many reasons for limited positive outcomes. Legault & Pelletier

(2000) note that there was repetition of information that may have impeded motivational change to learn the information of the 184 children in the sample. The authors also further noted that the population showed evidence of diminished extrinsic motivation. Eagles and Demare (1999) noted that in their sample of 72 students that there was a moderate level of pre-existing knowledge and attitudes before the conservation education program and little change was expected. It appears that students entering conservation education programs in formal schools, experience programs that are either repeating information that is already known or not challenging students to higher cognitive processes. It is useful to note that in the previously mentioned studies, none of them took into account the learning activities within these programs.

The outcomes prevalent from conservation education programs occurring in formal schools are in contrast to conservation education programs occurring in zoos or other out-of-class contexts. Many studies have indicated that conservation education programs in informal contexts do have a noticeable positive effect (Bogner, 1998; Dettman-Easler & Pease, 1999; Knapp & Barrie, 1998; Kruse & Card, 2004).

Studies conducted by Knapp and Barrie (1998) and Dettman-Easler and Pease (1999) both found that these programs increase participants' knowledge and environmental attitudes. The study conducted by Knapp and Barrie (1998) included 1,500 students in grades fourth through sixth that participated in interpretive programs at a nature area in Indiana. Two programs were evaluated, one focused on teaching students knowledge and the second program focused on teaching about issues facing that specific site. The researchers found that each of the programs offered at this nature area significantly improved student knowledge but did not have a noticeable impact on students' attitudes and behaviors regarding the environment (Knapp & Barrie, 1998). It appears that in this study the programs did not have an immediate effect on students' attitudes and behaviors but the authors did not focus on the types of activities that students participated that allowed them to explore these thoughts. A study conducted by Dettman-Easler and Pease (1999) included 1,363 students involved in the experimental and control groups in education programs at six residential wildlife education centers. The authors found students that participated in the education programs at the wildlife education centers displayed significantly more positive attitudes towards wildlife than did students in the control groups who experienced in-class wildlife programs. These positive attitudes were also displayed three months after the programs took place (Dettman-Easler & Pease, 1999). The authors of this study were successful in measuring differences between student groups that participated in different program types but this study did not focus on the types of learning activities that students participated in to improve their attitudes regarding wildlife.

Kruse and Card (2004) demonstrated that a summer camp program at a zoo had significantly positive impacts on students involved. Three-hundred and eighty-three campers participated in an animal husbandry course over the course of several weeks. This course was designed as a consecutive unit of learning experiences that involved interactions with animals and animal husbandry techniques. The progression of students from one camp to another, generally, demonstrated an increase in conservation knowledge, attitude, and student behavior (Kruse & Card, 2004). This study was effective in demonstrating improved positive outcomes of conservation education programs but did not incorporate any evaluation of the learning activities involved in these camps.

Bogner (1998) conducted a study involving 700 students that attended education programs in a national park. These students demonstrated an increase in conservation knowledge, positive attitudes regarding the environment, and more positive behaviors. One interesting finding of this study was that the pre-test instrument demonstrated that students participating in these environmental education programs were already more knowledgeable about nature and more willing to act for nature that average populations (Bogner, 1998). This was an important finding because many of the studies included in this review did not take into consideration the comparison of participants' attitudes and behaviors in relation to the rest of the population in their experimental designs.

2.6. Summary

There has been much research into the impacts of conservation education programs on participants' conservation knowledge and environmental attitudes and behaviors. It can be said that there is a known positive effect in participating in these programs but there is a gap in the literature regarding how these programs are able to accomplish these tasks. This study sought to identify relationships between the learning activities in a conservation education program, the educator, and prior youth variables and the outcomes of student knowledge and interest. By determining if these relationships exist, further research can be done to uncover the extent of these variables and offer suggestions for program improvements and educator training to increase student outcomes and have the outcomes have a longer effect.

CHAPTER 3. METHODOLOGY

3.1. Purpose of the Study

The purpose of this exploratory study was to identify and describe variables and relationships between summer camp learning activities, the role of the educator, and youth variables such as prior interest in science and nature and prior camp experiences, and the students' achievement of the learning outcomes and the students' interest during week-long camp activities during five separate weeks in one age group (8-11 years old) over the course of summer 2010 at a small zoo, in a small Midwest city.

3.2. Research Questions for the Study

The following questions guided the study:

1. Was there an increase in science knowledge and were students interested in science at the end of a five day camp experience?
2. Is students' personal connection to camp activities related to the youth outcomes of science knowledge and interest?
3. Is the level of active learning related to the achievement of the youth outcomes of science knowledge and interest?

4. Are educators' educational and professional training related to the level of active learning in the activities they choose to implement in a camp?
5. Are students' prior interests in science and nature related to the youth outcomes of science knowledge and interest?
6. Are previous zoo experiences related to boys' and girls' science knowledge and interest to learn science in school and work in science careers?
7. Are parents' perceptions of camp value related to the youth outcomes of science knowledge and interest?

3.3. Researcher's Paradigm

The researcher's paradigm was positivism and this paradigm posits that there is a reality out there and it can be studied and eventually understood. Positivist researchers strive to establish internal and external validity of their research methods to allow results to be generalized to the larger population (Denzin & Lincoln, 2005). A positivist researcher seeks the facts about a phenomenon and works to distance the data from the subjective nature of the participants in that phenomenon (Patton, 2002).

3.4. Research Design

The researcher sought to identify and describe variables and relationships between learning activities; the educator; and youth variables including student prior interest, gender, student prior experience at zoo programs, and parent expectations; and the students' knowledge gained and interest. This study was a pre-experimental design utilizing a variety of instrument formats; including a pre-/post-test format for students, a single instrument for parents, and a demographics questionnaire and activity checklist for educators. The pre-experimental design was adopted because of limitations due to the site of study not allowing for a comparison group. In the context of a zoo-based informal science education program, the pre-/post-survey design was the most effective to evaluate student changes from the beginning to the end of the education program because the week-long camps are offered to intact groups and the existing facilities do not allow for comparison groups. The pre-test was delivered to students at the beginning of the camp week on Monday mornings before any learning activities took place. The intervention of the camp took place during the week and the post-test was delivered to students at the end of the camp day on Friday after all learning activities had been completed. The following is a graphical representation of the research design:

S O X O

O = Observation or Assessment Delivered

X = Treatment Delivered

This design was repeated for a total of five times (five camp weeks involving children ages 8-11 years old).

3.5. Participants

The participants identified for this study were children 8-11 years old that pre-registered for any summer 2010 *Young Edventurer* camps, participants' parents and zoo educators. Student participants represent children in grades third through fifth and families from the Greater Lafayette area and served as a convenience sample. Results of this study can be generalized to camp participants within the last three years of this program at this zoo because the 2010 participants did not vary in any practical significance to participants within the last three years (A. Frederick, personal communication, October 13, 2010). Out of one-hundred potential participants, ninety-six consented to participate and completed at least some of the data collection process resulting in a 96% response rate. Thirty-seven participants were male and 59 participants were female. Of these 96 participants, there were a variety of ages. Two percent of participants were seven years old, 33% were eight years old, 27% were nine years old, 21% were ten years old, 14% were eleven years old, 2% were twelve years old, and one participant did not respond. In total, 84.5% of participants had participated in another zoo camp prior to attendance in summer 2010. Thirty-six participants only participated in one summer zoo camp during 2010 and 51 participants participated in multiple camps. The results of this convenience sample will allow further development of the instruments to be utilized in future evaluations of summer camps.

The Internal Review Board for Purdue University approved consent letters, which were mailed to each participant's house. This consent letter informed each family of the study taking place at their child's camp and described the process of participation, potential risks, and the process of consent. Parents were instructed to indicate their consent on the form provided and return it the first day of camp (Appendix C). Consent letters were provided Monday mornings for individuals that requested another copy. All signed consent forms were cataloged and children with forms indicating participation were allowed to participate in the study and children with forms indicating no participation were given alternate activities during the data collection throughout this study.

Zoo educators that were chosen for this study represented the four primary educators for this age group. These educators were chosen because they were they only educators employed at the zoo teaching this age group at the time of the study. All four of these educators had attained at least a Bachelor's of Science or were within one to two years of completing one. The typical formal teaching experience level was zero to three years with one educator having approximately seven years of experience in the field of conservation education. These educators had post-secondary degrees from the life science areas of Biology, Wildlife, Biochemistry, Animal Sciences, and Entomology. All educators participating in this study were over the age of 18 and verbally consented to their participation after they were informed that participation in this study was completely voluntary and would not affect their employment at Columbian Park Zoo.

3.6. Treatment

The treatment involved in this study was the camp itself. Data were collected before and after each camp and analyzed to determine if any relationships among variables were present. The *Young Edventurer* camps consisted of five, full days worth of learning experiences including many hands-on activities and explorations and encounters with live animals. The typical camp day involves the following general schedule:

9:00-9:05	Sign-In, Workbooks
9:05-9:20	Introductions: names, camp room, rules
9:20-9:30	Discussion: Introduce camp day, theme, topic.
9:30-9:40	Science Exploration
	DNA extraction, skull exploration, etc.
9:40-10:00	Live Animal Encounters
10:00-10:30	Snack and Game
10:30-10:50	Science Exploration
	DNA extraction, skull exploration, etc.
10:50-11:30	Craft
11:30-12:00	Live Animal Encounters
12:00-1:00	Lunch and Recess
1:00-2:00	Science Explorations
	DNA Extraction, skull exploration, etc.
2:00-3:00	Exploration Activities
	Habitat snatch, Oh Deer!, etc.
3:00-4:00	Live Animal Encounters

This schedule was variable depending on the instructor of the camp and the camp theme but this served as a general template for each camp day and was replicated for five days. The following were the camp themes for the summer 2010 season:

1. Extreme Animals (June 7-11)
2. Animal Detectives (June 21-25)
3. Life on Earth (July 5-9)
4. Wild Design (July 19-23)
5. Backyard Biology (August 9-13)

The learning objectives and educational content of each of these camp themes were unique to this zoo and each camp focused heavily on science and nature.

3.7. IRB Approval

The protocol for this study was reviewed by the Human Research Protection Program Institutional Review Board and was approved on March 17, 2010 with protocol number 1003009069 (Appendix A).

3.8. Instrumentation and Data Sources

The research methods chosen to gather data on designated variables and relationships were a pre-/post-test for students including a knowledge test, interest scales, and connection to learning scales; a demographics instrument for educators to gather data regarding professional and education backgrounds; an activity checklist for educators regarding the level of active learning of learning activities; and interest and utility scales for parents.

The dependent variables included in this study were student knowledge and student interest. Student knowledge was measured utilizing a pre-/post-test format where students indicated their knowledge at the beginning of the camp week and at the end of the camp week. Student knowledge was measured utilizing a multiple-choice test relating to the learning objectives across the five weeks at a local zoo. There were nine items measuring concepts such as habitats, adaptations, and human impact on the environment (Appendix D). The majority of multiple-choice items included pictorial representations for the answer choices which facilitated readability and understandability for an audience of eight to eleven year old children. Another added step to accommodate all reading levels was that each item was read to the entire group of students by an educator and a secondary educator was allowed to individually assist students if they experienced difficulty in understanding any items. The student population of this study may have contained students with reading delays or other learning disabilities that required reasonable accommodations. Students' general interest in science was measured at the beginning of the camp to be utilized as descriptive data. Students' science interests related to learning science in school and pursuing science later in life were measured on the post-test.

Independent variables included in this study were camp learning activities, the role of the educator, and youth variables. These independent variables were measured in a variety of ways. The camp learning activities were measured by two raters: the primary instructors' intentions and the assistant instructors' observation of the entire group. This method allowed the level of active learning and student connection to learning activities to be established. Determining the role of the educator involved each primary educator complete a demographics instrument to determine their educational and professional background. Youth variables were determined by utilizing information from the parents and students. Parental value of the camp was established by parents completing a short instrument before picking their children up on Friday of each camp week. Student interest, gender, and prior experiences in these programs were all assessed using the pre-/post-test design.

3.8.1. Student Data Instrument

The pre-test for students consisted of nine knowledge questions. These knowledge questions were designed as three true or false items, one matching item, and five multiple-choice items. Considering the age of the audience, color pictures were utilized on the one matching item and three of the multiple-choice items. The pictures facilitated student understanding of the stem and distracters. The remainder of the knowledge items was written in such a way that they were easily understood by the primary audience. Each knowledge item was written to measure knowledge relating to the educational outcomes of the zoo and pilot-tested with a group of twelve students with a resulting Cronbach's alpha of 0.47. To verify that these items were educationally and age-appropriate, they were reviewed by experts in the field of academic assessment and conservation education to establish validity. *Post-hoc* reliability was determined to be 0.71 on the pre-test and 0.69 on the post-test.

The six student interest items included on the pre-test were modeled and adapted from Schiefele, Krapp, and Winteler (1992). These six interest items (e.g., I like learning about animals.) were designed as a three-point Likert scale (0 = No, 1 = I Do Not know, & 2 = Yes). The three choices were determined appropriate for the audience and the scale was reviewed by an expert in assessment and an expert in conservation education to establish validity and had a *post-hoc* reliability of 0.70.

The student post-test consisted of the same three true or false items, one matching item, and five multiple-choice items that were contained on the pre-test (e.g., Match each animal with the picture of the habitat that the animal would live in). These same items were included on both instruments as to ascertain the amount of knowledge that students gained during the course of the camp week. The post-test also consisted of five items adapted from Black and Deci (2000) related to learning climate (e.g., I thought this camp was boring) and was reviewed by an expert panel consisting of three individuals representing assessment, conservation education, and human development. Student connection to learning was determined by a three-point scale (0 = No, 1 = I Do Not Know, and 2 = Yes). The three point scale was determined most effective for ages 8-11 from the results of the pilot test. The five "connection to camp" items were included on the student post-test only and had a pilot-test Cronbach's alpha of 0.61. This scale had a *post*-hoc reliability of 0.74.

There were four scale items (e.g., I like learning science in school) relating to student interest modeled after Schiefele, Krapp, & Winteler (1992). These four items were reviewed by an expert panel to establish validity and had a *post*-hoc reliability of 0.48. At the end of the post-test, there were three items gathering data regarding demographics such as gender and prior camp experiences (e.g., I have come to camp before).

3.8.2. Parent Data Instrument

The parent data instrument consisted of twelve, four-point Likert scale items (0=Strongly Disagree, 1=Disagree, 2=Agree, & 3=Strongly Agree) modeled from Eccles and Wigfield (1995) and Black and Deci (2000) that gathered data regarding parent's perceptions of utility or value (e.g., I think it is important my child attend this camp because it will help them learn science concepts) and their child's connection to learning (e.g., My child liked the instructor of this camp). Eight of the twelve items were contained in the utility perceptions scale and four items were contained in the student connection perceptions scale. This instrument was completed by one parent of each child on the last day of camp at the time of pick-up. The adults that were asked to complete this instrument were the adults that were the primary guardians of the child and also one of the primary decision makers that chose to allow their child to attend camp.

3.8.3. Educator Data Instrument

Two components were involved for the educators. Both components were designed by the researcher and review by a panel of experts in conservation education, assessment and evaluation, and adolescent development. One component was a demographics instrument that was developed by the researcher to gather data regarding the educational and professional background of each educator responsible for leading any camps in the 8-11 years old series which resulted in four participants.

The camp learning activities variable included two sub-variables titled level of active learning and level of student connection to learning activities. For the purposes of this study, active learning was defined as the level that students were able to incorporate many different senses in the learning process (Knobloch, 2009). This variable was measured by using a scale from low to high (1 = low, 2 = medium, and 3 = high). A low level of active learning was defined to be when students primarily sat and listened and did not physically do anything. A medium level of active learning was defined to be when students participate in minimal tasks in a learning activity. For example, a medium level situation would involve if students were asked to build a diorama detailing a habitat of an animal and the educator supplied a pre-fabricated habitat and the only task for the student was to the place a few extra habitat pieces. A high level of active learning was defined as students participating in major tasks that utilized multiple senses and was done largely on their own. The activity in the previous example would be considered high instead of medium if students were allowed to design, gather, and construct the entire diorama. The primary instructor completed the instrument prior to the camp week regarding their level of active learning intended and the assistant instructor completed the instrument during the camp week based off of observations of each learning activity. The average between the intended level of active learning and the observed level of active learning gave a glimpse of the true level of active learning occurring in each camp.

The role of the educator variable involved educators completing a demographics instrument. This instrument asked for information regarding an educator's educational and professional background. The information collected from this instrument allowed basic demographics to be determined such as highest educational degree, pertinent professional experiences, degree focus, and length of time in the field of conservation education. This information could be used to design effective training programs for incoming educators that may lack certain skill sets before the start of the camp season.

3.9. Data Collection

All educators participated in a training session regarding data collection for this study presented by the researcher. Each instrument was described in detail and verbally delivered to them as it would need to be during the actual data collection. The levels of active learning were demonstrated during this training session as to assure that all participants had the same definition and perceptions. Once training was complete, all educators felt comfortable with delivering each instrument.

The student pre- and post-tests were delivered to students at the beginning of the camp week on Monday morning and at the end of the camp week on Friday afternoon, respectively. All directions, stems, and distracters were read aloud to the entire group of students by one educator while the second educator in the room was available to individually assist students that required additional assistance. This was done to accommodate students with Individualized Education Plans (IEP) in formal schools or reading delays. Students were allowed to work at their own pace and not forced to stay with the pace of the educator. Once completed, students turned their tests face-down and began to quietly work in their camp workbooks until everyone was finished. At this time the educators collected all completed instruments and placed in a sealed envelope. The completed tests were not opened until at a separate location. Students who did not have parent permission to participate in the study were allowed to work in their camp workbooks while everyone else was completing the survey.

The parent data collection instrument was offered to parents for completion at the time of pick-up on Friday afternoons. They were asked to complete this instrument before leaving the camp room but were allowed to complete it at their own pace. Parents were to select the most appropriate level of agreement for each item and return the completed instrument to a designated location. Once all instruments were completed, a camp educator placed them into a sealed envelope.

The educator demographics instrument was delivered to each educator during the training session. This instrument contained constructed response items and check-all that apply items and educators were asked to complete this instrument before the end of the training session. These completed instruments were collected by the researcher and placed into a sealed envelope.

The activity checklists (both for the primary educator and the assistant educator) were provided to each primary educator for each camp week approximately two weeks before the beginning of the respective camps. Educators were asked to select a maximum of four learning activities from their morning lesson plan and a maximum of four learning activities from their afternoon lesson plan for each day. The names of these activities were to be written on each daily checklist for both the primary and assistant sheets. The primary educator was responsible for indicating their intended level of active learning for each activity by placing a check in the box corresponding to a level for each activity for each day. Once these checklists were completed by the primary educator, they were collected by the researcher and placed into a sealed envelope. The assistant educator's observation sheets with pre-filled activity names were delivered to the assistant at the beginning of the camp day on Monday mornings by the researcher. The assistant was asked to observe the entire class of students and determine level of active learning that each learning activity involved. Once completed, the assistant placed their completed checklists into a sealed folder at the end of week and delivered to the researcher.

All completed instrument packs were collected by the researcher and opened off-site for data analysis after each camp week. All data were gathered confidentially by assigning each participant a participant number so the pretests and post-tests could be matched. These participant numbers were six digit numbers and designated in this format: 010203. The first two digits represented the month of the data collection, the next set of two digits represents the number of camp within the series, and the last two digits represent the individual participant. The individual participant numbers were assigned randomly.

A pilot-test group was identified and consisted of nine students from the ages of six to eleven years old. These students were determined to be similar to the target population of this study because they were students that had participated in a spring break camp experience at the zoo. This pilot-test focused on determining reliability and validity for student knowledge and interest scales. Face validity was determined as part of a qualitative approach where students voiced concerns over understandability and readability to the researcher.

3.10. Data Analysis

All data were entered into the statistical software SPSS (Statistical Package for Social Sciences). One item was reverse-coded and all subscales were aggregated into overall scores for each variable before analyzing the data. Missing data was excluded by SPSS. All means, standard deviations, relationship sizes, percentages, and effect sizes were rounded to the nearest $1/100^{th}$. Table 3.1 identifies the level of measurement, central tendency, and variance used to measure each dependent and independent variable. Relationships between variables were determined by a variety of statistical tools (Table 3.2). Relationships were described using conventions by Hopkins (1997; Table 3.3).

Table 3.1

Level of Measurement, Central Tendency, and Variance Related to Each Dependent and Independent Variable

Variable	**Level of Measurement**	**Central Tendency**	**Variance**
Gender	Nominal	Frequency	
Educator Demographics	Nominal	Frequency	
Level of Active Learning	Nominal	Frequency	Standard Deviation
Student Interest	Item: Ordinal	Frequency	Standard Deviation
	Scale: Interval	Mean	
Parent Interest/Utility	Item: Ordinal	Frequency	Standard Deviation
	Scale: Interval	Mean	
Student Knowledge	Ratio	Sum/Percentage	Standard Deviation

Table 3.2

Statistical Tests Used to Describe Each Relationship

Dependent and Independent Variable Relationships	**Statistical Test**	**Measure of Association**
Students' Specific Interest After the Camp/Students' Prior Interest	Pearson's correlation	Linear
Students' Specific Science Interest After the Camp/Student Connection to Learning,	Pearson's correlation	Linear
Student Knowledge/Weekly Average Level of Active Learning	Pearson's correlation	Linear
Students' Learn Science In School and Science Career Interest/Average Weekly Level of Active Learning	Pearson's correlation	Linear
Weekly Average Level of Active Learning/Types of Educator Informal Teaching Experiences	Pearson's correlation	Linear
Weekly Average Level of Active Learning/Years of Educator Teaching Informal Science Experience	Pearson's correlation	Linear
Average Weekly Level of Active Learning/Educator College Degree	Pearson's correlation	Linear

Table 3.2 Continued

Average Weekly Level of Active Learning/Educator Highest Level of Education	Pearson's correlation	Linear
Average Weekly Level of Active Learning/Educator Gender	Pearson's correlation	Linear
Boys' Knowledge Post-Test Score/Boys' Previous Zoo Camp Experience	Pearson's correlation	Linear
Girls' Knowledge Post-Test Score/Girls' Previous Zoo Camp Experience	Pearson's correlation	Linear
Students' Post-Test Scores/Parents' Perceived Value of Camp	Pearson's correlation	Linear
Students' Specific Interest After the camp/Parents' Perceived Value of Camp	Pearson's correlation	Linear
Students' Knowledge Post-Test Score/Student Connection to Learning	Spearman rho	Rank Order
Students' Knowledge Post-Test Score/Students' Prior Interest	Spearman rho	Rank Order
Students' Specific Interest After the camp/Students' Previous Zoo Camp Experience	Eta correlation	Ratio of Between Group Sums of Squares and Total Sum of Squares

Table 3.3

Conventions for Relationships (Hopkins, 1997)

Relationship Coefficient (*r*)	**Convention**
0.9-1.0	Nearly Perfect
0.7-0.9	Very Large
0.5-0.7	High
0.3-0.5	Moderate
0.1-0.3	Low
0.0-0.1	Trivial

Descriptive statistics used to analyze the data included means, standard deviations, frequencies, and percentages because the study was of a convenience sample and results were not to be inferred back to a larger population. As such, inferential statistics and tests of statistical significance were used to interpret the findings to establish knowledge claims. Rather practical significance was determined by using effect sizes. Medium or large effect sizes were interpreted as being practically significant. Effect sizes for mean differences were calculated using Cohen's (1988) *d* and were described by Cohen's descriptors (1988; Table 3.4).

Table 3.4

Conventions for Effect Sizes for Mean Differences (Cohen, 1988)

Effect Size Coefficient (*d*)	**Convention**
0.0-0.2	Trivial
0.2-0.5	Small
0.5-0.8	Moderate
<0.8	Strong

Effect sizes for relationships were calculated using Cohen's (1988) r^2 and were describe by Cohen's (1988) conventions (Table 3.5)

Table 3.5

Conventions for Effects Sizes of Relationships (Cohen, 1988)

Effect Size Coefficient (r^2)	**Convention**
0.01-0.08	Small
0.09-0.24	Medium
<0.25	Large

CHAPTER 4. RESULTS

4.1. Purpose of the Study

The purpose of this exploratory study was to identify and describe variables and relationships between summer camp learning activities, the role of the educator, and youth variables such as prior interest in science and nature and prior camp experiences, and the students' achievement of the learning outcomes and the students' interest during week-long camp activities during five separate weeks in one age group (8-11 years old) over the course of Summer 2010 at small zoo in a small, Midwest city.

4.2. Research Questions for the Study

The following questions guided the study:

1. Was there an increase in the youth outcomes of science knowledge and were students interested in science at the end of a five day camp experience?
2. Is students' personal connection to camp activities related to the youth outcomes of science knowledge and interest?
3. Is the level of active learning related to the achievement of the youth outcomes of science knowledge and interest?

4. Are educators' educational and professional training related to the level of active learning in the activities they choose to implement in a camp?
5. Are students' prior interests in science and nature related to the youth outcomes of science knowledge and interest?
6. Are previous zoo experiences related to boys' and girls' achievement of the educational outcomes and learn science in school and science career interest?
7. Are parents' perceptions of camp value related to the youth outcomes of science knowledge and interest?

4.3. Results for the Study

The results for this study were organized and presented for each research question.

4.4. Results for Research Question 1: Student Change in Science Knowledge and Science Interest at the End of Camp

On average, students performed 85.9% on the knowledge pretest (M = 10.31, SD = 1.97) and 88.3% on the knowledge post-test (M = 10.60, SD = 1.82; Table 4.1). The average post-test knowledge score was 2.4% higher than the pretest knowledge score (mean difference = .29). Although this difference would be a difference of one-third of a letter grade (B vs. B+), the difference had a small effect size (d = .20).

Table 4.1

Students' Pretest and Post-test Knowledge Scores for Summer Camp

Knowledge	**Mean (*N*)**	**Standard Deviation**
Pretest	10.31 (*N = 87)*	1.97
Posttest	10.60 (*N* = 75)	1.82

Note. Total possible points = 12.

Students did not know if they were interested in science at the end of camp (M = 1.44, SD = 0.45). After the camp, 12% of the students were not interested in specific areas of science and nature, 40% did not know if they were interested and 48% were interested (Table 4.2).

Table 4.2

Frequency Table of Self-Reported Specific Science Interest After Camp

	Interest Level (*N* = 75)		
	Not Interested	**Did Not Know If Interested**	**Interested**
Specific Science Interest After Camp	12%	40%	48%

Note: Scale: 0 = No, 1 = I Do Not Know (Undecided), 2 = Yes.

4.4.1. *Post-hoc* Analysis for Research Question 1

Because 57.3% of the students participated in more than one summer zoo camp, this presented limitations regarding potential threats to repeated testing and testing fatigue. As such, the pre- and posttests administered for each week were identical. Therefore, *post-hoc* analyses were conducted to determine if students participating in more than one zoo camp were significantly different in science knowledge and science interest upon completion of the camp than the 42.7% of students that only participated in one summer zoo camp. Analysis of covariance (ANCOVA) was used to analyze the data because this statistical tool controls for the difference in pretest knowledge scores or general interest in science before the camp between students participating only once and students participating more than one week.

Students attending only one camp scored 90.3% on the pretest (M = 10.83, SC = 1.46) and 91.9% (M = 11.03, SD = 1.28) on the posttest. Students attending multiple camps scored 82.8% on the pretest (M = 9.94, SD = 2.20) and 85.5% (M = 10.26, SD = 2.11) on the posttest. Students' posttest knowledge scores were not significantly different regardless of prior participation in summer zoo camps (p = .60; Table 4.3). Participants completing one week of a summer zoo camp had similar knowledge than participants completing more than one week. According to a one-sample t-test, prior attendance of students at a summer zoo camp during 2010 was not significantly related to students' pretest or posttest scores (p = .00).

Table 4.3

Analysis of Variance for Number of Weeks of Camp Attending During the Summer and Knowledge

Source	***df***	***F***	***η***	***p***
Number of Weeks (W)	1	0.28	0.48	0.60
W within-group error	71	(1.73)		

Note. Values enclosed in parentheses represent mean square errors. W = number of weeks students participated in camps.

Students' interests in science after the camp was also analyzed using ANCOVA with general science knowledge as covariate. Students that participated in one summer camp were interested in general science before the camp (M = 1.56, SD = 0.43) and were not sure if they were more specifically interested in science after the camp (M = 1.35, SD = 0.50). Students that participated in more than one summer zoo camp were interested in general science before the camp (M = 1.60, SD = 0.45) and were interested in learning science in school and interested in pursuing a science related career later in life (M = 1.50, SD = 0.41). Students' interests in science after the camp were not significantly different regardless of the number of weeks of they participated in summer zoo camps (p = .26; Table 4.4). Participants completing one week of a summer zoo camp had similar interests in science than participants completing more than one week. However, even though there were no significant differences regarding science knowledge or science interests between the two groups of participants, these results should be interpreted cautiously because further research is needed due to control for potential threats to repeated testing and testing fatigue among participants who participated in more than one summer camp.

Table 4.4

Analysis of Variance for Number of Weeks of Camp Attending During the Summer and Interest

Source	***df***	***F***	***η***	***p***
Number of Weeks (N)	1	1.28	0.16	0.26
N within-group error	70	(0.13)		

Note. Values enclosed in parentheses represent mean square errors. N = number of weeks students participated in camps.

4.5. Results for Research Question 2: Student Connection to Camp Activities and Knowledge and Interest

Students felt connected to the learning activities involved in the camp (M = 1.81, SD = .35; Table 4.5).

Table 4.5

Mean and Standard Deviation of Student Connection to Learning

	Mean (*N = 75)*	**Standard Deviation**
Student Connection to Learning	1.81	0.35

Note: Scale: 0 = No, 1 = I Do Not Know (Undecided), 2 = Yes.

There was a low relationship between student connection to learning and students' posttest knowledge scores (r = .26). This relationship had a small effect size (r^2 = .07) and was not practically significant.

There was a moderate relationship between students' specific science interest after the camp and student connection to learning (r = .50). This relationship had a large effect size (r^2 = .25) and was practically and statistically significant (p = .05). As such, students' specific interest in science after the camp and the level of student connection to learning co-vary by 25%.

4.6. Results for Research Question 3: Level of Active Learning and Student Knowledge and Learn Science in School and Science Career Interest

The weekly average of the level of active learning per camp was determined by averaging the total self-reported active learning levels per activity per day per camp by the primary instructor and the assistant instructor. The weekly average of the level of active learning for Week One was 2.19, Week Two was 2.43, Week Three was 2.23, Week Four was 2.18, and Week Five was 2.50 (Table 4.6). All five weeks had at least a moderate or medium level of active learning incorporated into the camp and some were approaching a high level at 2.50.

Table 4.6

Weekly Averages of Levels of Active Learning

Week Number	Average Level of Active Learning	Standard Deviation
1	2.19	
2	2.43	
3	2.23	
4	2.18	
5	2.50	
Grand Mean	**2.31**	**0.15**

Note: Scale: 1 = low level of active learning, 2 = medium level of active learning, 3 = high level of active learning).

There was a negative, low relationship between the weekly level of active learning and students' posttest knowledge scores (r = -.20). This relationship had a small effect size (r^2 = .04) and was not practically significant.

There was a very low relationship between student after the camp science interest and the average weekly level of active learning (r = .02). This relationship had a negligible effect size (r^2 = <.01) and was not practically significant.

4.7. Results for Research Question 4: Educator's Training and Level of Active Learning

The results of the educator survey demonstrated that two educators were male, two educators were female, all participants had achieved at least a high school diploma and three of them had completed a four-year degree program, and all educators had achieved some prior experience in teaching in informal contexts (Table 4.7).

Table 4.7

Educator Demographics

	Gender	**Education Level**	**Years of Experience**	**Types of Experience**	**Level of Active Learning Included in Camp**	**Cohen's *d***
Educator A	Male	Bachelor's	2-4	Informal and Formal	2.31 (SD = 0.33)	0.00
Educator B	Female	High School	2-4	Informal	2.23 (SD = 0.23)	0.53
Educator C	Female	Bachelor's	8-10	Informal	2.18 (SD = 0.24)	0.87
Educator D	Male	Bachelor's	2-4	Informal	2.50 (SD = 0.28)	1.27

Note. Cohen's d the estimated effect size for the difference between two means (Cohen, 1988).

The weekly average level of active learning for Week One was 2.19, Week Two was 2.43, Week Three was 2.23, Week Four was 2.18, and Week Five was 2.50 and were based on a three point scale (1 = low level of active learning, 2 = medium level of active learning, 3 = high level of active learning; Table 4.6).

Three of the five relationships among the educator characteristics were practically significant. There was a very high relationship between the educators' years of experience and the average level of active learning (r = .88). This relationship had a large effect size (r^2 = .44) and was practically and statistically significant (p = .01). As such, the average weekly level of active learning and the educators' years of experience co-varied by 44%. It was also noted that the types of informal contexts in which educators have experience in, were related to the weekly average level of active learning. There was a moderate, negative relationship between the types of contexts in which educators have experience in and the weekly average level of active learning (r = -.40). This relationship had a medium effect size (r^2 = .16) and was practically significant. As such, the weekly average level of active learning and experience in formal or informal teaching co-varied by 16%. There was a high, negative relationship between the gender of the educator and the average weekly level of active learning (r = -.62). This relationship had a large effect size (r^2 = .38) and was practically significant. As such, the average weekly level of active learning and the gender of the educator co-varied by 38% (Table 4.8).

Although close, two educator characteristics were not practically significant relationships with the level of active learning. There was a low relationship between the college degree of an educator and the average level of active learning (r = .29). This relationship had a small effect size and as such, was not practically significant (r^2 = .08). There was a low relationship between the highest level of education and the average level of active learning (r = .29). This relationship had a small effect size and as such, was not practically significant (r^2 = .08).

Table 4.8

Relationships between Educators' Demographics and Average Weekly Level of Active Learning

	Average Weekly Level of Active Learning	**Effect Size (Cohen's r^2) (*N = 4)***
Types of Informal Teaching Experiences		
Pearson Correlation	-0.36	0.13
Years of Teaching Informal Science Experience		
Pearson Correlation	0.73*	0.53
College Degree		
Pearson Correlation	0.29	0.08
Highest Level of Education		
Pearson Correlation	0.29	0.08
Gender		
Pearson Correlation	-0.62	0.38

Note. *Correlation was significant at the 0.05 Level (2-Tailed).

4.8. Results for Research Question 5: Prior Interest and Student Knowledge and Learning Science in School and Science Career Interest

Students were generally interested in science prior to the start of the camp (M = 1.58, SD = .44; Table 4.9).

Table 4.9

Mean and Standard Deviation of the Student Prior Interest Scale.

	Mean (*N = 87*)	**Standard Deviation**
Student Prior Interest Scale	1.58	0.44

Note. Scale: 0 = No, 1 = I Do Not Know, 2 = Yes.

There was a medium relationship between student prior interest and students' posttest knowledge scores (r = 0.30). This relationship had a medium effect size (r^2 = 0.09) and was practically and statistically significant (p = .01). As such, students' posttest knowledge scores and students' prior interest in science co-varied by 9%. There was also a medium relationship between student prior interest and students' pretest knowledge scores (r = 0.30). This second relationship had a medium effect size (r^2 = 0.09) and was practically and statistically significant (p = .01). As such, pretest knowledge scores and students' prior interest in science co-varied by 9%.

Table 4.10

Relationship Between Student Prior Interest and Test Scores

	Pretest Score (*N = 87*)	**Posttest Score (*N* = 75)**
Student Prior Interest		
Correlation Coefficient	0.30*	0.30*

Note. *Correlation was significant at the 0.05 Level (2-Tailed)

There was a high relationship between students' prior general science interest and students' specific science interest after the camp (r = .63). This relationship had a medium effect size (r^2 = .39) and was practically and statistically significant (p = .01). As such, students' specific science interest after the camp and students' prior general science interest co-varied by 39%.

4.9. Results for Research Question 6: Boys' and Girls' Previous Camp Experience and Educational Outcomes

Boys scored 86.3% on the knowledge pretest (M = 10.36, SD = 1.48) and 89.5% on the knowledge post-test (M = 10.74, SD = 1.45). There was a medium effect size regarding the difference between pre-and posttest scores (d = 0.52). Girls scored 83.4% on the knowledge pretest and (M = 10.01, SD = 2.46) and 84.9% on the knowledge post-test (M = 10.19, SD = 1.94; Table 4.11). There was a trivial effect size regarding the difference between pre- and posttest scores for girls (d = 0.13). There was a trivial effect size between boys' and girls' pretest knowledge scores (d = .16) and a small effect size between boys' and girls' post-test scores (d = .31, Table 4.11). However, the difference of 4.4% would be one-third of a letter grade using a standard grading scale in most formal education classrooms. As such, the difference in knowledge between the boys and girls was practically significant.

Table 4.11

Mean Pretest and Post-test Scores and Standard Deviations for Both Boys and Girls

	Boys (***N*** **= 37)**	**Girls** (***N*** **= 58)**	**Effect Size (Cohen's *d*)**
Mean Pre-test Score	10.36 (86.3%)	10.01 (83.4%)	0.16
Pre-test Score Standard Deviation	1.48	2.46	
Mean Posttest Score	10.74 (89.5%)	10.19 (84.9%)	0.31
Posttest Score Standard Deviation	1.45	1.94	

Note. There were 12 possible points on the pretest and the posttest.

Over half of both boys and girls scored at least seven points out of twelve (Table 4.12; 4.13). However, between the pretest to the posttest, there were five girls that moved from the bottom group to the middle group in terms of score. According to a one-sample t-test, the pretest scores for both girls and boys were not significantly different ($p = 0.38$) and were significantly different for the posttest scores ($p = 0.61$).

Table 4.12

Frequency Distribution of Boys' Pre- and Posttest Scores

	Frequency
Pretest Score	**(*N* = 33)**
7	1
8	5
9	3
10	3
11	6
12	15
Posttest Score	**(*N* = 30)**
7	2
8	4
9	1
10	1
11	8
12	14

Table 4.13

Frequency Distribution of Girls' Pre- and Posttest Scores

	Frequency
Pretest Score	**(*N* = 54)**
4	1
5	2
6	2
7	3
8	2
9	4
10	12
11	8
12	20
Posttest Score	(*N* = 45)
5	2
7	1
8	4
9	4
10	7
11	6
12	21

Among the 29 male participants that responded to previous zoo camp attendance, 72.4% indicated they had participated in another zoo camp. There was a high relationship between boys' previous experience in zoo camps and posttest scores (r = 0.61). This relationship had a large effect size (r^2 = 0.31) and was practically and statistically significant (p = .05). As such, boys' posttest knowledge scores and their previous experience in zoo camps co-varied by 31%.

Among the 42 female participants that responded to this item, 92.8% indicated they had participated in another zoo camp. There was a low, negative relationship between girls' previous experience in zoo camps and their posttest knowledge scores (r = -0.13). This relationship had a small effect size (r^2 = 0.02) and was not practically significant.

In total, 84.5% of participants had participated in another zoo camp prior to coming to the camps involved in this study. There was a low relationship between student learn science in school and science career interest and prior camp attendance (r = 0.19). This relationship had a negligible effect size (r^2 = 0.04), which was not practically significant.

4.10. Results for Research Question 7: Parents' Perceived Value of Camp and Youth Outcomes of Knowledge and Interest

Parents strongly agreed that their child's participation in camp was important (M = 2.65, SD = .27; Table 4.14).

Table 4.14

Parents' Perceived Value of Camp Mean Score and Standard Deviation

	Mean (*N* = 34)	**Standard Deviation**
Parents' Perceived Value of Camp	2.65	0.27

Note: Scale: 0 = Strongly Disagree, 1 = Disagree, 2 = Agree, 3 = Strongly Agree

The relationship between parents' perceived value of camp and students' posttest knowledge scores was determined by conducting a Pearson correlation. There was a trivial relationship between parents' perceived value of camp and students' posttest knowledge scores (r = 0.06). This relationship had a negligible effect size (r^2 = <0.01) and was not practically significant, even though 100% of parents either agreed or strongly agreed that the camp was important.

There was a low relationship between parents' perceived value of camp and students' learn science in school and science career interest (r = 0.22). This relationship was a small effect size (r^2 = 0.05) and was not practically significant.

CHAPTER 5. CONCLUSION

5.1. Purpose of the Study

The purpose of this exploratory study was to identify and describe variables and relationships between summer camp learning activities, the role of the educator, and youth variables such as prior interest in science and nature and prior camp experiences, and the students' achievement of the learning outcomes and the students' interest during week-long camp activities during five separate weeks in one age group (8-11 years old) over the course of Summer 2010 at a small zoo in a small, Midwest city.

5.2. Research Questions for the Study

The following questions guided the study:

1. Was there an increase in the youth outcomes of science knowledge and were students interested in science at the end of a five day camp experience?
2. Is students' personal connection to camp activities related to the youth outcomes of science knowledge and interest?

3. Is the level of active learning related to the achievement of the youth outcomes of science knowledge and interest?
4. Are educators' educational and professional training related to the level of active learning in the activities they choose to implement in a camp?
5. Are students' prior interests in science and nature related to the youth outcomes of science knowledge and interest?
6. Are previous zoo experiences related to boys' and girls' achievement of the educational outcomes and learn science in school and science career interest?
7. Are parents' perceptions of camp value related to the youth outcomes of science knowledge and interest?

5.3. Conclusions for the Study

There were four conclusions for this study. Each conclusion is discussed regarding its interpretation and contribution to the knowledge base.

5.4. Conclusion 1: Student Knowledge and Interest

Students were similarly knowledgeable in general science before and after the summer zoo camp. Students performed at B and B+ grade levels prior to and after the programs in regards to their knowledge of science. Regarding interest in science, approximately half of students were more interested in specific science and nature topics after camp.

Even though there was not a practically significant increase in students' knowledge, approximately one-third of students scored at least one point higher (8.3%) on the post-test than they did on the pretest. Of this one-third of students, approximately half scored at least two points (16.7%) higher on the post-test than the pretest.

One plausible reason why a practically significant difference in students' knowledge gain was not noticed is because this group entered the camp week knowledgeable about science. These results supported a study by Eagles and Demare (1999), in which, they found that in a sample of 72 students that had a moderate level of pre-existing knowledge and attitudes before a conservation education program, there was not a significant increase in student knowledge or attitudes. Furthermore, this conclusion supported Bogner's (1998) suggestion that students self-electing to participate in informal environmental education programs have high pre-existing knowledge and interest in nature. As a result of these programs attracting a highly knowledgeable and interested audience, it can be difficult to improve students' knowledge and interests higher than their pre-existing knowledge and interest.

As part of this study, students completed a relatively short (i.e., 12 multiple choice items) knowledge test. This knowledge test was designed to measure general science knowledge across all five weeks of camp. One knowledge assessment tool was designed for all five camp weeks and each camp week covered a different topic. The level of specificity of the knowledge assessment tool was sufficient in gathering information about students' general science knowledge but perhaps the tool may have been insufficient in assessing more specific information regarding each camp theme

(Bott, 1996). More than half of the students participating in these summer camps completed the pre- and posttest more than once. This might have caused students that had repeated participation to score higher on the tests. However, this was not the case. Because this experience was during the summer and outside of school, students may have experienced testing fatigue and not take the test seriously. For future studies, it may be beneficial to develop a more specific knowledge assessment for each camp week to more accurately differentiate between learning outcomes for each week. This could alleviate the limitation that students who participated in more than one summer camp and experienced the assessment tool more than one time.

The research design constructed for this study included a convenience sample of students who self-selected to participate in short-term summer camps. Essentially, this group of students was a subset of the population and was not representative of the greater student population in the local community. A limitation of this study was that the students were not randomly selected as a cross representation of the local community. As such, the conclusions of the convenience sample cannot be generalized to the whole student population within the local community (Schutt, 2009). Furthermore, the limitation of not having a comparison group limited the researcher from determining the effects of the treatment. A comparison group might enable researchers to design a more effective research protocol that might enable a conclusion to be drawn regarding differences between students self-selecting to participate in zoo education programs and other students that do not. Perhaps, directions for future research in this area would be to locate a context where a comparison group can be identified along with the experimental group.

Interest level was determined in two different contexts. General interest was utilized as a characteristic of the students before they participated in the camp. Students in this study demonstrated a general interest in science and nature before they participated in the summer camp. Specific science interest was an outcome variable of this study which was measured after the camp. This outcome variable focused on context-specific science interest such as learning science in school or pursuing science later in life. Even though it appears that, overall, students did not know if they were interested in context-specific science, half of the participants indicated they were. It might be plausible that because half of the students had completed the assessment tool more than once, they experienced testing fatigue in answering the same items more than once which could have hidden some potential differences in interest. This might serve as an indicator of their interest in science in a formal school setting. If zoos are to promote situational interest in science and link that back to students interest in science in a formal setting, student might choose to pursue science classes or other opportunities later in life (Eccles et. al., 1998; Denissen, Zarrett & Eccles, 2007). Plausibly, once interest items were presented as context-specific, students might have experienced difficulty in recalling each context and their interest in science in those contexts.

These results are important for practitioners because knowing that current programs are already attracting a knowledgeable and interested audience can allow for program and assessment design (Worthen, Sanders, & Fitzpatrick, 1997). It is also beneficial for this immediate context because it allows a zoo-based informal education program to more effectively tailor educational objectives and curriculum to the knowledge level of incoming students.

5.5. Conclusion 2: Students' Personal Connection to Camp

Students' interest in learning environmental science beyond the camp setting was related to their connection to the zoo-camp activities. This connection to camp activities through active learning promoted situational interest because it was tied to the specific content of science and nature taught during the camp (Hidi & Anderson, 1992). It may be possible that this situational interest, developed during a zoo camp, can lead students to develop a personal interest in learning science and nature in other contexts. This conclusion supports the theoretical and conceptual frameworks of this study because students who were connected to the camp developed intrinsic and utility value wanted to learn science in school and pursue science related careers. Future studies should investigate student connection to camp and student pursuit of science in school and future career interests.

The expectancy-value theory of motivation served useful in understanding the role of interest in this informal context. The results of this study suggest that this theory of motivation might work to explain how situational interest developed outside school could be used to influence interest and achievement choices in school. By applying this theory to situational interest, practitioners might be able to influence student interest and performance in the formal classroom. Future studies should describe the relationship between students' situational interest in informal science education programs and their science interest and achievement in a formal context.

Students' science knowledge after the camp experience was not related to their connection to zoo camp. Even though students were engaged in learning and self-reported feeling connected to learning during the camp, their science knowledge upon completion of the camp was not related to their connection to camp activities. Although this conclusion does not support the assumption that guided this study-increasing personal connection to learning through active learning would increase students' knowledge (Di Vesta & Smith, 1979; Ruhl, Hughes, & Schloss, 1987), this may have been caused by the limitation to measuring knowledge for this age group of students who arrived at the camp with science knowledge. Therefore, this relationship was nearly practically significant and should be considered as a promising relationship, especially for the age of the students in this study.

One plausible reason that this relationship was not practically significant was that student connection to activity was measured in relation to the entire camp week and not each individual activity. For example, Di Vesta and Smith (1979) suggested that the type of learning activity itself is just as important as including active learning activities and evaluating the entire program. In future studies, it might be pertinent to assess students' connection to specific activities rather than a general, overall connection. Learning activities for the camp were very specific to learning objectives; however, the knowledge test assessed a broader outcome – the overall camp education program goal. Other studies have supported the assumption that the type of learning activity is related to positive educational outcomes and were able to more specifically measure such concepts and relationships (Hake, 1998; Laws, Sokoloff, & Thornton, 1999; Redish, Saul, & Steinberg, 1997; Taraban et. al., 2007).

Considering the young age of the participants, the relationship between students' connections to learning and interest may be related to student achievement or performance later in life in other contexts. This assumption was supported by studies by Eccles (1983) and Renninger (2000). Results of both studies suggested that interest influences task value and, in turn, should influence achievement (Eccles, 1983; Renninger, 2000). It is plausible to assume that according to these studies, interest developed in zoo camps might influence students' decisions to pursue science in school and, in turn, influence their achievement in science courses.

It may be possible that, because this particular group of students was very homogeneous in regards to prior knowledge and interest, zoos might not be appropriate venues to determine if a relationship between personal connection to learning and knowledge and interest exists. A more appropriate target audience may be one that has more diversity or variance in prior student knowledge and interest.

The theory of active learning served as an important interpretation tool when describing the relationship between active learning and student knowledge and interest. The results of this study suggest that students' personal connection to learning through the level of active learning is related to students' interest and might be related to students' knowledge. The development of this theory might benefit for future studies to describe the relationship between personal connection, active learning, and students' interest and knowledge more fully.

5.6. Conclusion 3: Active Learning

Informal educators reported higher levels of active learning in the zoo camp if they were male, had more years of teaching experience, or had teaching experience in informal learning settings and no teaching experiences in formal educational settings. The relationship between educator prior experience and the incorporation of active learning into a camp does lend support to current literature regarding the quality of teachers. Students taught by educators with higher levels of experience are more likely to score higher on academic tests, continue to pursue education, and have a greater intrinsic motivation to learn (Hill, Rowan, & Ball, 2005; Nye, Konstantopoulos, & Hedges, 2004; Rockoff, 2004). If students become more interested and knowledgeable after an education program that has a high level of active learning and experienced educators are more likely to incorporate a higher level of active learning, then it is plausible that more experienced educators would increase students' knowledge and interest more than less experienced educators. Zoos strive to hire individuals that are passionate and knowledgeable about science and nature and the conclusion of this study demonstrated that the experiences of these individuals are important when the educators design camp curriculum, which support the current belief that teacher experience is related to positive student outcome (Cantrell, 2003; Tuckman, 1975).

This study included four individual educators, which resulted in a very homogeneous sample regarding education level, experience level, and degree field. As such, this very limited pool of educators may have not revealed subtle important differences regarding educator quality in relation to curriculum design and instruction. Many small zoos only employ a small number of educators to teach summer camps so a small zoo context may not be appropriate to determine some of these small differences. Therefore, for future studies, a zoo with a larger number of summer camp staff might be a more appropriate venue instead of a small zoo. This study could be replicated across many zoos to determine if these preliminary findings are substantiated with further evidence.

5.7. Conclusion 4: Gender Differences in Previous Zoo Experience

Boys had higher science knowledge before and after the camp compared to girls. This result supports current literature that suggests gender differences in achievement begin to become apparent during the six to eleven year old time span (Crandall et. al., 1980; Parsons & Ruble, 1977; Yoon, 1997). Boys tend to exhibit higher self-perceptions and achievement in the domains of science. One plausible reason for this gender difference is that science achievement and attitudes are generally the two concepts in science education educators are trying to impact and these two concepts seem to be directly related in boys but are separate constructs in girls (Mattern & Schau, 2002). It might be possible that as boys participate in a zoo camp program, educators only need to focus on either increasing science interest or science knowledge for boys to achieve higher. On the other hand, emphasis would need to be applied to both science knowledge and science interest in order for girls to achieve higher (Mattern & Schau, 2002). According to Erickson and Erickson (2006), there are sociological interpretations that result in different expectations and experiences for girls than boys in regards to science. Some examples these authors cite as possible reasons for girls to be less likely to pursue science and perform well include different toys to play with as a child, games they were allowed to play, and the way science is portrayed as masculine and suited for boys instead of girls. These authors further explain that there are expectations for boys to perform well in science but that expectation is lacking for girls (Erickson & Erickson, 2006).

Even though boys had higher general knowledge after the camp, it appeared that girls were improving their scores more greatly than boys. The variance in girls' knowledge test scores decreased between the pretest to the post-test, whereas it was approximately the same for the boys. It might be plausible that these girls felt more connected to the learning over the course of the camp and became more interested in learning the content. If their expectations about science were changing, it might be possible that this change would be reflected in their knowledge scores. Because this was not a focus of the study, for future studies, it might be pertinent to compare camp differences between boys that have a male instructor and girls that have a female educator and vice versa.

There was also an important relationship between previous zoo experience and boys' science knowledge at the end of the camp. It appeared that if boys participated in multiple camps, they had higher pretest and posttest knowledge scores. This result further supports Erickson and Erickson (2006) in their assumption of prior experiences and expectations of boys lead to higher achievement. This result should be interpreted cautiously because there were substantial time periods in between one camp to another and other factors likely influenced their general science knowledge.

Girls scoring in the bottom 1/3 of participants increased slightly more in their science knowledge than boys', however it was difficult to tell if this slight increase was accurate based on a general knowledge assessment. Five girls moved from scoring less than 60% to scoring more than 60% from the pretest to the post test. Whereas, the one boy scoring lower than 60% on the pretest, remained there and another boy scored below a 60% on the posttest. It might be possible that these programs could serve as a potential useful educational experience for girls to increase their knowledge and interest in science at a time when their peers are experiencing decreased achievement in science.

5.8. Educational Significance

This study is pertinent because it demonstrates that a personal connection to learning through active learning techniques may lead to an increase in students' science interest. New and effective educational opportunities outside of the formal education classroom may be able to maintain students' interests in science and increase their knowledge. This is increasingly important to achieve because an ever-growing deficiency of science knowledge and interest in today's youth, and the situational interest developed in contexts outside of school may lead students to apply that interest in school and begin to achieve higher in the field of science.

With further study and identification of important relationships identified in this study, practitioners can begin to tailor educational programming to their local communities and offer experiences to students that will complement their formal learning and increase the general and specific science knowledge and interest. While these zoo camp programs were relatively short (i.e., five days) and there was not a diverse and representative population, some important relationships were identified that bear further scrutiny and might lead to new program improvements and further understanding of teaching and learning in the informal context.

5.9. Recommendations

It is important to recognize that this was the first study of this nature to be conducted at the zoo. Although much was learned, the limitations of this study created several more questions and recommendations for further study. Future research should focus on designing more specific knowledge assessments that more effectively differentiate between various knowledge concepts and domains especially at the early elementary level. Creating more effective assessment tools to measure knowledge will allow researchers to make more accurate judgments regarding important relationships in an informal context. It might also be pertinent to more specifically assess students' connection to learning for each learning activity instead of at the end of a five day camp week. This might mean a substantial amount of resources will need to be dedicated to this aspect of future studies but it is necessary in order to uncover the subtle nuances of an informal learning environment. These learning environments are very complex and there are new opportunities for researchers to better understand these contexts.

Another important aspect to consider before designing any future studies are the demographics of the population. The population for the current study was a convenience sample, which is very common for informal education programs. The convenience sample included in this study yielded a very homogenous population in terms of prior knowledge, interest, and experiences. The homogeneity of the population may have resulted in the loss of subtle nuances in many of the relationships. There were several relationships that were close to being deemed important but were under the pre-determined criteria. A more diverse population with more variance might yield more important relationships.

If future studies are carried out in zoo education programs, important relationships can be determined that explain learning in this context. Once these important relationships are identified and understood, future research can be conducted with the application of these relationships and more vigorous research designs (e.g., quasi-experimental, mixed methods, grounded theory) in various other informal contexts such as museums, aquariums, and nature park centers. Once researchers understand important relationships across several contexts, a clear and more comprehensive understanding of learning in informal contexts can be achieved.

5.10. Research Summary

In summary, this study focused on identifying relationships between active learning and the student outcomes of knowledge and interest in science and nature. It was demonstrated that establishing a personal connection to learning through active learning was related to students' interest in science after the camp program. It is plausible that the number of important relationships might have been higher if the population was more varied and there were knowledge assessments constructed that were more specific. Given the outcomes of this study, there are new directions and recommendations for research in this field and hints that informal education programs at zoos may serve as an important educational opportunity for students.

REFERENCES

REFERENCES

Association of Zoos and Aquariums. (2010). *The Accreditation Standards and Related Policies*. Retrieved September 13, 2010, from http://www.aza.org/uploadedfiles/accreditation/microsoft%20word%20-%202010%20accred%20standards.pdf.

Axelrod, R. (1973). An information processing model of perception and cognition. *The American Political Science Review, 67(4),* 1248-1266.

Basile, C. G. (2000). Environmental education as a catalyst for transfer of learning in young children. *The Journal of Environmental Education, 22,* 36-40.

Bem, S. L. (1981). Gender schema theory: A cognitive account of sex typing. *Psychological Review, 85,* 485-501.

Bem, S. L. (1983). Gender schema theory and its implications for child development: Raising gender-aschematic children in a gender-schematic society. *Signs, 8(4),* 598-616.

Bennett, D. B. (1989). Four steps to evaluating environmental education learning experiences. *Journal of Environmental Education, Winter 1988/1989,* 14-21.

Black, A. E., & Deci, E. L. (2000). The effects of instructors' autonomy support and students' autonomous motivation on learning organic chemistry: A self-determination theory prospective. *Science Education, 84,* 740-756.

Bell, P., Lewenstein, B., Shouse, A. W., Feder, M. A. (Eds.). (2009). *Learning Science in Informal Environments.* Washington, D.C.: The National Academies Press.

Bogner, F. X. (1998). The influence of short-term outdoor ecology education on long-term variables of environmental perspective. *Journal of Environmental Education, 29*(4), 17-29.

Bonwell, C. C., & Eison, J. A. (1991). Active learning: Creating excitement in the classroom. *ASHEERIC Higher Education Report No. 1,* George Washington University, Washington, DC.

Bott, P. A. (1996). *Testing and Assessment in Occupational and Technical Education.* Allyn & Bacon: Needham Heights, MA.

Brewer, C. (2001). Cultivating conservation literacy: "Trickle-down" education is not enough. *Conservation Biology, 15(5),* 1203-1205.

Burrill, G., & Kennedy, D. (1997). *Improving Student Learning in Mathematics and Science: The Role of National Standards in State Policy*. National Academy Press: Washington, D. C.

Cantrell, S. (2003). *Pay and Performance: The Utility of Teacher Experience, Education, Credentials, and Attendance as Predictors of Student Achievement at Elementary Schools in LAUSD*. Los Angeles, CA: Los Angeles Unified School District, Program Evaluation and Research Branch.

Carrell, P. L. (1984). Schema theory and ESL reading: Classroom implications and applications. *The Modern Language Journal, 68,* 332-343.

Carrell, P. L., & Eisterhold, J. C. (1983). Schema theory and ESL reading pedagogy. *TESOL Quarterly, 17(4),* 553-573.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences (2nd ed.).* New Jersey: Lawrence Erlbaum.

Coveny, D. (2010, May 5). *Top 10 Hot Jobs of 2012*. Retrieved from www.msnbc.msn.com/id/20283894.

Crandall, V., Armstrong, J., Boswell, S.L., Parsons, J.S., Brush, L., Steel, L. (1980). Gender differences in participation in mathematics: Developmental origins and consequences. In V. Cradell (Chair), *Gender Differences in Participation in Mathematics: Developmental Origins and Consequences.* Symposium.

Cronin-Jones, L. L. (2000). The effectiveness of schoolyards as sites for elementary science instruction. *School Science and Mathematics, 100(4), 203-211.*

Davis-Kean, P. E. (2005). The influence of parent education and family income on child achievement: The indirect role of parental expectations and the home environment. *Journal of Family Psychology, 19(2),* 294-304.

Denissen, J.J.A., Zarrett, N.R., & Eccles, J.S. (2007). I like to do it, I'm able, and I know I am: Longitudinal coupling between domain-specific achievement, self-concept, and interest. *Child Development, 78*(2), 430-447.

Denzin, N. K., & Lincoln, Y. S. (2005). *The Sage Handbook of Qualitative Research (3rd ed.)*. Thousand Oaks, CA: Sage Publications, Inc.

Dettman-Easler, D., & Pease, J. L. (1999). Evaluating the effectiveness of residential environmental education programs in fostering positive attitudes toward wildlife. *The Journal of Environmental Education, 31*(1), 33-39.

deWhite, T. G., & Jacobson, S. K. (1994). Evaluating conservation education programs at a South American zoo. *The Journal of Environmental Education, 25(4),* 18-22.

Di Vesta, F., & Smith, D. (1979). The pausing principal: Increasing the efficiency of memory for ongoing events. *Contemporary Educational Psychology, 4.*

Eagles, P. F. J., & Demare, R. (1999). Factors influencing children's environmental attitudes. *Journal of Environmental Education, 30*(4), 33-37.

Eccles, J. (1983). Expectancies, values and academic behaviors. In J. T. Spence (Ed.), *Achievement and Achievement Motives* (pp. 75-146). San Francisco: Freeman.

Eccles, J. S., & Wigfield, A. (1995). In the mind of the actor: The structure of adolescents' achievement task values and expectancy-related beliefs. *Personality and Social Psychology Bulletin, 21*, 215-225.

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology, 53*(3), 109-132.

Eccles, J. S., Barber, B. L., Updegraff, K., & O'Brien, K.M. (1998). An expectancy-value model of achievement choices: The role of ability self-concepts, perceived task utility and interest in predicting activity choice and course enrollment. In A.K.L. Hoffman, K.A. Renninger & J. Baumert (Eds.), *Interest and Learning: Proceedings of the Second Conference on Interest and Gender* (pp. 267-280). Kiel, Germany: Institute for Science Education at the University of Keil.

Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., & Mac Iver, C. (1993). Development during adolescence: The impact of stage environment fit on young adolescents' experiences in schools and families. *American Psychologist, 48,* 90-101.

Eccles, J., Wigfield, A., Flanagan, C., Miller, C., Reuman, D., & Yee, D. (1989). Self-concept, domain values, and self-esteem: Relations and changes at early adolescence. *Journal of Personality, 57*, 283-310.

Erickson, G. L., & Erickson, L. J. (2006). Females and science achievement: Evidence, explanations, and implications. *Journal of Science Education, 68*(2), 63-89.

Falk, J. H., & Dierking, L. D. (1997). School field trips: Assessing their long-term impact. *Curator: The Museum Journal, 40(3),* 211-218.

Falk, J. H., & Dierkling, L. D. (2000). *Learning from Museums: Visitor Experiences and the Making of Meaning.* Walnut Creek, CA: Altamira Press.

Fein, J., Scott, W., & Tilbury, D. (2001). Education and conservation: Lessons from an evaluation. *Environmental Education Research*, *7(4),* 379-395.

Fenichel, M., & Schweingruber, H. A. (2010). *Surrounded By Science: Learning Science in Informal Environments.* National Research Council, National Academies Press: Washington, D. C.

Griffin, J. (1998). *School-museum Integrated Learning Experiences in Science: A Learning Journey*. Unpublished doctoral dissertation, University of Technology, Sydney.

Hake, R. (1998). Interactive-engagement vs. traditional methods: A six-thousand-student survey of mechanics data for introductory physics courses. *American Journal of Physics, 66 (1),* 64-74.

Hidi, S., & Anderson, V. (1992). Situational interest and its impact on reading and expository writing. In K. A. Renninger, S. Hidi, & A. Krapp (Eds.), *The Role of Interest In Learning and Development* (pp. 215-238). Hillsdale, NJ: Erlbaum.

Hill, H. C., Rowan, B., & Ball, D. L. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American Educational Research Journal, 42 (2),* 371-406.

Hopkins, W. G. (2000). *New View of Statistics: Effect Magnitudes*. Retrieved November 8, 2010 from http://www.sportsci.org/resource/stats/effectmag.html.

Indiana Department of Education. *2009 ISTEP+ Results Overview* [Data File]. Retrieved from www.doe.in.gov/istep/2009/pdf/2009_ISTEP_scores.pdf.

Jacobs, J. E., Lanza, S., Osgood, D. W., Eccles, J. S., & Wigfield, A. (2002). Changes in children's self-competence and values: Gender and domain differences across grades one through twelve. *Child Development, 73,* 509-527.

Jacobson, S. K. (1991). Evaluation model for developing, implementing, and assessing conservation education programs: Examples from Belize and Costa Rica. *Environmental Management, 15(2),* 143-150.

Jordan, J., & Seger, L. (2001). Environmental literacy evaluation. *Paper Presented at the 2001 AZA National Conference.* Retrieved September 1, 2010, from http://wwwstlzoo.org/content.asp?page_name=environmental.

Knapp, D., & Barrie, E. (1998). Ecology versus issue interpretation: The analysis of two different messages. *Journal of Interpretation Research, 3*(1), 21-38.

Knobloch, N. A. (2009). *Learner-Centered Teaching Modules*. Retrieved September 21, 2010, from http://www.ydae.purdue.edu/lct/hbcu.

Krapp, A., Hidi, S., & Renninger, K. A. (1992). Interest, learning, and development. In K. A. Renninger, S. Hidi, & A. Krapp (Eds.). *The Role of Interest In Learning and Development* (pp. 3-25). Hillsdale, NJ: Erlbaum.

Kruse, C. K., & Card, J. A. (2004). Effects of a conservation education camp program on campers' self-reported knowledge, attitude, and behavior. *Journal of Environmental Education, 35(4),* 33-45.

Laws, P., Sokoloff, D., & Thornton, R. (1999). Promoting active learning using the results of physics education research. *Uniserve Science News, 13,* 14-19.

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

Legault, L., & Pelletier, L. G. (2000). Impact of an environmental education program on students' and parents' attitudes, motivation, and behaviours. *Canadian Journal of Behavioral Science, 32*(4), 243-250.

Lindemann-Matthie, P. (2001). Evaluation of the interactive visitor information in the Goldau Zoo. *Zoologischer Garten, 71(3),* 21-38.

Mahoney, J. L., & Eccles, J. S. (2007). Organized activity participation for children from low- and middle-income families. In A. Booth & A. C. Crouter (Eds.), *Disparities in School Readiness* (pp. 207-222). New York, NY: Lawrence Erlbaum Associates.

Malcolm, J., Hodkinson, P., & Colley, H. (2003). The interrelationships between informal and formal learning. *Journal of Workplace Learning, 15 (7/8),* 313-318.

Marshdoyle, E., Bowman, M. L., & Mullins, G. W. (1982). Evaluating programmatic use of a community resource: The zoo. *The Journal of Environmental Education*, *13*(4), 19-26.

Mattern, N, & Schau, C. (2002). Gender differences in science attitude-achievement relationships over time among white middle-school students. *Journal of Research in Science Teaching, 39*(4), 324-340.

Melendez, E. J., & Pritchard, R. H. (1985). Applying schema theory to foreign language reading. *Foreign Language Annals, 18,* 399-403.

North American Association of Environmental Education. (1990). Excellence in Environmental Education – Guidelines for Learning (K-12).

Nye, B., Kostantopoulos, S., & Hedges, L. V. (2004). How large are teachers effects?. *Educational Evaluation and Policy Analysis, 26 (3),* 237-257.

Parsons, J. E. (1978). The development of attributions, expectancies and persistence. In the *Symposium on Success and Failure Attributions and Student Behavior in the Classroom.* Symposium conducted at the meeting of the American Psychological Association, San Francisco, CA.

Parsons, J. E., & Ruble, D. N. (1972). Attributionaal processes related to the development of achievement-related affect and expectancy. *Proceedings of the American Psychological Association 80th Annual Convention,* 105-106.

Parsons, J. E., & Ruble, D. N. (1977). The development of achievement-related expectancies. *Child Development*, *48,* 1075-1079.

Patton, M. Q. (2002). *Qualitative Research & Evaluation Methods* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Pearson-Casanave, C. R. (1984). Communicative pre-reading activities: schema theory in action. *TESOL Quarterly, 18,* 336-336.

Pintrich, P. R. (1988a). A process-oriented view of student motivation and cognition. In J. Stark and L. Mets (Eds.), *Improving Teaching and Learning Through Research: New Directions for Institutional Research* (Vol. 57, pp 65-79. San Francisco: Jossey-Bass.

Pintrich, P. R. (1988b). Student learning and college teaching. In R. Young and K. Eble (Eds.), *College Teaching and Learning: Preparing for New Commitments: New Directions for Teaching and Learning.* (Vol. 33. Pp. 71-86). San Francisco: Jossey-Bass.

Pintrich, P. R. (1989). The dynamic interplay of student motivation and cognition in the college classroom. In C. Ames & M. L. Maehr (Eds.), *Advances in Motivation and Achievement: Motivation Enhancing Environments* (Vol. 6, pp. 117-160). Greenwich, CT: JAI Press.

Pintrich, P. R., & De Groot, E. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82,* 33-40.

Pintrich, P. R., & Garcia, T. (1991). Student goal-orientation and self-regulation in the college classroom. In M. L. Maehr & P. R. Pintrich (Eds.), *Advances in Motivation and Achievement: Goals and Self-regulatory Processes* (Vol. 7, pp. 371-402). Greenwich, CT: JAI Press.

Pintrich, P. R., & Schrauben, B. (1992). Students' motivational beliefs and their cognitive engagement in classroom tasks. In D. Schunk & J. Meece (Eds.), *Student Perceptions in the Classroom: Causes and Consequences* (pp. 149-183). Hillsdale, NJ: Erlbaum.

Pomerantz, G. A. (1991). Evaluation of natural resource education materials: Implications for resource management. *The Journal of Environmental Education, 22(2),* 16-23.

Price, S., & Hein, G. E. (1991). More than a Field Trip: science programmes for elementary school groups at museums. *International Journal of Science Education, 13(5),* 505-519.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education,* 1-9.

Redish, E., Saul, J., & Steinberg, R. (1997). On the effectiveness of active-engagement microcomputer-based laboratories. *American Journal of Physics, 65 (1),* 45-60.

Renninger, K. (2000). Individual interest and its implications for understanding intrinsic motivation. In C. Sansone & J. M. Harackiewicz (Eds.), *Intrinsic and Extrinsic Motivation: The Search for Optimal Motivation and Performance.* (pp. 373 – 404). San Diego, CA: Academic Press.

Rockoff, J. E. (2004). The impact of individual teachers on student achievement: evidence from panel data, *The Economic Review, 94 (2), Papers and Proceedings of the One Hundred Sixteenth Annual Meeting of the American Economic Association,* (pp 247-252). San Diego, CA: American Economic Association.

Roth, C. E. (1990). Operationalizing the concept. *Environmental Literacy: Its Roots, Evolution and Directions in the 1990's,* 15-21.

Ruble, D. N. (1975). Visual orientation and self-perceptions of children in an external-cue-relevant or cue-irrelevant task situation. *Child Development, 47,* 990-997.

Ruhl, K., Hughes, C., & Schloss, P. (1987). Using the pause procedure to enhance lecture recall. *Teacher Education and Special Education, 10,* 14-18.

Schiefele, U., Krapp, A., & Winteler, A. (1992). Interest as a predictor of academic achievement: A meta-analysis of research. In K. A. Renninger, S. Hidi, & A. Krapp (Eds.), *The Role of Interest in Learning and Development* (pp. 183-212). Hillsdale, NJ: Erlbaum.

Schutt, Russell K. (2009). *Investigating the Social World: The Process and Practice of Research.* Thousand Oaks, CA: Pine Forge Press.

Serrell, B. Y. (1981). The role of zoological parks and aquariums in environmental education. *Journal of Environmental Education, 12(3),* 41-42.

Simmons, D. A. (1991). Are we meeting the goal of responsible environmental behavior: An examination of nature and environmental education center goals. *The Journal of Environmental Education, 22* (3*),* pp. 16-21.

Sutherland, D. S., & Hamm, S. H. (1992). Child-to-parent transfer of environmental ideology in Costa Rican families: An ethnographic case study. *Journal of Environmental Education, 23,* 9-16.

Taraban, R., Box, C., Russell, M., Pollard, R., & Bowen, C. W. (2007). Effects of active-learning experiences on achievement, attitudes, and behaviors in high school biology. *Journal of Research in Science Teaching, 44 (7),* 960-979.

Tuckman, H. P. (1975). Teacher effectiveness and student performance. *Journal of Economic Education,* 7(1), 34-39

Westphal, J. M., & Halverson, W. F. (1985). Assessing the long-term effects of an environmental education program: A pragmatic approach. *The Journal of Environmental Education, 17(*2), 26-30.

Whitehead, M. (1995). Saying it with genes, species, and habitats: biodiversity education and the role of zoos. *Biodiversity and Conservation, 4,* 664-670.

Wigfield, A. (1994). Expectancy-value theory of achievement motivation: A developmental perspective. *Educational Psychology Review, 6*, 49-78.

Wigfield, A., & Eccles, J. (1992). The development of achievement task values: A theoretical analysis. *Developmental Review, 12*, 159-183.

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of motivation. *Contemporary Educational Psychology, 25,* 68-81.

Wigfield, A., Eccles, J. S., Yoon, K. S., Harold, R. D., Arbreton, A. J. A., & Blumenfeld, P. C. (1997). Changes in children's competence beliefs and subjective task values across the elementary school years: A three-year study. *Journal of Education Psychology, 89,* 451-469.

Wiggins, G., & McTighe, J. (1998). *Understanding By Design.* Alexandria, Virginia: Merrill Education/ASCD College Textbook Series, ASCD.

Woodside, D.P., and Kelly, J. D. (1995). The development of local, national, and international zoo-based education programmes. *International Zoo Yearbook, 34(1),* 231-246.

Worthen, B. R., Sanders, J. R., & Fitzpatrick, J. L. (1997). *Program Evaluation: Alternative Approaches and Practical Guidelines.* Longman Publishers USA: White Plains, NY.

Wright, S. P., Horn, S. P., & Sanders, W. L. (1997). Teacher and classroom context effects on student achievement: implications for teacher evaluation. *Journal of Personnel Evaluation in Education, 11,* 57-67.

Yoon, K. S. (1997). *Exploring Children's Motivation for Instrumental Music.* Paper presented at the biennial meeting of the Society for Research in Child Development, Washington, D.C.

APPENDICES

Appendix A. IRB Protocol Ref. #0804006792

PURDUE
UNIVERSITY

HUMAN RESEARCH PROTECTION PROGRAM
INSTITUTIONAL REVIEW BOARDS

To:	NEIL KNOBLOCH AGAD
From:	RICHARD MATTES, Chair Social Science IRB
Date:	03/17/2010
Committee Action:	**Exemption Granted**
IRB Action Date:	03/17/2010
IRB Protocol #:	1003009069
Study Title:	An Exploratory Assessment of Youth Outcomes and Related Independent Variables in an Informal Zoo-Based Science Program

The Institutional Review Board (IRB) has reviewed the above-referenced protocol and has determined that it qualifies for exemption pursuant to Federal regulations 45 CFR 46.101(b) exempt category(1) .

If you wish to revise or amend the protocol, please submit a revision request to the IRB for consideration. Please contact our office if you have any questions.

We wish you good luck with your work. Please retain copy of this letter for your records.

Ernest C. Young Hall 10th Floor 155 S. Grant St. West Lafayette, IN 47907-2114 (765) 494-5942 Fax: (765) 494-9911

Appendix B. Zoo Approval Letter

March 2, 2010

Human Research Protection Program
Ernest C. Young Hall
10th Floor, Room 1032
155 S Grant Street
West Lafayette, IN

Columbian Park Zoo and Lafayette Parks and Recreation, gives permission to Noah Shields, Purdue University Graduate Student, to conduct the assessment study entitled “An Exploratory Assessment of Youth Outcomes and Related Independent Variables in an Informal Zoo-Based Science Program.”

This assessment study is important for the Columbian Park Zoo to participate in because it will allow a program assessment to be designed and validated for the summer education camps conducted annually from June-August. The information gained from this study will allow the Columbian Park Zoo Education Department to determine its effectiveness in delivering education programs and will allow the Education Department to identify improvements and recommendations for its summer camps. These improvements and recommendations will better serve the Greater Lafayette area as an educational resource.

Sincerely,

Ted Bumbleberg
Superintendent
Lafayette Parks and Recreation
1915 Scott Street
Lafayette, IN 47904

Appendix C. Parent Consent Letter

Dear Zoo Family,

Greetings!

My name is Noah Shields, a graduate student from Purdue University and an Education Assistant at the Columbian Park Zoo, and I am working on my Master' thesis project. I obtained your mailing address from your child's summer camp registration form. I am doing an evaluation study of our summer *Young Edventurer* camps. This evaluation study will be able to help us determine how we can improve our camps to make the *Young Edventurer* camps a successful educational experience for your child. We will be looking at your child's interests, motivation, and the knowledge that they gain from the camp.

This letter is to inform you what participants will be asked to do. Your child would only need to complete a short survey at the beginning of the camp week (on Monday) and another short survey at the end of the camp week (on Friday). These surveys will take approximately 10 minutes of time each and zoo staff will assist in the administration of the surveys. On Friday of the camp week, we are asking parent's to take a survey that will only take approximately 10 minutes to complete.

Participation in this study is completely voluntary. You and your child do not have to participate in this study. If you agree to participate, you can withdraw your participation at any time. The information that you provide us will enable us to determine the effectiveness of our programs and allow us to improve them to offer additional positive educational experiences in the future. The risks associated with this study are those feelings normally experienced in educational assessments and would not be any greater than your student would experience in their school classroom. If you and your child choose not to participate, your child will be offered an alternate activity without penalty.

All components of this project will be kept completely confidential. Participants will be identified by a unique number. **Please indicate your participation on the back of this letter and return to camp during drop-off on the first day. There will be extra copies of the letter available at camp.**

If you have any questions about this research project, you can contact Noah Shields (765-807-1540) or Dr. Neil Knobloch (765-494-8439). If you have concerns about the treatment of research participants, you can contact the Institutional Review Board at Purdue University, Ernest C. Young Hall, Room 1032, 155 S Grant Street, West Lafayette, IN 47907-2114. The phone number for the Board is (765) 494-5942. The email address is IRB@PURDUE.EDU.

Sincerely,

Noah C. Shields
Graduate Research Assistant
Purdue University
Education Assistant
Columbian Park Zoo

Dr. Neil Knobloch
Assistant Professor
Purdue University

☐ **YES,** I want to participate

☐ **NO,** I do not want to participate (Sign and return this letter at check-in)

Name of Child or Children: ____

Parent or Guardian
Signature: ____

Appendix D. Pretest Instrument

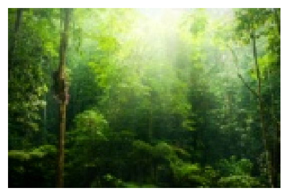
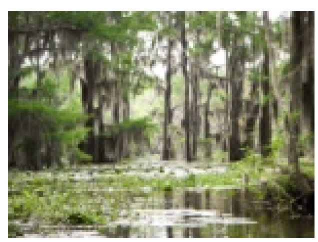
Participant Number__________

IRB Approval # 0804006792
Approval Date: March 17, 2010

Student Pre-Assessment
Directions: Please choose the best answer.

1. Some people help wild animals. T F
2. Some people cause problems for animals. T F
3. Some people hurt the planet. T F

4. Match each animal with the picture of the habitat that the animal would live in. Draw a line to connect each one.

Animal	Habitat
 Leopard Gecko	 Rainforest
 Parrot	 Swamp
 Wallaby	 Desert

Bullfrog

Grassland

5. Which of the four choices is a challenge that all animals have to deal with to survive in their habitats?
    a. Finding enough food and water.
    b. Finding a shelter from the weather.
    c. Staying safe from predators.
    d. All of the above.

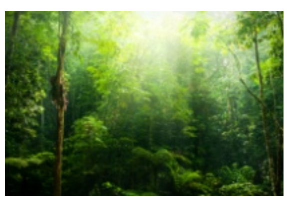
6. Which of the following pictures shows a habitat where an animal would have the most problems in finding enough water to survive?

a. 

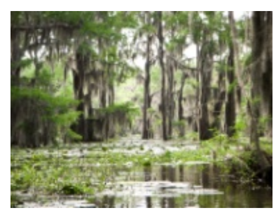
Desert

b. 

Grassland

c. 

Rainforest

d. 

Swamp

7. Which of the following animals would have a similar adaptation as a leopard gecko to live in the desert, where it cannot find food that easily?

a. 

Chameleon

b. 

Camel

c. 

Lion

d. 

Duck

8. Which of the following is something that humans do, that has a negative or bad impact on nature?
   a. Someone planting trees.
   b. Someone viewing wildlife.
   c. Someone recycling.
   d. Someone driving a car.

9. Which of the following pictures show an animal that is using color to scare predators away like this Firebelly toad?

a. 

Squirrel

b. 

Cheetah

c. 

Blue Tongue Skink

d. 

Parrot

<u>Interest</u>

Please circle Yes if you agree with the sentence, circle No if you don't agree with the sentence, or I do not know if you don't know what you think.

10. I like learning about animals. Yes No I do not know

11. I like watching animals on T.V. Yes No I do not know

12. I like being outside. Yes No I do not know

13. I like reading about animals. Yes No I do not know

14. I like learning science. Yes No I do not know

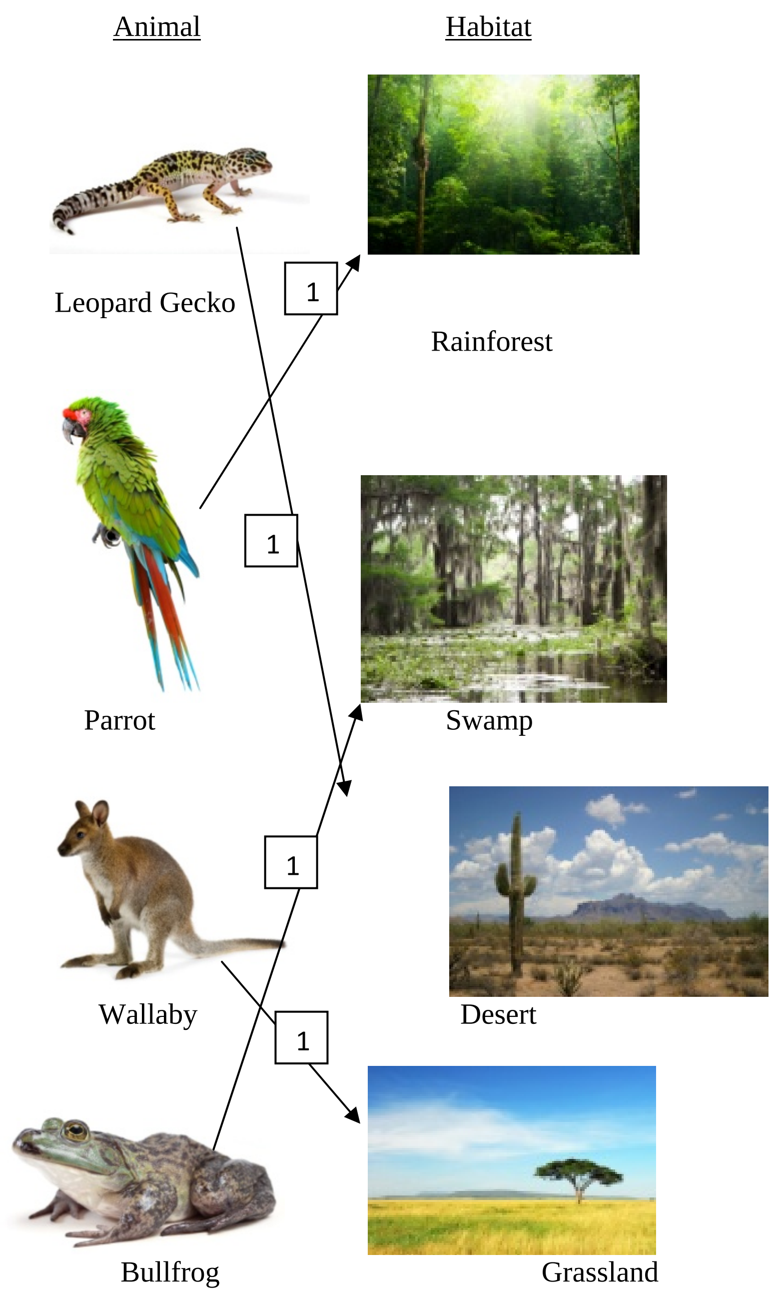
15. I like talking to my mom and dad about animals. Yes No I do not know

Appendix E. Pretest Answer Key

Student Pre-Assessment
Directions: Please choose the best answer.

1.	Some people help wild animals.	1	0
2.	Some people cause problems for animals.	1	0
3.	Some people hurt the planet.	1	0

4. Match each animal with the picture of the habitat that the animal would live in. Draw a line to connect each one.

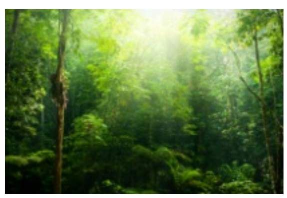


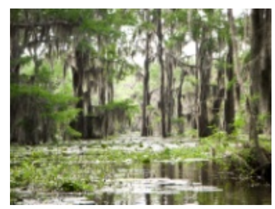
5. Which of the four choices is a challenge that all animals have to deal with to survive in their habitats?
   0 Finding enough food and water.
   0 Finding a shelter from the weather.
   0 Staying safe from predators.
   1 All of the above.

6. Which of the following pictures shows a habitat where an animal would have the most problems in finding enough water to survive?

1 
Desert

0 
Grassland

0 
Rainforest

0 
Swamp

7. Which of the following animals would have a similar adaptation as a leopard gecko to live in the desert, where it cannot find food that easily?

0 

Chameleon

1 

Camel

0 

Lion

0 

Duck

8. Which of the following is something that humans do, that has a negative or bad impact on nature?

0 Someone planting trees.
0 Someone viewing wildlife.
0 Someone recycling.
1 Someone driving a car.

9. Which of the following pictures show an animal that is using color to scare predators away like this Firebelly toad?

0 

Squirrel

0 

Cheetah

1 

Blue Tongue Skink

0 

Parrot

<u>Interest</u>

Please circle Yes if you agree with the sentence, circle No if you don't agree with the sentence, or I do not know if you don't know what you think.

1	I like learning about animals.	2	0	1
2	I like watching animals on T.V.	2	0	1
3	I like being outside.	2	0	1
4	I like reading about animals.	2	0	1
5	I like learning science.	2	0	1
6	I like talking to my mom and dad about animals.	2	0	1

Appendix F. Posttest Instrument

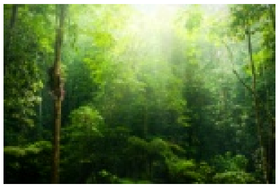
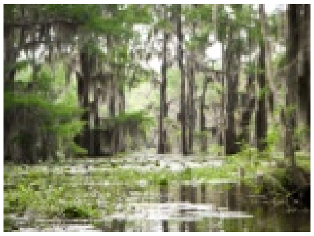
Participant Number__________ IRB Approval # 0804006792

Approval Date: March 17, 2010

Student Post-Assessment
Directions: Please choose the best answer.

1. Some people help wild animals. T F
2. Some people cause problems for animals. T F
3. Some people hurt the planet. T F

4. Match each animal with the picture of the habitat that the animal would live in. Draw a line to connect each one.

Animal	Habitat
 Leopard Gecko	 Rainforest
 Parrot	 Swamp
 Wallaby	 Desert

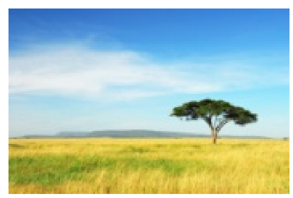

Bullfrog

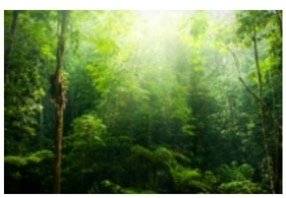

Grassland

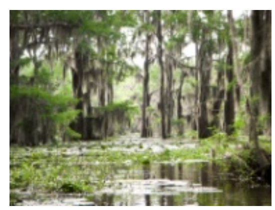
5. Which of the four choices is a challenge that all animals have to deal with to survive in their habitats?
    a. Finding enough food and water.
    b. Finding a shelter from the weather.
    c. Staying safe from predators.
    d. All of the above.

6. Which of the following pictures shows a habitat where an animal would have the most problems in finding enough water to survive?

a. 
Desert

b. 
Grassland

c. 
Rainforest

d. 
Swamp

7. Which of the following animals would have a similar adaptation as a leopard gecko to live in the desert, where it cannot find food that easily?

a. 

Chameleon

b. 

Camel

c. 

Lion

d. 

Duck

8. Which of the following is something that humans do, that has a negative or bad impact on nature?
   a. Someone planting trees.
   b. Someone viewing wildlife.
   c. Someone recycling.
   d. Someone driving a car.

9. Which of the following pictures show an animal that is using color to scare predators away like this Firebelly toad?

a. 

Squirrel

b. 

Cheetah

c. 

Blue Tongue Skink

d. 

Parrot

<u>Interest</u>

Please circle Yes if you agree with the sentence, circle No if you don't agree with the sentence, or I do not know if you don't know what you think.

10. I enjoyed coming to camp very much.	Yes	No	I do not know
11. I thought this camp was boring.	Yes	No	I do not know
12. I would like to go to other camps like this one.	Yes	No	I do not know
13. This camp was fun to me.	Yes	No	I do not know
14. I think what I learned in camp is very useful.	Yes	No	I do not know
15. I like learning science in school.	Yes	No	I do not know

16. I want to work with animals when I grow up. Yes No I do not know

17. I want to be a veterinarian when I grow up. Yes No I do not know

18. I want to be a zookeeper when I grow up. Yes No I do not know

Directions: Please circle the answer for each sentence.

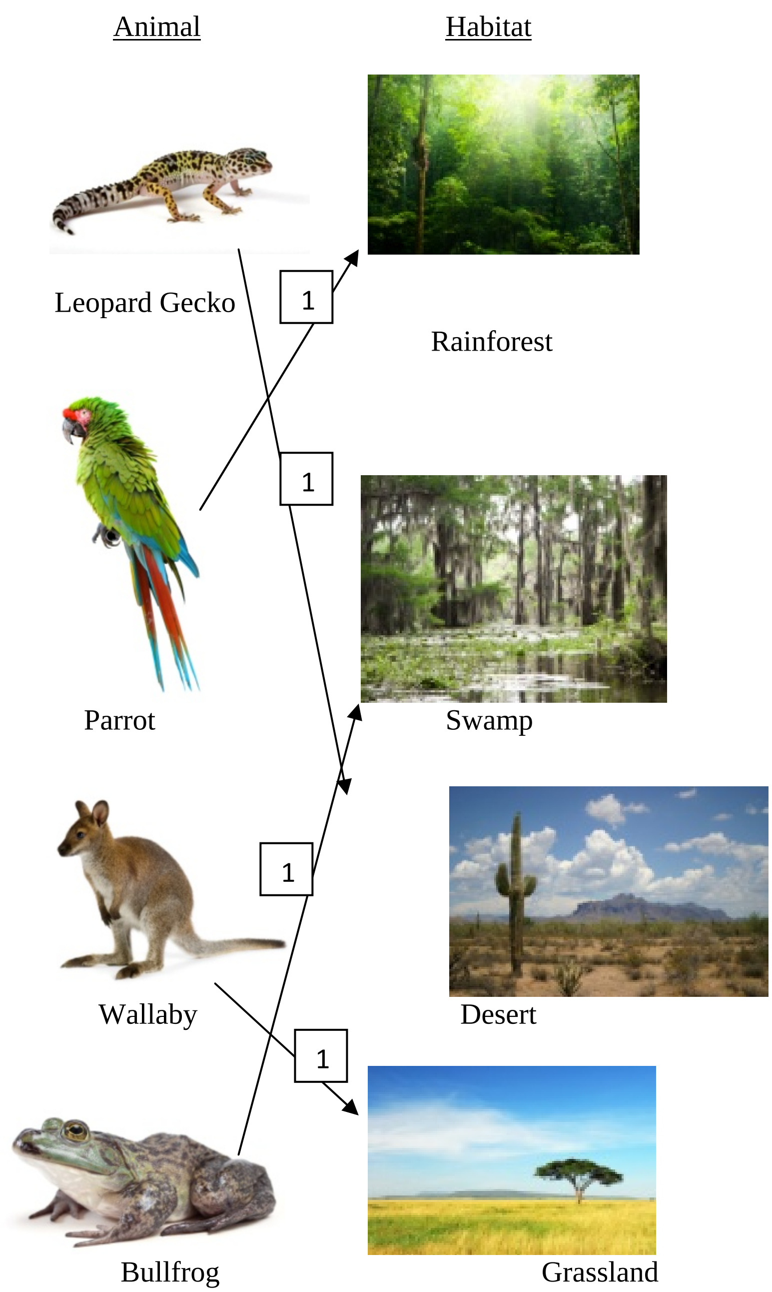
19. I am a: Boy Girl
20. I have come to camp before. Yes No
21. This is my first time coming to zoo camp. Yes No

Appendix G. Posttest Answer Key

Student Post-Assessment
Directions: Please choose the best answer.

10. Some people help wild animals. 1 0
11. Some people cause problems for animals. 1 0
12. Some people hurt the planet. 1 0

13. Match each animal with the picture of the habitat that the animal would live in. Draw a line to connect each one.



14. Which of the four choices is a challenge that all animals have to deal with to survive in their habitats?

    0 Finding enough food and water.
    0 Finding a shelter from the weather.
    0 Staying safe from predators.
    1 All of the above.

15. Which of the following pictures shows a habitat where an animal would have the most problems in finding enough water to survive?

1 

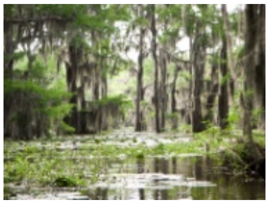
Desert

0 

Grassland

0 

Rainforest

0 

Swamp

16. Which of the following animals would have a similar adaptation as a leopard gecko to live in the desert, where it cannot find food that easily?

0 
Chameleon

1 
Camel

0 
Lion

0 
Duck

17. Which of the following is something that humans do, that has a negative or bad impact on nature?

0 Someone planting trees.
0 Someone viewing wildlife.
0 Someone recycling.
1 Someone driving a car.

18. Which of the following pictures show an animal that is using color to scare predators away like this Firebelly toad?

0 

Squirrel

0 

Cheetah

1 

0 

Blue Tongue Skink

Parrot

<u>Interest</u>

Please circle Yes if you agree with the sentence, circle No if you don't agree with the sentence, or I do not know if you don't know what you think.

19. I enjoyed coming to camp very much.	2	0	1
20. I thought this camp was boring.	2	0	1
21. I would like to go to other camps like this one.	2	0	1
22. This camp was fun to me.	2	0	1
23. I think what I learned in camp is very useful.	2	0	1
24. I like learning science in school.	2	0	1
25. I want to work with animals when I grow up.	2	0	1

26. I want to be a veterinarian when I grow up.	2	0	1
27. I want to be a zookeeper when I grow up.	2	0	1

Directions: Please circle the answer for each sentence.

28. I am a:	0 Boy	1 Girl
29. I have come to camp before.	1 Yes	0 No
30. This is my first time coming to zoo camp.	1 Yes	0 No

Appendix H. Parent Instrument

Participant Number of Child________

Parent Survey

Directions: Please indicate your level of agreement to each of the following statements.

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I think it is important my child attend this camp because it will help them learn science concepts.	SD	D	A	SA
2. My child will perform better in school after attending this camp.	SD	D	A	SA
3. My child needs to learn science concepts.	SD	D	A	SA
4. This camp is a good opportunity for my child to learn about animals and science.	SD	D	A	SA
5. I would allow my child to participate in another camp at the zoo.	SD	D	A	SA
6. My child liked the instructor of this camp.	SD	D	A	SA
7. My child talked about what they learned when they got home during this camp.	SD	D	A	SA
8. My child would attend another camp taught by this instructor.	SD	D	A	SA
9. It is very important to me that my child is good in science.	SD	D	A	SA
10. It is very useful for my child to learn science.	SD	D	A	SA
11. My child will do better in science in school after attending this camp.	SD	D	A	SA
12. My child is more interested in science after attending this camp.	SD	D	A	SA

Appendix I. Parent Instrument Codebook

Parent Survey
Directions: Please indicate your level of agreement to each of the following statements.

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I think it is important my child attend this camp because it will help them learn science concepts.	0 SD	1 D	2 A	3 SA
2. My child will perform better in school after attending this camp.	0 SD	1 D	2 A	3 SA
3. My child needs to learn science concepts.	0 SD	1 D	2 A	3 SA
4. This camp is a good opportunity for my child to learn about animals and science.	0 SD	1 D	2 A	3 SA
5. I would allow my child to participate in another camp at the zoo.	0 SD	1 D	2 A	3 SA
6. My child liked the instructor of this camp.	0 SD	1 D	2 A	3 SA
7. My child talked about what they learned when they got home during this camp.	0 SD	1 D	2 A	3 SA
8. My child would attend another camp taught by this instructor.	0 SD	1 D	2 A	3 SA
9. It is very important to me that my child is good in science.	0 SD	1 D	2 A	3 SA
10. It is very useful for my child to learn science.	0 SD	1 D	2 A	3 SA
11. My child will do better in science in school after attending this camp.	0 SD	1 D	2 A	3 SA
12. My child is more interested in science after attending this camp.	0 SD	1 D	2 A	3 SA

Appendix J. Educator Demographic Instrument

Educator Survey

Please answer the following questions to the best of your ability.

Academic/Professional Background

1. Please list the camp themes you are responsible for designing curriculum (lesson plans) for and instructing:

   ____

   ____

2. Select the highest level of education that you have achieved at this point in time.

   ☐ GED ☐ High School Diploma ☐ Associate's Degree

   ☐ Bachelor's Degree ☐ Graduate Degree

3. If you are currently completing an undergraduate degree, please select how many years of undergraduate work you have completed at this point in time.

   ☐ 1 ☐ 2 ☐ 3 ☐ 4

4. If you have completed (or will complete) a post-secondary degree, what field is the degree in?

   ____

5. How many years have you taught in an informal context?

   ☐ 0-1 ☐ 2-4 ☐ 5-7 ☐ 8-10

6. What types of informal programs have you been involved in as an instructor or developer?

   ____

   ____

   ____

7. I am: ☐ male ☐ female

Directions: Please circle the selection that best represents your level of agreement.

	Strongly Disagree	Disagree	Agree	Strongly Agree
8. I enjoy teaching scientific topics.	SD	D	A	SA
9. I enjoy working with children.	SD	D	A	SA

10. I plan to pursue environmental/ conservation education as a career.	SD	D	A	SA

Appendix K. Active Learning Checklist (Primary Educator)

Primary Instructor's Learning Activities

Camp Theme:___________________ DAY 1

Directions: Please write the title of 1-4 learning activities for the morning and afternoon times. Indicate the amount of student participation you intend by placing an X in one of the three boxes labeled Low, Medium, and High.

Morning Learning Activity:	**Low Activity (Students only observe and listen)**	**Medium Activity (Students complete minimal tasks)**	**High Activity (Students complete major tasks)**
1.			
2.			
3.			
4.			

Afternoon Learning Activity:	**Low Activity (Students only observe and listen)**	**Medium Activity (Students complete minimal tasks)**	**High Activity (Students complete major tasks)**
1.			
2.			
3.			
4.			

Appendix L. Active Learning Checklist Codebook (Primary Educator)

Primary Instructor's Learning Activities

Camp Theme:__________________ DAY 1

Directions: Please write the title of 1-4 learning activities for the morning and afternoon times. Indicate the amount of student participation you intend by placing an X in one of the three boxes labeled Low, Medium, and High.

Morning Learning Activity:	**Low Activity (Students only observe and listen)**	**Medium Activity (Students complete minimal tasks)**	**High Activity (Students complete major tasks)**
1.	1	2	3
2.	1	2	3
3.	1	2	3
4.	1	2	3
Afternoon Learning Activity:	**Low Activity (Students only observe and listen)**	**Medium Activity (Students complete minimal tasks)**	**High Activity (Students complete major tasks)**
1.	1	2	3
2.	1	2	3
3.	1	2	3
4.	1	2	3

Appendix M. Active Learning Checklist (Assistant Educator)

Assistant Instructor's Observations

Camp Theme:___________________ DAY 1

Directions: Indicate the amount of student participation as a group you observed by placing an X in one of the three boxes labeled Low, Medium, and High.

Morning Learning Activity:	**Low Activity (Students only observe and listen)**	**Medium Activity (Students complete minimal tasks)**	**High Activity (Students complete major tasks)**
1.			
2.			
3.			
4.			

Afternoon Learning Activity:	**Low Activity (Students only observe and listen)**	**Medium Activity (Students complete minimal tasks)**	**High Activity (Students complete major tasks)**
1.			
2.			
3.			
4.			

Appendix N. Active Learning Checklist Codebook (Assistant Educator)

Assistant Instructor's Observations

Camp Theme:_________________ DAY 1

Directions: Indicate the amount of student participation as a group you observed by placing an X in one of the three boxes labeled Low, Medium, and High.

Morning Learning Activity:	**Low Activity (Students only observe and listen)**	**Medium Activity (Students complete minimal tasks)**	**High Activity (Students complete major tasks)**
1.	1	2	3
2.	1	2	3
3.	1	2	3
4.	1	2	3
Afternoon Learning Activity:	**Low Activity (Students only observe and listen)**	**Medium Activity (Students complete minimal tasks)**	**High Activity (Students complete major tasks)**
1.	1	2	3
2.	1	2	3
3.	1	2	3
4.	1	2	3