THE EFFECT OF AN OUTDOOR ENVIRONMENTAL EDUCATION PROGRAM ON PRESERVICE TEACHER KNOWLEDGE, SELF-EFFICACY, AND OUTCOME EXPECTANCY

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CHAPTER I

INTRODUCTION

Background

"In the end, we will conserve what we love, we will love what we understand, and we will understand what we are taught" (Estes, 1993, p. K6). This statement by Baba Dioum, a Senegalese conservationist, provides what many people see as an undeniable reason for environmental education teaching children to understand, love, and conserve the environment. If humans are to conserve natural resources and protect against environmental degradation, they must understand the environment, have a positive attitude toward it, and behave in a manner that maintains environmental integrity (UNESCO, 1980). These three aspects of environmental education (knowledge, attitude, and behavior) are generally accepted to be its foundation.

To effectively teach environmental concepts to children, teachers themselves should be knowledgeable and have a positive attitude toward environmental education. One means of providing this knowledge and positive attitude is through the training of preservice teachers in environmental education. Research suggests that educating preservice teachers about the environment and appropriate teaching methodologies will improve their attitude (Chang, 1998) and knowledge about the environment (Ferry, 1995). However, no consensus has been reached as to the most suitable instructional technique for preservice teachers. This is of particular concern in Oklahoma where environmental education is a multidisciplinary endeavor taught in courses such as

science, social studies, English, and agriculture education (Sasse, 1997). More research is needed on environmental education to determine how to provide preservice teachers with necessary knowledge and positive attitudes, specifically self-efficacy and outcome expectancy.

Statement of the Problem

Environmental education has received substantial attention by public schools in recent years, but little data exist to suggest the most effective technique or techniques for training teachers in environmental education. Day-long outdoor activities are a common means of accomplishing these environmental education training goals. However, little evidence substantiates the claim that preservice teachers have the knowledge and positive self-efficacy and outcome expectancy necessary to teach environmental education in an outdoor setting as a result of these training programs.

Purpose of the Study

This study attempted to evaluate whether a day-long outdoor environmental activity, specifically the Adventures Beyond the Classroom (ABC) Program, helped prepare preservice elementary teachers for teaching environmental education by providing them with necessary environmental knowledge and positive self-efficacy and outcome expectancy.

Definition of Terms

Adventures Beyond the Classroom (*ABC*): Cooperative, integrated day-long outdoor, environmental education program based on *Project WILD* and *Project Wet* activities that took place at a university-owned camp. The program is taught by preservice

teachers for sixth grade participants.

Environmental education: Process of producing citizens that are knowledgeable about the environment and its problems, aware of potential solutions, and willing to work toward those solutions (Stapp, 1973).

Environmental Education Efficacy Belief Instrument (EEEBI): Preservice teacher self-efficacy and outcome expectancy attitude instrument (Sia, 1992).

Outcome expectancy: A person's belief that his/her behavior (teaching environmental education) will produce a desired outcome (learning by the children) (Bandura, 1977; Sia, 1992).

Outdoor education: Educational methodology which utilizes the outdoors to facilitate direct experience with natural materials and living conditions, allowing student involvement in planning and exploration (Hammerman et. al., 1994).

Preservice elementary teacher: University student majoring in elementary education who has not completed his/her training, meaning he/she has not begun teaching formally nor received his/her teacher certification.

Project WET: An interdisciplinary water education program for educators and young people sponsored by the Council for Environmental Education and the Watercourse (*Project WET*, 1995).

Project WILD: An interdisciplinary, supplementary conservation and environmental education program emphasizing wildlife, sponsored by the Council for Environmental Education and the Western Association of Fish and Wildlife Agencies (*Project WILD*, 1992).

Self-efficacy: Person's belief that he/she can perform a certain behavior (teaching

environmental education) based on personal perception (Bandura, 1977; Sia, 1992).

Significance of the Study

The significance of this study relates to the evidence it provides as to effective means of preparing preservice teachers for teaching environmental education. The Adventures Beyond the Classroom Program was the only formal opportunity for these preservice elementary teachers to learn and utilize environmental education curricula and methodology during their teacher preparation. This study helped determine if the program cultivated environmental knowledge and positive attitudes toward environmental education.

The results of this study could indicate that planning and implementing an integrated outdoor environmental education program was effective in improving preservice teachers' ability to teach environmental education and to teach outdoors. Studies have indicated that teachers' perceptions of environmental education programs' effectiveness were based in part on their comfort with the outdoors (Ainsworth, 1997). Increasing preservice teachers' environmental knowledge and improving their attitude toward outdoor environmental education may increase their comfort with the outdoors and alleviate concerns about their teaching skills. This would be of benefit because according to Gibson and Dembo (1984), teachers who believe themselves to be capable and effective at teaching create a learning environment with better focus. In addition, many school systems and textbooks integrate environmental education into other subjects (Sasse, 1997; Schmidt, 1996); therefore, preservice teachers may be expected to have environmental knowledge even if science is not their specialty. The evidence from this study will further the search for meaningful environmental and outdoor education training

techniques for teacher preparation.

CHAPTER II

REVIEW OF LITERATURE

Environmental Education Objectives and Purpose

Environmental education as a concept would not seem difficult to define; however, little agreement exists within the discipline or across agencies as to its specific purpose or objectives. The United States Department of Health, Education, and Welfare (1973) employs two different definitions for environmental education, describing it as a process of increasing society's understanding of environmental problems but also as a means of explaining man's relationship to the land. This lack of consensus within a single agency highlights the overall situation within the discipline. Hungerford and Volk (1990) suggest that educators should be creating environmentally knowledgeable citizens with the skills and commitment to create a better environment. Another opinion is that environmental education is "learning from or in the environment (educational process), about the environment (content), and for the environment (social purpose)" (Marsden, 1997, p. 8). Stapp (1969) provides further elaboration of the scope of environmental education as he defines it as a process of identifying problems, recognizing solution, and working toward their enactment. This is in contrast to many other definitions in that Stapp views environmental education as more than a course of study, but as a process for people's involvement in and with the environment. Regardless of what definition an individual chooses to accept, Swan urges people to remember that "While environmental

education is concerned with the biophysical environment and its associated problems, it ultimately is concerned with man, for you educate people, not environments" (1974, p. 25).

Although one comprehensive definition has not been adopted by the profession, most educators tend to focus on a three-part definition originally voiced by the Tbilisi Intergovernmental Council. This definition characterizes environmental education as being concerned with knowledge, attitudes, and behaviors toward the environment (UNESCO, 1980). It is this three-fold definition of environmental education that has helped shape environmental education research and project creation since the Tbilisi Intergovernmental Council conference in 1977.

The National Environmental Education Acts

Since 1970, the United States public school systems have had a commitment to environmental education. The National Environmental Education Act of 1970 (NEEA) first addressed the commitment of the United States government to educating American youth about man's involvement with and dependence upon the environment (U.S. Department of Health, Education, and Welfare, 1973). Although the NEEA of 1970 was repealed in 1981, legislators reaffirmed the importance of environmental education by authorizing a new version in 1990 (National Environmental Education Act, 1990; Roggenbuck & Driver, 1996). Another revision was made in 1996 to further refine the duties of the federal Office of Environmental Education (National Environmental Education Amendments Act, 1996). The creation of the NEEA in 1970 and later revisions display the government's continued support of environmental education in public schools and support of educators who choose to include environmental education

in their classrooms.

The NEEA addresses the responsibilities of the U.S. government toward environmental education, specifically classroom training, evaluation of programs and curricula, and distribution of environmental education grants and awards (Marcinkowski, 1991). What the legislation does not address is what components are to be included in these programs (Braus, 1995) or what teaching method should be employed. Environmental educators benefit from the resources and support that the NEEA provides, but educators have the responsibility of discovering and refining their own teaching objectives, methodologies, and personal knowledge.

Outdoor Education

The concept of outdoor education is best explained by one of its founders, L.B. Sharp, who said, "That which can best be taught inside the schoolrooms should there be taught, and that which can best be learned through experience dealing directly with native materials and life situations outside the school should there be learned" (1943, p. 364). This idea of going beyond school walls to teach dates back to the 1920's and nature study (Dacey, 1981), as has the connection between outdoor education and environmental education. Outdoor education is attributed with the ability to link natural materials and living things with experiences and awareness of the environment and life (Hammerman et al., 1994). By exploring for themselves, students learn more than by being told answers (Chapman, 1995). It is this underlying concept of connecting children to natural places and systems that keeps outdoor education a driving force in environmental education and has led to considerations of preservice teacher training in outdoor education.

Preservice Teacher Training

For teachers to effectively instruct in environmental education, they should be knowledgeable about the environment (Schmidt, 1996). They need to have opportunities to instruct and interact with children in contexts similar to those in which they will be teaching to gain experience and feedback (Tschannen-Moran et al., 1998). Several studies have suggested that teachers do not feel they have the knowledge or abilities to teach environmental education due to lack of training (Plevyak, 1997; Smith-Sebasto & Smith, 1997). Many also feel ineffective at teaching environmental education outdoors (Ainsworth, 1997; Ferry, 1995; Simmons, 1998). This lack of comfort and effectiveness is of particular concern because studies have shown that teachers from many disciplines are teaching environmental education topics in courses such as science, social studies, English, and agriculture education nationally (Middlestadt et al., 1999) and specifically in Oklahoma (Sasse, 1997). Several programs have been implemented to train preservice teachers to teach environmental education and to teach outdoors. However, as Disinger (1984), Disinger and Howe (1990), and Gabriel (1996) noted, preservice training for environmental education, if it exists at all, is often lacking in cognitive and affective outcomes. In addition, training on outdoor education techniques are not discussed effectively (Peyton et al., 1980).

Based on the apparent ineffectiveness of preservice teacher training for environmental education, the question arises of what preservice teachers should be taught and how they should be trained. The North American Association for Environmental Education (NAAEE), a leading organization committed to the success of environmental education in schools, has provided a set of guidelines for preservice teacher

competencies. The NAAEE (1999) posted a draft under revision of knowledge areas and skills for preservice teachers. Among them are knowledge of environmental processes and systems, skills for understanding and addressing environmental issues, and questioning and analyzing techniques (NAAEE, 1999). Suggestions as to pedagogy competencies are also recommended, such as knowledge of a range of instructional techniques, resources, curriculum planning, and settings for instruction (NAAEE, 1999). Although these guidelines have not been officially adopted by the NAAEE, they offer a useful base for evaluating preservice teacher competencies and shaping preservice teacher training.

Attitude, Self-Efficacy, and Outcome Expectancy

Research on the effectiveness of preservice teacher training for attitude improvement concerning environmental education has produced mixed results. Some environmental education training programs have produced positive changes in preservice teacher attitudes (Brown, 1996; Chang, 1998; Plevyak, 1997; Stoner, 1976). However, Housel (1982) found that with the use of an outdoor education training program, preservice teachers had a positive attitude but their attitudes were not significantly different from the control. The apparent contradictions between the results of Brown (1996), Chang (1998), Plevyak (1997), and Stoner (1976) when compared to Housel's (1982) results have prompted more specific and thorough considerations of preservice teacher attitudes.

Specific areas of interest for attitudes are self-efficacy and outcome expectancy. Self-efficacy is defined by Bandura (1977) as a person's perception of his/her ability to perform a behavior, in this case, the teacher's ability to teach effectively (Enoch & Riggs,

1990). It is task or context specific (Tschannen-Moran et al., 1998) in that feelings of efficacy about a single task, such as teaching environmental education, may not affect feelings of efficacy concerning another skill or teaching responsibility, such as math. The opposite is also true in that feelings of high self-efficacy about another teaching area will not necessarily carry over to environmental education, making environmental education self-efficacy a specific concern even if preservice teachers appear to have high self-efficacy in other areas. The importance of self-efficacy for a single task is evidenced by Bandura's (1997) assertion that feelings of low self-efficacy can lead to less effort, less flexibility in the face of failure, and more stress or depression as a result of demands. He also suggests that efficacy can be influenced the most during the early stages of a teacher's career (Bandura, 1977), leading researchers to address preservice teacher efficacy (Tschannen-Moran et al., 1998). Self-efficacy can be improved through experience, based on research findings on science teacher perceived efficacy (Chun & Oliver, 2000; Finson, 2000; Wingfield & Ramsey, 1999). In addition, teacher efficacy has been linked to student feelings of efficacy but not their achievement (Anderson et al., 1988).

The other attitude construct, outcome expectancy, is defined by Bandura (1977) as a person's expectation that a specific behavior will result in desired outcomes, with the preservice teacher's instruction in environmental education resulting in elementary student learning (Sia, 1992) in the context of this study. Outcome expectancy is influenced by an individual's self-efficacy because outcome expectancy is a manifestation of ability or efficacy. Bandura's (1997) more recent work indicates that he believes outcome expectancy does not add much predictive data that perceived self-efficacy has

not already provided, making outcome expectancy unnecessary to measure. However, Tschannen-Moran et al. (1998) suggest that when outcome expectancy is addressed in light of task requirements, it is a powerful predictor.

Specific research relating self-efficacy and outcome expectancy to environmental education is extremely limited. Sia (1992) found that preservice teachers tend to lack self-efficacy about teaching environmental education but tend to have high outcome expectancy. He suggests that this is not a contradiction because, although the preservice teachers do not feel they teach environmental topics effectively (low self-efficacy), they believe that if they could teach effectively the students would learn (high outcome expectancy). Research on environmental education in terms of self-efficacy and outcome expectancy is minimal when considered under those terms. However, research has supported Sia's findings, if not with the specific intent of investigating self-efficacy and outcome expectancy. Simmons (1993) found teachers to have low expectations of their ability to teach outdoor education (low self-efficacy); although, they did have positive attitudes toward environmental education. Similar studies have been done to address basic attitude measures (Ainsworth, 1997; Brown, 1996; Hilger & Sivek, 1993) and locus of control (Chang, 1998). The growing popularity of self-efficacy and outcome expectancy studies in science education (see Chun & Oliver, 2000; Finson, 2000; Wingfield et al., 1999), where most environmental education is based, would indicate that self-efficacy and outcome expectancy are valid constructs to address in environmental education.

Training Workshops

One specific training technique utilized by the university in this study and others is a day-long workshop, highlighting an environmental education curriculum such as *Project WILD*, *Project WET*, or *Project Learning Tree* (see Jones, 1999; Johnson, 1999). Research has found that these types of day-long trainings are effective at improving preservice teacher knowledge and/or attitude. Crosby (1991) found that participating in a *Project WILD* workshop significantly improved preservice elementary teachers' attitudes toward teaching science and environmental education. Kunz (1990) found similar results from a *Project Learning Tree* workshop. The use of this type of training would seem to be substantiated by the research and the fact that Sasse (1997) found *Project WILD* and *Project WET* to be the most common educational supplements used among Oklahoma teachers. The few number of studies focused on *Project WET, Project WILD*, and *Project Learning Tree* in comparison to the apparent popularity of the guides would suggest more study is needed.

Knowledge

Another consideration for preservice teacher training is the knowledge teachers have of ecology and the environment. Knowledge of the environment, according to the Tbilisi Conference, is one of the three foundations of environment education (UNESCO, 1980). "(The) ultimate aim of environmental education is to enable people to understand the complexities of the environment and the need for nations to adapt their activities and pursue their development in ways which are harmonious with the environment" (UNESCO, 1977, p.12). Orr summarized the sentiment by saying, "(The future generation) must be smarter, better informed, more creative, and wiser than earlier

generations" (1996, p.7). He went on to explain that students' knowledge must include systems, patterns, practical applications, and the difference between "ecological sense and nonsense" (p. 7). This idea of improving understanding of natural processes pervades virtually every definition of environmental education, and improving knowledge is suggested to be the first step toward positive attitudes and behavior. In fact Hines, Hungerford, and Tomera (1986) found through a meta-analysis of environmental education research from 1971-1985 that knowledge is a prerequisite to positive behavior and action. These knowledge concepts are applicable to teachers, as well as students, because the accurate knowledge of teachers provides the means for the students to learn.

According to Hungerford and Volk (1990, p.9), the progression from environmental knowledge to appropriate action was viewed as a straight transition.

Knowledge → Awareness or attitudes → Action

Recent research has indicated that this model may be too simple and that the relationship between knowledge and action still remains unclear (Iozzi, 1989). Hungerford and Volk (1990) have suggested that more factors may be involved in an individual's attitude and behavior than just factual knowledge of the environment, but their new model still lists providing ecological information as the first level or step. This would support the improvement of preservice teacher knowledge as more knowledge may encourage positive attitude formation about not only the environment but also environmental education, making them more effective teachers.

Preservice teachers are expected to display certain competencies as to curriculum and setting (Boyer, 1984). Specific knowledge is suggested in the areas of environmental systems, processes, and issues (Ballard & Pandya, 1990; NAAEE, 1999; Peyton, 1980).

However, research on knowledge levels of preservice teachers has suggested conflicting results. Ferry (1995) found an outdoor environmental education program improved preservice teacher knowledge, while Simmons (1993) found that teachers did not have requisite knowledge of the environment. Little evidence exists to suggest whether preservice teachers are knowledgeable enough to teach environmental education, which could be the result of few teacher training programs addressing environmental education, as discussed previously.

CHAPTER III

METHODOLOGY

Introduction

This section describes the manner in which the study was conducted. The Adventures Beyond the Classroom Program is described, followed by information on the assumptions, limitations, and hypotheses. The subjects and population they represent are discussed. The design and testing instruments employed are described as to their use and appropriateness. Finally, the procedures for study execution are included.

The Adventures Beyond the Classroom Program

The Adventures Beyond the Classroom Program (ABC) is a collaborative program between a public middle school and a university's elementary education program with an objective of allowing preservice elementary teachers to design, plan, and teach environmental education lessons in an outdoor setting. The program was comprised of three parts: the *Project WET/Project WILD* training, the planning period, and the three day ABC Program. The training took place over six hours at the camp where ABC was located, which is owned and operated by the study university. The preservice teachers were trained in the curriculum, methods, and various discipline content areas of the *Project WET* (1995) and *Project WILD* (1992) *Activity Guide Books*, which served as the program basis for ABC. Program planning by the preservice teachers took place during the month preceding ABC and resulted in two to three activities per preservice teacher

team for an individual activity station. Most teams relied heavily on the activity instructions from the *Guide Books* and training session, but some groups chose to modify the activities to fit specific learning goals and the location of the activity. The ABC Program took place over three days at an outdoor education and camping facility. Each team of preservice teachers taught one set of activities four times on one day to approximately one hundred thirty sixth graders. The setting and approach to learning utilized at ABC allowed for a semi-structured exploratory atmosphere in which student discoveries could and did lead activities through unexpected turns.

TABLE I

ADVENTURES BEYOND THE CLASSROOM SEQUENCE

Date	Activity
August 28	*Project WILD, Project WET* Training
August 29-September 27	Activity planning by preservice teachers
September 28-30	Adventures Beyond the Classroom

Assumptions

The following assumptions were accepted:

1. The preservice teachers understood the directions and questions on the testing instruments and answered to the best of their ability.
2. The two groups of preservice teachers formed for the study were not significantly different in knowledge or attitude.
3. The preservice teachers had limited or no experience with outdoor and environmental education prior to the ABC activity sequence.

Limitations

The study was limited by the following:

1. Only one outdoor environmental education program (Adventures Beyond the Classroom) with a specific set of components was studied. This limits generalizability to programs that do not resemble ABC.
2. The study was conducted with preservice elementary teachers at a state-run university. This limits generalizability to other preservice teachers and to other types of elementary education programs at other universities.

Hypotheses

Knowledge

1. H_o: The *Project WILD/Project WET* training did not affect the preservice teachers' knowledge of the environment.

   H_1: The *Project WILD/Project WET* training did affect the preservice teachers' knowledge of the environment.

2. H_o: The Adventures Beyond the Classroom Program did not affect the preservice teachers' knowledge of the environment.

   H_1: The Adventures Beyond the Classroom program did affect the preservice teachers' knowledge of the environment.

Self-efficacy

3. H_o: The *Project WILD/Project WET* training did not affect the preservice teachers' self-efficacy regarding environmental education.

   H_1: The *Project WILD/Project WET* training did affect the preservice teachers' self-efficacy regarding environmental education.

4. H_o: The Adventures Beyond the Classroom Program did not affect the preservice teachers' self-efficacy regarding environmental education.

   H_1: The Adventures Beyond the Classroom Program did affect the preservice teachers' self-efficacy regarding environmental education.

5. H_o: The passage of seven weeks time following ABC did not affect the lasting nature of the preservice teachers' self-efficacy.

   H_1: The passage of seven weeks time following ABC did affect the lasting nature of the preservice teachers' self-efficacy.

Outcome expectancy

6. H_o: The *Project WILD/Project WET* training did not affect the preservice teachers' outcome expectancy regarding environmental education.

   H_1: The *Project WILD/Project WET* training did affect the preservice teachers' outcome expectancy regarding environmental education.

7. H_o: The Adventures Beyond the Classroom Program did not affect the preservice teachers' outcome expectancy regarding environmental education.

   H_1: The Adventures Beyond the Classroom Program did affect the preservice teachers' outcome expectancy regarding environmental education.

8. H_o: The passage of seven weeks time following ABC did not affect the preservice teachers' outcome expectancy regarding environmental education.

   H_1: The passage of seven weeks time following ABC did affect the preservice teachers' outcome expectancy regarding environmental education.

Study Participants

The participants for this study came from the population of ninety-three preservice elementary teachers who taught at ABC. These teachers were enrolled in one or more of five teaching methods courses at the study university. From this total population, the science methods course was chosen for the study. This course included seventy-two preservice elementary teachers varying in demographics, personal experience, and stage of education. These preservice teachers were deemed representative of the population because many of them were concurrently enrolled in other methods courses that participated in ABC.

Two preservice teacher groups were formed by random assignment of the science methods lab sections to Group 1 or Group 2. Because of absenteeism during testing times, group sizes vary for Group 1 from twenty-six to twenty-three and for Group 2 from forty-six to thirty-seven. The preservice teachers chose which lab section to take and the resulting fairly random distribution of teachers should have ensured as close to equal as possible distribution of demographic characteristics in lieu of no random placement of participants into groups.

Research Design

The research design for this study was based on a pretest-two posttest-control group design (Gay, 1996), with modifications similar to Kunz's (1990) study. The modifications to the design dealt with participant assignment to groups, which was not random, and with the testing procedure. Because all of the science methods preservice teachers were required to participate in Adventures Beyond the Classroom and no comparable population was available, half of these preservice teachers acted as a control

for the study. This was accomplished through the timing of testing of the two groups, with Group 1 being tested before the training, before ABC, and before any length of time had elapsed subsequent to ABC and Group 2 being tested after each of these activities. This testing procedure is described in more detail in the Procedure section to follow.

Testing Instruments

The testing instruments for the preservice teachers included a pretest and two posttests. The pretest and first posttest contained environmental knowledge and attitude questions, and the second posttest contained only attitude questions.

Pretest

The pretest (see Appendix A) consisted of forty-seven questions. Questions 1-3 were demographic questions that requested age, gender, and area of specialization. Questions 4-24 were environmental knowledge questions based on two existing tests, Holly's (1982) *Ecology Unit Test* and Leeming, Dwyer, and Bracken's (1997) *Children's Environmental Attitude and Knowledge Scale*. Questions 25-47 came from Sia's (1992) *Environmental Education Efficacy Belief Instrument.*

In the environmental knowledge section, questions 4-16, 18-19, and 21-24 were taken from Holly's (1982) instrument, and questions 17 and 20 came from Leeming et al.'s (1997) instrument. All of the questions dealing with ecological and environmental knowledge (Questions 4-24) were modified from the original sources to clarify wording, to apply directly to Oklahoma ecosystems, and to limit the number of answer choices to four. Although Leeming et al.'s (1997) and Holly's (1992) instruments were created for elementary and middle school students, they were deemed appropriate for two reasons. First, the content of the resulting composite instrument used in the study correlated to the

objectives and content of the educational activities, which the preservice teachers would be expected to know at or above the level of the sixth graders they taught. Second, the questions were considered rigorous enough to determine knowledge levels of the preservice teachers.

The validity and reliability of the composite knowledge test were evaluated during the study. Validity was determined through a panel analysis by university faculty in education and natural resources. They judged the content, language, and length of the questions and test to be acceptable for the preservice teacher population. The instrument's reliability was ascertained by conducting an unequal-length Spearman-Brown analysis on Group 1's pretest scores, resulting in a 0.5469 reliability coefficient. Because reliability is measured on a scale from zero to one, the 0.5469 coefficient indicated that the instrument had moderate internal consistency. Therefore, the resulting data will be considered in light of the reliability of this portion of the instrument.

The preservice teacher attitudes were judged with Sia's (1992) *Environmental Education Efficacy Belief Instrument* (EEEBI), questions 25-47 on the pretest. The EEEBI was created to judge preservice teacher attitude toward self-efficacy and outcome expectancy, that is their belief of their ability to teach and the positive outcomes that will come from teaching. The EEEBI is a five option Likert-type scale, response choices ranging from strongly agree to strongly disagree, with thirteen positively worded and ten negatively worded statements. Questions 26-27, 29-30, 32, 36, and 41-47 judge self-efficacy and questions 25, 28, 31, 33-35, and 37-40 judge outcome expectancy. Both Sia and a panel of judges attributed the instrument with high validity. In addition, the reliability was determined by the researcher of this study to be 0.8906 based on an

unequal-length Spearman-Brown analysis.

Posttest 1

Posttest 1, the first preservice teacher posttest, was identical to the pretest with the demographic questions removed, resulting in forty-four questions addressing knowledge, self-efficacy, and outcome expectancy. The order and form of the questions did not change.

Posttest 2

Posttest 2, the preservice teacher second posttest, consisted only of Sia's (1992) EEEBI. The twenty-three questions were identical in form and order as in the pretest and first posttest.

Procedure

The main components of the study were obtaining Institutional Review Board approval, gaining participant consent, administering the pretest, and administering the posttests. The Institutional Review Board (IRB), the university governing organization for research with human subjects, approved the study in July, 1999. The IRB approval is provided in Appendix C. Consent from study participants, the preservice teachers, was then obtained before any testing began. The preservice teachers were provided with consent forms at the time of the pretest (Appendix B).

The preservice teachers received their pretest, first posttest, and second posttest during their science methods lab time. For the pretest, the study researcher came at the beginning of the lab and explained to the preservice teachers the content of the instrument, the length of time for the study, and the confidentiality and consent procedures. Each preservice teacher was then given a consent form and the pretest and

asked to complete them. After the teachers completed the test, which took approximately fifteen minutes, their tests were collected. The procedure for the first posttest and second posttest consisted of the science methods lab instructors administering the tests, collecting them from the preservice teachers, and then returning them to the researcher.

The timing of the testing was important to create a controlling feature for making comparisons. Group 1 was pretested one week before the training workshop and posttested with Posttest 1 one week before ABC. They were administered Posttest 2 two weeks after ABC. The pretest data provided baseline knowledge and attitude levels before the training. The first posttest was used to show the teachers' knowledge and attitudes before ABC. Finally, the second posttest was used to show the teachers' attitudes before any substantial amount of time had elapsed subsequent to ABC.

Group 2 was pretested three weeks after the training. Posttest 1 was given two weeks after ABC, and the second posttest, Posttest 2, was given five weeks later. The pretest was utilized to show what effect the training had on knowledge, self-efficacy, and outcome expectancy, as compared to Group 1's pretest. The first posttest was used to show the effect of ABC. Finally, the second posttest was to show if time affected attitude levels. Although this testing procedure may seem complicated, it was deemed the most effective means of creating a type of control for the training, ABC, and time. The following table illustrates the timing of the tests and activities.

TABLE II

PRESERVICE TEACHER TESTING
AND ACTIVITY SEQUENCE

Group 1	Activity	Group 2
Pretest		
	Training	
Posttest 1		Pretest
	ABC Program	
Posttest 2		Posttest 1
	5 weeks time	
		Posttest 2

CHAPTER IV

RESULTS AND DISCUSSION

Introduction

The data from this study consisted of three separate data sets for the preservice teachers that relate to knowledge, self-efficacy, and outcome expectancy. Each set was analyzed as to the effect of the ABC components on the measurement construct. The knowledge data were scored on a scale from 0 to 21 for the number of correct answers. In contrast, the data for the self-efficacy and outcome expectancy measures were Likert scale data with responses ranging from one for strongly disagreeing with a statement to five for strongly agreeing. The self-efficacy and outcome expectancy data were standardized for scoring by renumbering the responses to negatively worded questions to reflect a positive statement, and then a composite score was attained for each participant for self-efficacy and outcome expectancy. The resulting possible range of scores for the self-efficacy scale was 13-65, with 13 to 38 being ranging levels of disagreement or negative self-efficacy, 39 being an average of undecided or indifferent on every question, and 40-65 being ranging levels of agreement or positive self-efficacy. For the outcome expectancy, the range was 10-50, with 10 to 29 being ranging levels of disagreement or negative outcome expectancy, 30 being an average of undecided or indifferent on every question, and 31 to 50 being ranging levels of agreement or positive outcome expectancy.

After all data had been entered and standardized, parametric t-tests were conducted on the groups' composite scores to determine what differences resulted from

the ABC sequence with α=0.05 the necessary level of significance. P-values (observed significance levels) are reported for each comparison, as well as a ninety-five percent confidence intervals for the differences between group means found in each comparison. Table III shows the comparisons made and the constructs they evaluated.

TABLE III

COMPARISONS FOR DATA ANALYSIS

Tests compared	**Activity**	**Construct**
Group 1 pretest Group 2 pretest	Training	Knowledge Self-efficacy Outcome expectancy
Group 1 posttest 1 Group 2 posttest 1	ABC Program	Knowledge Self-efficacy Outcome expectancy
Group 1 posttest 2 Group 2 posttest 2	Time	Self-efficacy Outcome expectancy

Demographics

The demographic data obtained from the preservice teachers on the pretest provided the means to characterize the participants. Group 1 had a mean age of 24.81 with a range of 21 to 41, and Group 2 had a mean age of 23.06 with a range of 21 to 40. The distribution of males and females was similar between the groups with Group 1 having eighty-eight percent females and twelve percent males and Group 2 having ninety-three percent females and seven percent males. The information regarding teachers' endorsements and/or area of specialization is outlined in Table IV. The endorsement response rate for Group 1 was fifty-nine percent and for Group 2, fifty percent, so this data should not be viewed as comprehensive of the study participants or the population. This data provided some insight into the distribution of academic interests of the

preservice teachers and added support to the previous statement that the science methods course provided study participants from various disciplines representative of the population. An important factor in evaluating this data was that elementary educators are considered generalists, that is they are expected to be proficient in all areas of elementary study; therefore, the study participants were expected to have multiple interests and to be proficient at multiple disciplines, regardless of their enrollment in a science methodology course.

TABLE IV

DISTRIBUTION OF PRESERVICE TEACHER ENDORSEMENTS/AREAS OF SPECIALIZATION

Subject	**Group 1**	**Group 2**
Math	12%	22%
English	4%	11%
Social Studies	19%	4%
Science	12%	7%
Special Populations	4%	4%
Spanish	8%	2%
Not responsive	41%	50%
Total	100%	100%

Knowledge

The preservice teachers' knowledge of environmental concepts and ecology was judged through a series of parametric t-tests to ascertain the effect of the training and ABC.

Training

The effect of the training was examined by comparing Group 1's pretest mean score of 16.5769 to Group 2's pretest mean score of 16.0000 and was found not to be statistically significant with a p-value of 0.329. Therefore, this data did not support the

rejection of null hypothesis one. Summary and comparison data are provided in Table V.

TABLE V

ANALYSIS OF TRAINING EFFECT ON KNOWLEDGE

	n	Mean	Standard deviation	P-value	95% Confidence interval for the difference	
					Lower	Upper
Group 1	26	16.5769	2.3862			
Group 2	46	16.0000	2.3944	0.329	-0.5934	1.7472

ABC Program

The results for the preservice teachers' knowledge as affected by ABC were similar to those in relation to the training. The ABC Program was found to have no significant effect (p-value=0.800) on teacher knowledge when Group 1's first posttest mean score of 16.3846 was compared to Group 2's first posttest mean score of 16.2273. Again, the related null hypothesis, hypothesis two, was not rejected. The data are outlined in Table VI.

TABLE VI

ANALYSIS OF ABC PROGRAM EFFECT ON KNOWLEDGE

	n	Mean	Standard deviation	P-value	95% Confidence interval for the difference	
					Lower	Upper
Group 1	26	16.3846	2.4992			
Group 2	44	16.2273	2.5045	0.800	-1.0780	1.3926

The data analysis of teacher knowledge suggested that, although the teachers started with knowledge of approximately eighty percent of the information on the instrument (averaging 16.3846 on the twenty-one item scale), neither the training nor the

program affected their knowledge. This did not support Ferry's (1995) findings on preservice teacher knowledge improvement from an outdoor environmental education program.

The tests offered insight into the preservice teachers' knowledge from a different aspect. Overall the teachers did well on the tests having averaged an eighty percent, but several questions were missed consistently. The teachers displayed repeated difficulty with questions concerning succession, habitat change, and animal relationships such as symbiosis and neutralism. Another pattern of teachers' responses was the inability to apply concepts. Few teachers had problems with simple questions such as question 18 on the pretest, which concerned predation, but the teachers showed less consistency in answering question 13 on the pretest, which dealt with predation in a more applied context. Because there are few guidelines for teacher knowledge competencies about the environment, each training and teaching program must choose concept areas to highlight. However, basic concepts such as succession and competition, as well as the application of these concepts with which the preservice teachers in this study showed difficulty, were recommended by the North American Association for Environmental Education (1999) in their draft on teacher training. The ABC Program should be acknowledged for addressing knowledge areas of preservice teachers because Disinger (1984), Disinger and Howe (1990), and Gabriel (1996) suggest that preservice teacher training often does not consider the cognitive domain, but opportunities for improvement do exist within the ABC Program by addressing more core concepts and their application.

In both cases of knowledge comparisons, there was the potential that the results did not accurately portray the true learning of the preservice teachers. The composite

instrument addressed specific concepts and applications appropriate for environmental education but was not specifically written to mirror the training or the ABC Program. Therefore, portions of the test may have dealt with subject matter not in the training or teaching material of the preservice teachers, in which case the results would not show their true learning. In addition, some elements of the training curriculum may not have been addressed by the instrument. Finally, the reliability of the instrument suggested that there may have been problems repeatedly applying the instrument to preservice teachers. These results should be a fairly accurate measure of the preservice teachers' knowledge of the test material, but the results must be considered in light of how well the instrument aligned with the ABC Program subject material.

Self-efficacy

The preservice teachers' self-efficacy was analyzed through a series of parametric t-tests similar to those used for the knowledge section.

Training

Hypothesis three, the effect of the training on self-efficacy, was examined by comparing Group 1's pretest mean score of 45.2692 to Group 2's pretest mean score of 42.4474. The comparison showed no significant difference between the mean group scores, with a p-value of 0.162. Table VII provides the statistical data for the training comparison.

TABLE VII

ANALYSIS OF TRAINING EFFECT ON SELF-EFFICACY

	n	Mean	Standard deviation	P-value	95% Confidence interval for the difference	
					Lower	Upper
Group 1	26	45.2692	6.1485			
Group 2	38	42.4474	8.8032	0.162	-1.1677	6.8114

The lack of a significant difference in self-efficacy from the training suggested that the experience the preservice teachers gained from the training was not substantial enough to improve or worsen their feelings of self-efficacy. This contradicted the findings of Crosby (1992) and Kunz (1990) whose subjects reported higher attitudes after a similar training. A factor that may have contributed to this lack of change was that, unlike Sia's (1992) preservice teachers, the preservice teachers in this study did not begin the study with negative self-efficacy. The significant difference of Group 1's mean pretest score of 45.2692 (p-value<0.01) from 39 indicated that their self-efficacy was at least moderately positive as the 45.2692 value falls within the 40 to 65 range of positive self-efficacy scores. The teachers did not begin the study with low self-efficacy; however, no significant improvement in their self-efficacy was made with the training.

The structure of the training facilitated timely, concise learning of specific assigned activities. Although the preservice teachers had opportunities for exploration within the curriculum, their main goal at the training was to become familiar with the specific activities they would teach, with each activity having a specific set of objectives, content, and pedagogy outlined for the preservice teachers. Because they were provided with the majority of the components needed to teach, they did not necessarily question

their ability to teach, which means they may not have evaluated their self-efficacy. The training allowed them to avoid the issues, such as curriculum and pedagogy development, that could have negatively affected their self-efficacy. If the preservice teachers had been responsible for taking a content area and developing a teaching strategy or even choosing their own activities from the *Project WET* (1995) and *Project WILD* (1992) *Activity Guide Books*, they may have seen more complexities to teaching environmental education that would have affected their self-efficacy. Through the structure of the training, necessitated by time constraints, and through the structure of the *Activity Guide Books*, the preservice teachers appeared not to have changed their view of their self-efficacy in light of the training.

ABC Program

The effect of the ABC program on self-efficacy, as judged by comparing Group 1's posttest 1 mean score of 45.5600 to Group 2's posttest 1 mean score of 44.1579, was also not statistically significant, with a p-value of 0.523. The results of this comparison did not allow for the rejection of null hypothesis four. Table VIII provides the summary and comparison data.

TABLE VIII

ANALYSIS OF ABC PROGRAM EFFECT ON SELF-EFFICACY

	n	Mean	Standard deviation	P-value	95% Confidence interval for the difference	
					Lower	Upper
Group 1	25	45.5600	7.8638			
Group 2	38	44.1579	8.8395	0.523	-2.9589	5.7632

The lack of significance of the teaching component together with the training analysis suggested that, although an environmental education program such as this may have had beneficial characteristics, the individual elements or the combination of these elements did not significantly affect self-efficacy as judged by this instrument. One reason for this may have been the limitations of the program in that the teachers were trained for a single day and then taught for a single day, providing little opportunity for extensive exploration of their self-efficacy. Another explanation was that the preservice teachers taught a collection of activities given to them at the training that included the objectives, key concepts, and methodologies. They may not have evaluated their self-efficacy because they felt prepared. They may also have viewed their ability highly, as suggested by the mean group scores, because of the perceived simplicity of teaching environmental education with the materials they were given. It was interesting to note that this second possibility supported the usefulness of the training as having successfully prepared the teachers.

The time frame of the program potentially had an added impact on the teachers' self-efficacy. Teaching for a single day may not have encouraged or facilitated considerable self-evaluation in regards to environmental education. A longer or more comprehensive program might have allowed for more introspection and belief evaluation by the teachers that the time frame of this program did not promote. In addition, reinforcement through more teaching opportunities or feedback might have facilitated the teachers' consideration of their teaching abilities, which could have impacted their self-efficacy. Although no similar studies on self-efficacy have been conducted in environmental education, these results further exacerbated the existing contradictions of

the role of preservice teacher training for attitudes as this study supported the findings of Housel (1982), but refuted those of Brown (1996), Chang (1998), Plevyak (1997), and Stoner (1976).

Time

Finally, self-efficacy in relation to time, hypothesis five, showed a significant negative relationship, with a p-value equal to 0.016. Table IX displays the statistical data. The approximately five week time span between Group 1's second posttest two weeks following the ABC program and Group 2's second posttest seven weeks after ABC revealed a significant drop in self-efficacy from 48.6087 to 42.9189.

TABLE IX

ANALYSIS OF TIME'S EFFECT ON SELF-EFFICACY

	n	Mean	Standard deviation	P-value	95% Confidence interval for the difference	
					Lower	Upper
Group 1	23	48.6087	7.6855	0.016	1.0909	10.2887
Group 2	37	42.9189	9.1935			

Potential explanations for this drop in self-efficacy included both program and teacher characteristics. After the completion of ABC, the preservice teachers did not participate in environmental education activities through their methods course; there was no reinforcement of their related self-efficacy. This lack of reinforcement could have resulted in the teachers forgetting the environmental education curricula and/or methodology, lowering their self-efficacy. Another potential explanation was that with the distance of time from the activity, the teachers re-evaluated and questioned their abilities, lowering their self-efficacy. As the teachers learned more about teaching

methods, content areas, and activity creation, they may have realized that not all environmental education programs will be as conveniently packaged and prepared as the ABC experience, which could have caused them to question their abilities. In addition, this was their first and potentially only formal experience with environmental education. This, added to the lack of reinforcement, may have caused them to view environmental education as less important than more traditional science topics and consequently influenced their whole view of environmental education more negatively. Finally, the preservice teachers' continued exposure to more traditional science methods through their science methods course may have caused the teachers to view science as harder to teach, causing lowered self-efficacy not only for science but also for environmental education, a type of science. This drop in self-efficacy should be carefully considered, perhaps not as a negative impact on the effectiveness of the ABC program but as a potential opportunity for program improvement in addressing reinforcement and teacher views, as well as further defining the factors causing the drop in self-efficacy.

Outcome expectancy

The final construct, outcome expectancy, was measured and analyzed in relation to the training, the ABC Program, and time. Parametric t-tests examined the similarity between the two groups, testing the effect of the activities on outcome expectancy.

Training

Hypothesis six dealt with the training's effect on outcome expectancy and was evaluated by comparing Group 1's pretest mean score of 32.3462 to Group 2's pretest mean score of 32.9474. No significant difference was found between the two groups (p-value=0.485) indicating that the training created no measurable change in outcome

expectancy. Data are provided in Table X.

TABLE X

ANALYSIS OF THE TRAINING EFFECT ON OUTCOME EXPECTANCY

	n	Mean	Standard deviation	P-value	95% Confidence interval for the difference	
					Lower	Upper
Group 1	26	32.3462	2.5289	0.485	-2.3142	1.1118
Group 2	38	32.9474	4.3055			

The training facilitated teacher exposure to and preparation in teaching environmental education, and the bulk of the time was devoted to the curriculum and methodology. No formalized system addressed what outcomes the teachers could expect or how to predict student benefits from the activities. Therefore, the responsibility fell to the preservice teachers to consider what outcomes they desired and could anticipate. In addition, the preservice teachers could have easily focus on the concrete, obvious implications of the training, in the way of activity planning,. resource needs, and location, among others. Issues as abstract as outcome expectations could have been overlooked by the preservice teachers and resulted in the lack of change in their outcome expectancy.

It was also interesting to note that the preservice teachers began the study with positive outcome expectancy, similar to Sia's (1992) preservice teachers. Group 1's mean composite pretest score of 32.3462 was significantly higher (p-value<0.01) than an indifferent score of 30. This indicated the preservice teachers had at least marginally positive outcome expectancy as the 32.3462 fell in the positive range for outcome expectancy of 31 to 50. As the training did not specifically address outcome expectancy and the preservice teachers began with marginally positive outcome expectancy, the lack

of significant change due to the training seemed appropriate.

ABC Program

To ascertain what influence teaching at the ABC Program had on the preservice teachers' attitude about outcome expectancy, Group 1's posttest 1 mean score of 33.6000 was compared to Group 2's posttest 1 mean score of 32.5000. This resulted in a non-statistically significant difference (p-value=0.257) and the failure to reject null hypothesis seven. Table XI shows the statistical results.

TABLE XI

ANALYSIS OF ABC PROGRAM EFFECT ON OUTCOME EXPECTANCY

	n	Mean	Standard deviation	P-value	95% Confidence interval for the difference	
					Lower	Upper
Group 1	25	33.6000	3.4641			
Group 2	38	32.5000	3.9025	0.257	-1.1677	6.8114

Outcome expectancy, as described in this study, related to the preservice teachers' estimation of their influence on student learning. Both external indicators and internal considerations could have influenced their outcome expectancy for environmental education. External indicators would have been the students' reactions to the teachers and methods of teaching. These reactions could be judged through student performance on an examination or assignment; however, the structure of the program did not allow for feedback of this type for the preservice teachers. As a result, the preservice teachers had to rely on other means of determining the effectiveness of their teaching, potentially through their evaluation of the level of student enthusiasm, participation, and feedback during the activities. As the preservice teachers were relatively inexperienced at teaching

in general, and especially at teaching environmental education, their attention may have been more focused on the steps of each activity, discipline concerns, and time constraints than on how effective their teaching was. In addition, each team of preservice teachers only spent approximately one hour with each group of students, so their interaction time was limited. The lack of feedback from the elementary students and/or the preservice teachers' inexperience with evaluating student learning may have limited their ability to accurately determine their outcome expectancy. This potentially explained why their outcome expectancy did not change as a result of teaching at the ABC Program, a conclusion supported by Bandura's (1997) assertion that a person's perception of his/her performance is the most powerful source of efficacy knowledge, which is closely related to outcome expectancy.

Critique of the preservice teachers' abilities by an outside party could have also influenced the preservice teachers' outcome expectancy. However, the preservice teachers did not receive formalized evaluations of their teaching, as the preservice teachers' mentors and program coordinators did not have the opportunity to witness all of the preservice teachers' activities and provide insight, praise, and/or criticism to everyone. Bandura (1997) suggested that this feedback, he called social persuasion, was a strong influence on self-efficacy. Although he did not specifically relate social persuasion to outcome expectancy, only to self-efficacy, he saw self-efficacy and outcome expectancy as closely correlated, which would seem to support the conclusion that lack of feedback could negatively impact outcome expectancy. When the lack of feedback was added to the apparent lack of self-evaluation by the preservice teachers, the similarity of the teachers' outcome expectancy before and after the teaching component

was not that unanticipated.

Time

The final measurement of teacher outcome expectancy and their environmental education experience related to hypothesis eight and time's effect. Again, the comparison of Group 1's posttest 2 mean score of 34.0870 to Group 2's posttest 2 mean score of 33.8108 did not find a statistically significant difference (p-value=0.778). Table XII outlines the summary and comparison data.

TABLE XII

ANALYSIS OF TIME'S EFFECT ON OUTCOME EXPECTANCY

	n	Mean	Standard deviation	P-value	95% Confidence interval for the difference	
					Lower	Upper
Group 1	23	34.0870	2.8590	0.778	-1.6724	2.2247
Group 2	37	33.8108	4.0814			

Although no significant changes in outcome expectancy took place after five weeks, the data did provide information as to the relative permanence of teacher outcome expectancy, as no statistically significant change was found from the beginning to the end of the program. Three major concerns arose from this data. The first concern was that the preservice teachers either did not or could not assess their outcome expectancy, which was supported by all of the group means being so close to each other. Admittedly, the teachers needed to be concerned about aspects of teaching not related to outcome expectancy, but they appeared not to have decided whether there were positive outcomes from their teaching, which seemed a fundamental issue. The second concern was that the training, planning, and teaching activities as part of a university course did not

specifically address outcome expectancy nor did the process create a desire in the preservice teachers to evaluate it themselves. These concerns which relate to the program were important but may not be as fundamental as the final concern.

The third concern was that outcome expectancy may not have been a valid construct to consider. Although Bandura (1977) was in the forefront of discussions on outcome expectancy, he later became less supportive of the usefulness of outcome expectancy measures (Bandura, 1997). With further research and consideration, Bandura (1997) concluded that outcome expectancy is inescapably tied to self-efficacy and that outcome expectancy in and of itself does not add any information not gained from self-efficacy measurements. If Bandura was correct, one would expect teachers with high self-efficacy to have high outcome expectancy, which was not the case in this study. However, Tschannen-Moran et al. (1998) suggested that when outcome expectancy is contextually bound, as it was in this study, it is a useful predictor and can be considered separately from self-efficacy. This seemed to indicate that an individual's level of self-efficacy could be different from his/her outcome expectancy, as found in this study. Because no consensus has been reached as to the appropriateness of measuring outcome expectancy, it was difficult to determine if the lack of change in the teachers' outcome expectancy resulted from program concerns or from measuring a construct with limited predictive utility.

Summary

The results from this study suggested that ABC had varying effects on the preservice teachers' knowledge, self-efficacy, and outcome expectancy. These results are summarized in Table XIII.

TABLE XIII

SUMMARY OF HYPOTHESES AND RESULTS

Hypothesis	**Significance**	**Result**
1. The Project WET/WILD training did not affect the preservice teachers' knowledge of the environment.	Not significant	Fail to reject
2. The ABC Program did not affect the preservice teachers' knowledge of the environment.	Not significant	Fail to reject
3. The Project WET/WILD training did not affect the preservice teachers' self-efficacy regarding environmental education.	Not significant	Fail to reject
4. The ABC Program did not affect the preservice teachers' self-efficacy regarding environmental education.	Not significant	Fail to reject
5. The passage of seven weeks time following ABC did not affect the preservice teachers' self-efficacy regarding environmental education.	Significant	Reject
6. The Project WET/WILD training did not affect the preservice teachers' outcome expectancy regarding environmental education.	Not significant	Fail to reject
7. The ABC Program did not affect the preservice teachers' outcome expectancy regarding environmental education.	Not significant	Fail to reject
8. The passage of seven weeks time following ABC did not affect the preservice teachers' outcome expectancy regarding environmental education.	Not significant	Fail to reject

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the results of this study, three major conclusions were reached regarding knowledge, self-efficacy, and outcome expectancy as they relate to preservice teacher training for environmental education. First, although the preservice teachers began the program with a basic knowledge of environmental concepts, the training and Adventures Beyond the Classroom teaching program were unable to influence that knowledge or help them apply the concepts they partially understood. Second, the preservice teachers began the program with moderately high self-efficacy that was not significantly affected by the training or ABC program but decreased with time. The most likely explanation for this was the preservice teachers' decrease in confidence of their abilities to teach environmental education and/or science education. Third, the preservice teachers' outcome expectancy did not change significantly as a result of the training, ABC program, or time. Considering these constructs together, the Adventures Beyond the Classroom experience would not seem significantly beneficial for making the preservice teachers better prepared environmental educators as measured by their knowledge, self-efficacy, and outcome expectancy.

This study attempted to evaluate a specific outdoor environmental education program's effectiveness at influencing preservice elementary teachers' knowledge, self-efficacy, and outcome expectancy. These three constructs (knowledge, self-efficacy,

outcome expectancy) were believed to be useful predictors of teachers' ability to teach environmental education and to be predict the likelihood of teachers' positive experiences teaching environmental education. The results of this study suggested that while this program did not significantly affect knowledge or outcome expectancy, the program could be modified to address these constructs in more depth and become an influential experience for preservice teachers. Additional freedom for the preservice teachers in selecting activities and tailoring them to the teaching teams' objectives, as well as more reinforcement of the methodology, knowledge areas, and attitudes could create major changes in the preservice teachers' ability to teach environmental education. While the program did not appear to greatly influence the preservice teachers' view of environmental education, potential exists within the ABC Program to provide preservice teachers with knowledge and positive attitudes.

While this study supported the belief that knowledge, self-efficacy, and outcome expectancy are important measures of teachers' feelings toward environmental education and their likelihood to continue to teach it, these three constructs were not the specific goal of the ABC Program nor did the coordinators of the program have a goal of creating environmental educators. Their main goal was to provide preservice teachers with a learning experience in environmental education curricula, pedagogy, and actual teaching. However, the potential exists that these preservice teachers may have environmental education responsibilities in the future (see Sasse, 1997; Schmidt, 1996) for which their knowledge, self-efficacy, and outcome expectancy will be a concern. The distribution of this study's preservice teachers' specializations and endorsements (see Table IV, p. 27) showed a diverse background, not centered on science, which could indicate that their

preparation for environmental education was limited to the ABC experience. With that fact comes consideration of the goals for environmental education programs such as this and the appropriateness of expecting teachers who have received similar environmental education training to teach environmental education. A major responsibility is placed on teachers when they are expected to teach specialized fields such as environmental education with minimal familiarity and experience in the subject. A new teacher with a background in general science would not be expected to teach physics, but elementary teachers are often expected to approach environmental education with a similar limited background. The inclusion of environmental education in elementary school curricula has proven useful in providing information and awareness to many students. However, the true effectiveness of environmental education may depend on teachers' knowledge and attitude toward the process of environmental education, which is a wider concern than just a subject included in elementary school curriculum.

Recommendations

Environmental education research has predominantly centered on the knowledge, attitude, and behavior of elementary and secondary students. While these studies provide valuable information about environmental education, more research is needed to assess how preservice teachers are prepared to be environmental educators. Data are also needed to determine what types of teacher training programs exist and which appear to have the best outcomes, predominantly through measures of knowledge, self-efficacy, and outcome expectancy. Specifically Project WET, WILD, and Learning Tree, as they are common curricula for elementary schools, should be evaluated more extensively as to their effect on self-efficacy, outcome expectancy, and knowledge.

As discussed in the knowledge section of the results, consideration must be given to the level of correlation between the testing instrument and the subject matter of this study. This type of instrument appropriateness is a concern in any study but appears to be of great concern in environmental education studies. Only one study was found that addressed preservice teacher knowledge of environmental concepts; therefore, little guidance was available as to the structure and content of the instrument for this study. Future studies could create an instrument for judging teacher knowledge, as well as for identifying standards for teacher knowledge and assessing the NAAEE's proposed standards. In addition, future research could focus on whether or not assessing the knowledge of preservice teachers should be a concern for environmental education.

Because teacher self-efficacy and outcome expectancy have not been addressed in much detail in environmental education studies, research is needed to determine if they are appropriate constructs for assessing the level of teacher preparation for environmental education. This is of importance based on the contradictions in the theoretical literature and the conflicting and negative results of this study. If self-efficacy and outcome expectancy are concluded to be useful measures for assessing teacher preparation for environmental education, further investigation is needed on how to influence these attitudes in teacher preparation programs.

Environmental education has existed since the 1970's and has progressed to include various knowledge areas, teaching methodologies, and curricula. The data of this study suggest that more investigation is needed into preservice teacher preparation and the theoretical and practical basis for preservice teacher training in environmental education. Programs such as Adventures Beyond the Classroom provide a unique

opportunity to train preservice teachers about environmental education, as well as to evaluate the overall effectiveness of these programs for preparing knowledgeable teachers with positive attitudes, which will be vital to the future of preservice teacher training in environmental education and environmental education in general.

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APPENDIXES

APPENDIX A

PRETEST

Student Identification # _____

DIRECTIONS: Read each question carefully. Choose the BEST answer to each question and circle it.

1. Please indicate your age. _____
2. _____ Male _____ Female
3. What is your area of specialization or emphasis?

4. Which one of these organisms does not belong to a natural pond community?
   A. dog
   B. turtle
   C. snake
   D. mosquito

5. Select the ecosystem where cattails grow best.
   A. grassland
   B. deciduous forest
   C. wetland
   D. coniferous forest

6. The place in an ecosystem that a specific organism and only that organism fills is _____.
   A. niche
   B. habitat
   C. interaction
   D. community

7. Which of these organisms interact in a food chain as a producer?
   A. turtle
   B. grass
   C. raccoon
   D. bacteria

8. At the edge of a wetland, plant and animal life change from the surrounding areas. This change is the result of
   A. the amount of water in the ecosystem
   B. the soil characteristics
   C. the elevation
   D. A and B

9. When walking through a wooded area, you notice that you are no longer in a wooded tree area. You have reached a tall grass area and then a short grass area. How would you classify or describe this gradual change in vegetative growth?
    A. animal succession
    B. climax community
    C. niche
    D. vegetative succession

10. When a community of living organisms has reached a stable stage and does not undergo any further major changes:
    A. This is called ecological succession.
    B. This becomes an ecological community.
    C. This becomes a habitat.
    D. This becomes a climax community.

11. During the early spring, a fishpond was stocked with three kinds of fish: perch, bass, and catfish. In August, the pond has turned dark green in color and the perch have all disappeared. Which of these explanations best explains this problem?
    A. Not enough light caused little plant growth, so the perch were used as the food supply for the larger fish.
    B. The seasons changed too fast causing the smaller plants and fish to die.
    C. There was not enough light or food supply for all of the fish.
    D. There were too many animals and not enough plant growth.

12. In a small fish bowl community there were four medium-sized goldfish, a good supply of plants, light, and water. Which action below would produce the most sudden and noticeable change in the fish bowl community?
    A. removal of the gold fish from the fish bowl
    B. replacing the water in the fish bowl
    C. moving the light source farther away from the bowl
    D. adding more larger gold fish to the fish bowl

13. Which one of the following groups of animals would be in the least competition for survival if the members were placed in the same territory?
    A. a man, bears, lions, wolves, and tigers
    B. turtles, frogs, mice, robins, and squirrels
    C. dogs, cats, squirrels, lions, and foxes
    D. fish, snakes, rats, worms, and frogs

14. The kinds and amounts of nonliving things help decide what organisms should be a part of an ecosystem. Select the organism that should not be a part of a pond ecosystem.
    A. squirrel
    B. bird
    C. snake
    D. snail

15. In a large jar there is a cricket, frog, lizard, turtle, and a fly. Select one food source that is missing from their food web.
    A. plant life
    B. other animal life
    C. air
    D. a consumer

16. Which of the following is NOT needed in the ocean web of life?
    A. trees, shrubs, and grass with roots
    B. plant plankton
    C. sunlight
    D. mammals

17. Ecology assumes that man is what part of nature?
    A. special
    B. related to all other parts
    C. not important
    D. the first part

18. Select the best pair of organisms that have a predator and prey relationship.
    A. eagle and mouse
    B. trees and grass
    C. rabbit and quail
    D. butterflies and houseflies

19. When the environment has too little space, too much pollution, and not enough food, what happens to the human population?
    A. The human population increases.
    B. Rapid growth occurs.
    C. The human population is not affected.
    D. The human population decreases.

20. Ecology is the study of the relationship between:
    A. different species of animals
    B. plants and the atmosphere
    C. organisms and their environments
    D. man and other animals

21. Factors that affect a population, such as deer, include:
    A. disease
    B. predation
    C. humans
    D. all of the above

22. An interaction that occurs when two living organisms associate closely with each other and both receive benefit from the relationship is called
    A. predation
    B. symbiosis
    C. neutralism
    D. none of these

23. Human activities
    A. don't affect the environment
    B. are always harmful to the environment
    C. can be harmful or helpful to the environment
    D. are always helpful to the environment

24. Which of the following natural resources is not really needed to satisfy the needs of man?
    A. air
    B. gold
    C. water
    D. shelter

Please indicate the degree to which you agree or disagree with each statement below by circling the appropriate letters to the right of each statement.

SA: Strongly Agree D: Disagree UN: Uncertain
A: Agree SD: Strongly Disagree

25. When a student does better than usual in environmental education (EE) it is often because the teacher exerted extra effort.	SA	A	UN	D	SD
26. I will continually find better ways to teach EE.	SA	A	UN	D	SD
27. Even if I try very hard, I will not teach EE as well as I will most subjects.	SA	A	UN	D	SD
28. When the EE grades of students improve, it is often due to their teachers having found a more effective teaching approach.	SA	A	UN	D	SD
29. I know the steps necessary to teach EE concepts effectively.	SA	A	UN	D	SD
30. I will not be very effective in monitoring activities.	SA	A	UN	D	SD
31. If students are underachieving in EE concepts, it is most likely due to ineffective EE teaching.	SA	A	UN	D	SD
32. I will generally teach EE ineffectively.	SA	A	UN	D	SD
33. The inadequacy of a student's EE background can be overcome by good teaching.	SA	A	UN	D	SD
34. The low achievement of some students cannot be blamed on their teachers.	SA	A	UN	D	SD
35. When a low-achieving child progresses in EE, it is usually due to extra attention given by the teacher.	SA	A	UN	D	SD
36. I understand EE concepts well enough to be effective in teaching EE.	SA	A	UN	D	SD

37. Increased effort in EE teaching produces little change in some students' EE achievement.	SA	A	UN	D	SD
38. The teacher is generally responsible for the achievement of students in EE.	SA	A	UN	D	SD
39. Students' achievement in EE is directly related to their teacher's effectiveness in EE teaching.	SA	A	UN	D	SD
40. If parents comment that their child showing more interest in EE at school, it is probably due to the performance of the child's teacher.	SA	A	UN	D	SD
41. I will find it difficult to explain to students why science experiments involving environmental topics work.	SA	A	UN	D	SD
42. I will typically be able to answer students' EE questions.	SA	A	UN	D	SD
43. I wonder if I will have the necessary skills to teach EE.	SA	A	UN	D	SD
44. Given a choice, I will not invite the principal to evaluate my EE teaching.	SA	A	UN	D	SD
45. When a student has difficulty understanding an EE concept, I will usually be at a loss as to how to help the student understand it better.	SA	A	UN	D	SD
46. When teaching EE, I will usually welcome student questions.	SA	A	UN	D	SD
47. I do not know what to do to turn students on to EE.	SA	A	UN	D	SD

APPENDIX B

PRESERVICE TEACHER CONSENT FORM

Study of Teacher Knowledge and Attitudes Toward Environmental Education

This study will be researching the effectiveness of Adventures Beyond the Classroom (ABC) for teaching environmental education. Information from this study will guide the use of ABC in the future for preservice teacher training about the environment and outdoor education. The study is being conducted by Masters student Veronica Keithley under the advisement of Dr. Thomas Kuzmic and has been approved by OSU's Elementary Education Program faculty. The purpose of this study is to gain a better understanding of the knowledge and attitudes of elementary education majors toward environmental education as they relate to ABC.

The portion of this research project in which we would like you to participate involves comparing your knowledge and attitudes on environmental education before participating in ABC to your knowledge and attitudes at varying intervals after ABC. You will only be included if you provide consent below. Your involvement will be limited to 15-20 minutes on three different days during the fall semester during this course, once before ABC and twice afterward, for a total combined time for the three dates of 45-60 minutes. This is the time it will take to complete the questionnaire.

You inclusion in this study is voluntary, and you decision will not affect your grade or standing in this course in any way whether you participate in this study or not. Your confidentiality will be maintained by identifying you only by a number on the questionnaires. In addition, the following consent form, which requires your name and identification number, will be stored separately from the questionnaires and no identifying information will be included in the published thesis.

If you agree to participate in this research study, please sign the following form. Questions and comments are welcomed; please contact Veronica Keithley at (918) 242-3114 or (405) 744-5440. You may also Sharon Bacher, IRB Executive Secretary, 203 Whitehurst, Oklahoma State University, Stillwater, OK 74078; telephone number: (405) 744-5700. Thank you for your consideration of this project.

Sincerely,

Veronica Keithley	Thomas Kuzmic
OSU Researcher	OSU Research Advisor

Please note:

1. Data collected in this study are confidential; no names will be used in reporting the data. All data will be reported in summary format.
2. While there may not be individual benefits of this study, there is also no risk (physical, mental, or psychological) to you as a participant in this study.

Please check one of the following boxes, sign, and complete the survey questions on the

next pages.

_____ I understand the benefits and risks of this study and voluntarily agree to provide the data requested for this study and the two questionnaires that will follow during the semester.

_____ I understand the benefits and risks of this study but decline to provide the data requested for this study.

Signature_____ Date_____

Student ID Number _____

APPENDIX C

INSTITUTIONAL REVIEW BOARD APPROVAL

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD

Date: July 23, 1999 IRB #: AG-00-035

Proposal Title: "AN ASSESSMENT OF THE EFFECTIVENESS F THE ADVENTURES BEYOND THE CLASSROOM ENVIRONMENTAL EDUCATION PROGRAM"

Principal Investigator(s): Thomas Kuzmic
Veronica Keithley

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

Signature:

Carol Olson, Director of University Research Compliance

July 23, 1999
Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modification to the research project approved by the IRB must be submitted for approval. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

VITA

Veronica K. Bookout

Candidate for the Degree of

Masters of Science

Thesis: THE EFFECT OF AN OUTDOOR ENVIRONMENTAL EDUCATION PROGRAM ON PRESERVICE TEACHER KNOWLEDGE, SELF-EFFICACY, AND OUTCOME EXPECTANCY

Major Field: Environmental Science

Biographical:

Personal Data: Born in Duncan, Oklahoma, on January 20, 1976, the daughter of James and Karen Keithley

Education: Graduated from Duncan High School, Duncan, Oklahoma in May, 1994; received Bachelor of Science degree in Forestry from Oklahoma State University, Stillwater, Oklahoma in May, 1998. Completed the requirements for the Master of Science degree with a major in Environmental Science at Oklahoma State University in May, 2000.

Experience: Employed as an undergraduate teaching and research assistant, Oklahoma State University, Department of Forestry and College of Agriculture, 1995 to 1996; Outdoor Classroom Project Coordinator for Tree Bank, Oklahoma City, Oklahoma, 1996 to 1998; graduate research assistant, Oklahoma State University, Department of Forestry and School of Curriculum and Educational Leadership, 1998 to present.