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UMI
THE RELATIONSHIP BETWEEN LOCUS OF CONTROL, ATTITUDE TOWARD, AND PERCEPTION OF ENVIRONMENTAL EDUCATION AMONG PRESERVICE TEACHERS IN A TAIWAN TEACHERS COLLEGE

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By
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The Ohio State University 1998

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ABSTRACT

The purpose of this study was to examine the domain-specific LOC of preservice teachers, the attitudes of preservice teachers toward EE learning/teaching, and the perceptions of preservice teachers concerning EE preservice training and EE teaching, as well as to look for relationships between preservice teachers’ LOC and their attitudes and perceptions. The primary reason for doing the study was to access potential for increasing EE in elementary school by means of preservice teacher training.

The study participants were all of the 665 freshmen and juniors enrolled at National Chiayi Teachers College in Taiwan. Data from the valid 579 respondents were collected by a questionnaire survey among teacher colleges students using a self-developed instrument that consists of demographic information, locus of control (LOC) scale, attitude scale and perception scale. Comparisons of variables are presented on the basis of using one-way analysis of variance (ANOVA) and Duncan’s new multiple range test. Relationships between the dependent variables are also described.

The findings of this study indicated that preservice teachers moderately agreed that their actions to offer EE could bring desirable outcome in EE; they possess positive attitudes and perceptions regarding EE. Preservice teachers, who are females, freshmen, physical education majors, or early childhood education majors appear to have a higher
internality toward EE learning and teaching than those of males, juniors, and the other majors. Preservice teachers comprised of females, juniors, early childhood education majors, or with EE experience appeared to have a more positive attitude toward EE than those of males, freshman, the other eleven majors, or those with no EE experience. Females, art education majors or school administration education majors appeared to have a more positive perception of EE learning and teaching than those of males, or the other ten majors. The greater the internality regarding efforts of EE, the more positive the attitude toward EE. The more internal individuals' scores LOC are, the more positive the EE dimensions are perceived to be by individuals. The more positive the EE dimensions are perceived to be by individuals, the more positive the attitude toward EE. Among the selected variables, perception of EE is the best predictor of attitude toward EE; and LOC regarding EE was the most powerful predictor of perception of EE.

Based on the findings and their implications, a set of recommendations are suggested for the curricula used in the teaching and learning strategies of EE and several suggestions are recommended for further research.
Dedicated to my family
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CHAPTER 1

INTRODUCTION

The environment has limited resources and needs to be well balanced to be sustained. Unfortunately the balance is disturbed today by human impacts such as pollution, overpopulation, and deforestation. Therefore, responsible actions should be made to promote the recovery of the damaged environments and to prevent the adverse effect of others. It is hoped that education can help people think about these environmental problems and find solutions.

Since the late 1960s, the term environmental education (EE) has been used to describe education focusing on the environment. EE is complex. It focuses on the process of learning, such as emphasizing problem-solving skills. It uses the community as a learning resource. Moreover, its nature is interdisciplinary, i.e., a part of every curriculum area; thus it needs well trained and motivated teachers in every subject. It requires teachers to be life-long learners in their preservice and inservice levels. Also, teacher education institutions must strengthen EE preservice training positions of their local EE programs.
Because of the complex and less structured character of EE, implementing preservice teacher training in EE is also complex. Review of the literature also shows that teacher training programs in EE are continuously planned and changed in their content and methods in existing or planned courses of instruction (e.g., Hungerford & Peyton, 1976; Hungerford & Peyton, 1980; Wilke, 1985; Lane et al., 1994). If change in education is to take place, how can we motivate preservice teachers to become active EE learners and contributors? According to Fullan (1991), the expectations of preservice teachers could be a crucial aspect in relation to the success of some innovations. Effective EE implementation must come from a thorough understanding of preservice teachers' expectations of EE. There is a definite need to explore the thoughts of preservice teachers regarding EE.

Need for the Study

The greatest perceived need in the area of EE in Taiwan is in the preparation of teachers, especially preservice elementary school teachers, who will contribute their received environmental information to their future students. The majority of inservice teachers in Taiwan recommend that teacher training schools offer EE courses to preservice teachers (Goa, 1988; Chiu, 1990; C. Wang & Tseng, 1991; Hong & Chung, 1991; Chin, 1993; Hsu and Roth, 1998). It is hoped that teachers colleges in Taiwan will nurture preservice teachers who would be capable of successfully implementing EE programs in elementary schools. Preservice training is a transitional period when the individual has successfully completed undergraduate studies recently and is facing life as an elementary teacher in the near future.
EE is typically considered a multidisciplinary field. Since EE intervention in elementary schools needs more cooperation among the fields of science and other disciplines, achievement of EE competency can not be confined to science or EE majors only. There is a wide diversity in preservice teachers' perceptions, knowledge and attitudes about EE, which makes it all the more important to understand both the science majors, and nonscience majors, and the wide variety of expectations that preservice teachers possess when enrolling in a teachers college. Elementary teachers of EE could therefore come from various majors; those at National Chiayi Teachers College were chosen for this study.

The beliefs and behaviors consistent with each other is an important factor of a successful teaching and a key to a congruent teaching (Heimlich and Norland, 1994). According to Hines et al. (1987), the understanding of personality factors which include locus of control (LOC), attitudes, and personal responsibility is essential to understanding and perhaps predicting behaviors in EE. LOC refers to a person's perception of the degree of control they have over events and circumstances. If teachers feel personal power to make a difference, this may aid in increasing the attention given to EE by preservice teachers. Teachers and Administrators in teachers colleges need to become familiar with personality factors among preservice teachers and to see how these factors affect teachers' preparation in order to better shape policy towards developing EE preservice training programs. It would be very useful to staff members to devise a method for measuring the level of interest and type of views that people have about EE,
what preservice teachers’ attitudes are towards the learning and teaching of EE, and what policies of teacher education should be used.

In addition to developing EE preservice training programs, staff members in a teachers college are responsible for assuring that the programs offer quality EE experience to preservice teachers. This study explores preservice teachers’ LOC, attitudes, and perceptions regarding EE in order to aid staff understanding of people in different academic majors in a teachers college. Such information would provide a basis for making informed policy decisions and as a guide to developing interventions through EE preservice training programs. Programs could then be developed which aim at different academic majors and their different LOC, attitudes and perceptions. These programs would increase the effectiveness of EE policies and also encourage preservice teachers’ recognition of opportunities for learning/teaching EE.

The Development of Environmental Education in Taiwan

Since 1986, the Republic of China has been doing its best to translate environmental protection concepts into action by means of both schooling and social education. Actually this effort has been attained by adopting a "reverse education" scheme that uses the younger generation to teach its elders (Environmental Protection Administration [EPA], 1993). To promote the public’s knowledge of environmental protection, the EPA has made many efforts through mass media, public participation, and integrating environmental studies into the curricula at elementary and junior high schools since 1987 (Environmental Protection Committee, 1987). The EPA, rather than schooling, has played an important role in promoting environmental protection. As a consequence, over
the years policy making within school systems has been based more on the protection imperative and less on the basis of teachers' expectations and needs.

A series of studies conducted from 1987 to 1991 showed that in the past that a great deal of research in Taiwan has centered around protection issues. Most of these research was undertaken within the context of ecosystem and environmental impacts through an extensive survey on environmental awareness, environmental information media and content analysis of current curriculum (e.g., C. Wang & Tseng, 1991; Hong & Chung, 1991; Hong, 1991; Chan et al., 1991; Huang & Chiang, 1991; Chang et al., 1991). Such an extensive survey was sponsored by the National Science Council (NSC) in order to collect baseline data for EE promotion in Taiwan. Few EE workshops and teaching materials were developed during this period.

It was after 1990 that more emphasis was placed on exploring students' environmental knowledge and attitude looking at inservice teachers participating EE workshops, including research on their environmental attitudes/knowledge, but little on EE teaching status and environmental behavior. This type of research (e.g., Chang, 1990; Chiu 1990; Cheng, 1991; Tu & Hsu, 1994) was mostly master's degree theses for which the study samples were selected from the EE workshops conducted by EPA, the Ministry of Education, the EE center of National Taiwan Normal University, or Yangmingshan National Park. At the same time, some research focused on exploring students environmental knowledge, attitudes, and behaviors (e.g., Fu, 1991; Wang, 1991; Liou, 1992; Chin, 1993; Tu & Hsu, 1994). Results from these types of research gave the necessary information for developing an environmental curriculum and/or offer baseline
data for a further program to nurture more EE teachers. However, because these types of workshops were not always available, in-depth inservice or preservice EE training programs were lacking.

More recently Yen (1995) and Shih (1995) have developed and conducted research on preservice and inservice EE training programs. The study of Yen (1993, 1994, 1995), a three-year program beginning 1993, was an attempt to build an EE teaching model for educational intervention in a teachers college and to develop a package of activities for EE curriculum of teachers colleges in Taiwan. Shih (1995) has conducted a two-year program beginning 1994 in order to construct an EE teacher training model - “Teachers Training Teachers” for elementary school teachers. Four elementary school teachers selected by Shih were trained to develop EE teaching units for use by 105 other elementary teachers, who will then be expected to play the role of facilitators for more elementary teachers in Hualien county.

The teaching model and training model for EE in Taiwan have been developed; the implementation now depends on more and more motivated preservice and inservice teachers. Considerable research has focused on the existing EE of inservice teachers from K-12 grade levels in Taiwan, but relatively few studies have surveyed the EE-related feelings and opinions among preservice teachers studying at all of the different departments in a teachers college. It remains an open question. How to motivate students in these various majors to learn elementary EE. This study involves an in-depth survey of preservice teachers’ perspectives of including EE within learning and teaching in
order to more effectively design preservice training programs and implement EE in a
teachers college.

Statement of the Problem

The problem to be investigated is to assess the potential for implementing successful
EE programs in the various majors of elementary education. For this we need to develop
better understanding of the degree to which preservice teachers in Taiwan feel they can
learn and teach EE, and the conditions that surround their EE perspectives. More
specially, this study analyzes the association among preservice teachers’ personality
factors -- LOC, attitudes and perceptions -- about including EE within learning/teaching
and compares these attributes across gender, grade, major, and EE experience.

According to research on precursors of environmental behavior, preservice teachers
with a more internal LOC, positive attitudes and perceptions regarding EE are more likely
to develop a desire to learn how to teach elementary EE. The effective implemention of
EE training programs may be determined by the factors of preservice teachers’ LOC,
attitudes and perceptions regarding EE. Little research in Taiwan has investigated
preservice teachers’ EE dimensions of LOC; low internality could be an obstacle to
providing an appropriate preservice EE training program in a teachers college. If teachers
do not feel they can do the job, they are less likely to succeed. More importantly,
teachers’ attitudes and perceptions in favor of EE infused curricula and team teaching are
key to successful EE implementation (Volk, 1984), so mechanisms to gauge such
parameters are needed.
The exploration of preservice teachers’ LOC, attitudes and perceptions and the search for an association between these three variables are needed in order to provide good information for teacher preparation. With understanding of these three variables and their association, a teachers college could one day design more effective EE training programs by considering these variables together to meet the need of those preservice teachers. Hopefully, the findings of this study could provide some information as a basis for teachers colleges to consider methods of changing its preservice teachers’ existing LOC, attitudes and perceptions of EE for the betterment of the teaching-learning process.

A wide variety of LOC, attitude, and perception of including EE within learning and teaching could exist among students in different majors enrolling in a teachers college. More importantly, while implementing an EE training program, the special needs among various majors should be seriously considered as well to see if the training program fits into existing school curricula for different majors in a teachers college. Also considered in such study is the other background such as gender, grade, and EE experience because of the need for basic research as a foundation for preservice EE training in a teachers college.

Purpose of the study

This research will help in the understanding of the EE perspectives of preservice teachers in a teachers college. The main purposes are:

1. To identify preservice teachers’ LOC, attitudes and perceptions of including EE within learning and teaching.
2. To detect the association of preservice teachers’ LOC, attitudes and perceptions with their gender, grade level, major and EE experience.

3. To determine the relationships among preservice teachers’ LOC, attitudes and perceptions of including EE within learning and teaching.

Questions to be Answered

The specific questions of the research are as follows:

1. What do preservice teachers think about including EE within learning and teaching?

2. Are preservice teachers’ LOC regarding EE different according to their gender, grade level, major, or EE experience?

3. Are preservice teachers' attitudes regarding EE different according to their gender, grade level, major, or EE experience?

4. Are preservice teachers' perceptions regarding EE different according to their gender, grade level, major, or EE experience?

5. Is there a significant relationship between preservice teachers’ LOC and attitudes regarding EE?

6. Is there a significant relationship between preservice teachers’ LOC and perceptions regarding EE?

7. Is there a significant relationship between preservice teachers’ attitudes and perceptions regarding EE?

8. Can preservice teachers’ demographic characteristics and LOC regarding EE be used to predict attitudes toward and perceptions regarding EE?
Definition of Terms

Teachers college

In Taiwan, a college that is designed to nurture and produce well-prepared teachers, administrators, and specialists for elementary education and early childhood education. In this study, the subject population is National Chiayi Teachers College students.

Preservice teachers

Undergraduate students who have registered and are studying at teacher training colleges and universities. In this study, the subject of preservice teachers refers to freshmen and juniors enrolled at National Chiayi Teachers College.

Environmental education (EE)

EE is “the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among human, their culture and their biophysical surroundings. EE also entails practice in decision-making and self-formulation of a code of behavior about issues concerning environmental quality” (Stapp et al., 1969, p. 30). In this study, EE refers to an educational process that helps people gain the knowledge, skills, motivation, values, and commitment to take responsibility for maintaining a quality environment.

Locus of control (LOC)

One’s expression of beliefs regarding to what extent the outcome of an event is personally influenced. One with a more internal LOC believes that the outcome of an event is contingent upon her/his own action. One with external LOC feels that the

Operationally, preservice teachers' LOC in this study is defined as the score on the 24-item Likert-type of LOC scale designed to measure preservice teachers' beliefs regarding control expectancies in situations including EE learning/teaching and advocacy.

**Attitudes toward environmental education**

Attitude refers to an organized belief which influences the individual's feelings, pro or con, favorable or unfavorable toward an object, person, or issue (Fishbein and Ajzen, 1975; Newhouse, 1990). Therefore, attitudes toward EE refer to organized beliefs which influence the individual's feelings, pro or con, favorable or unfavorable toward including EE within learning and teaching.

Operationally, preservice teachers' attitudes in this study were defined as their scores on the 21-item Osgood semantic type of attitude scale designed to measure preservice teachers' supportiveness, aspiration, and anxiety of including EE within learning and teaching.

**Perceptions of environmental education**

Functionally, images, views, or opinions on the learning of EE in teachers college and the teaching of EE in elementary schools.

Operationally, preservice teachers' perception of EE in this study was defined as the score on the perception scale designed to measure preservice teachers' viewpoints of including EE within learning and teaching.
Basic Assumptions

1. The questions included in the questionnaire adequately assess the complex concepts of LOC, attitudes and perceptions regarding EE held by freshmen and juniors enrolled at Chiayi Teachers College.

2. The respondents answered the questionnaire accurately by offering the correct information about their LOC, attitudes and perceptions with regard to EE.

Limitation of the Study

1. The preservice teachers' locus of control, attitudes and perceptions regarding EE contained in the study are limited to those revealed by the questionnaire.

2. A preservice teacher's LOC, attitudes, and perceptions regarding EE is founded upon perceptions that are not based upon real learning and teaching experience in EE.

3. The subjects for the study were from freshmen and juniors enrolled at National Chiayi Teachers College in 1996. The data collected are not appropriate to apply to the other students at that college.
CHAPTER 2

LITERATURE REVIEW

This chapter consists of five sections. The first section deals with teacher training for environmental education (EE). The second section reviews the literature of locus of control (LOC) regarding EE. The third section discusses attitudes toward EE. The fourth section is devoted to a review the literature concerning perceptions of EE. The final section introduces the relationship between preservice teacher's demographic characteristics, LOC, attitude toward, and perception of EE.

Teacher training for environmental education

Importance of preservice teacher training for environmental education and implementation of EE curriculum

If two major goals of EE are to develop children's attitudes toward the environment and to transmit environmental knowledge to children, a logical first step toward achieving these goals is to produce teachers who are willing to teach and are competent in EE in their classrooms. One way to produce such teachers is to train them in both environmental content and the methodology of teaching EE (Jaus, 1978). Being competent EE, teachers should help learners acquire knowledge, attitudes, skills, and
behaviors associated with environmental literacy (Wilke, 1985; Lane et al., 1995). These
teachers must be familiar with teaching strategies that will help meet the cognitive,
affective, and behavioral goals of EE (Iozzi et al., n.d.; Lane et al., 1995).

In many countries adequate attention has not been given to the development of
environmental attitudes, values and commitment leading to action in youth. The emphasis
thus far has been mainly on the imparting and acquisition of knowledge. A holistic
approach to EE is required in a variety of teaching-learning situations for ensuring its
effective implementation.

In the fall of 1977, an Intergovernmental Conference on Environmental Education
was held in Tbilisi, USSR, in which 70 nations participated, including all but two of the
European and North American nations. The Tbilisi Conference regards EE as:

... a process during which individuals and the community are made aware of their
environment and of the interaction of its biological, physical and socio-cultural
components, and acquire the knowledge, values, skills, experience and the will
enabling them to act, individually and collectively, so as to solve the present and
future problems of the environment. (UNESCO, 1980, p. 31)

The objectives of EE summarized in The Belgrade Charter were six items:

awareness, knowledge, attitude, skills, evaluation ability, and participation (UNESCO,
1977). The Tbilisi Conference endorsed the following five categories of objectives for
EE:

- **Awareness**: an awareness and sensitivity to the total environment.
- **Knowledge**: a variety of experiences in and a basic understanding of
  environmental problems.
- **Attitudes**: a set of environment values and a feeling of concern for the
  environment, and the motivation for actively participating in environmental
  improvement and protection.
- **Skills**: skills for identifying and solving environmental problem.
• Participation: taking thoughtful positive actions toward the resolution of environmental issues and problems. (UNESCO, 1980, p. 71)

The Tbilisi recommendations suggested that preservice teacher training must promote effective EE (UNESCO, 1978). Teachers play an important role in successful EE teaching. Besides teaching, teachers are also the main actor of curriculum development, teaching material design, and teaching methodology (Towler, 1980/81; Atreya et al., 1986; Shih, 1996).

Lane et al. (1995) explored strengths and weakness of teacher environmental education preparation in Wisconsin. With a sample of 1545 teachers, they found that for each of the areas studied (perceived competencies, attitudes, and class time), the mean responses of teachers who had received preservice EE preparation were consistently more positive than the mean responses of teachers who lacked this experience.

Gao (1988), in a study of secondary teachers in Taiwan, found that most teachers considered that environmental education courses should be provided in preservice teachers programs. Workshops for in-service teachers concerning environmental education were urgently needed to improve instructional competency in environmental education (Chin, 1993).

Yen (1993) found that most of preservice teachers (91.7%) argued that teachers college should provided an EE curriculum and they considered that having an elective course is better than a required one if an independent EE curriculum is offered. If instead EE is infused in the curriculum, more pre-service teachers (63.3%) thought that EE content is suitable to be incorporated into the following existing pre-service teachers
training courses: biology, health education, chemistry, earth science, ecology, environmental science, geography, social studies instruction, and arts & crafts. Nearly all preservice teachers (97.2%) agreed that they should take the responsibility of elementary school in the future (Yang, 1993).

What approach is suitable to be to implement EE? Because EE is issue-oriented, it provides a multidimensional approach across the disciplines of science (i.e., life, earth/space, physical) and across other disciplines (e.g., technology, mathematics, social sciences) (Cantrell & Barron, 1994). Studies indicate EE is not a separate discipline. The generally recognized method in which EE should be included in the school curriculum is as an interdisciplinary/multidisciplinary subject (Hawkins & Vinton, 1973; Tanner, 1974; Helgeson et al., 1971; Johnson, 1980; Kao, 1995). Many researchers (e.g., Cantrell & Barron, 1994) provide a comparison between the meaning of the terms multidisciplinary and interdisciplinary; “multi-” referring to many approaches and “inter-” referring to mutual approaches or cooperation. To be interdisciplinary is to establish EE courses separately. To be multidisciplinary is to infuse EE content into all subject areas.

Studies indicate that an infusion/multidisciplinary approach is suitable for practice in elementary school level, but requires more teachers' involvement and higher level instructional skills. This approach has the advantage that there is not an increase in teaching hours of the current curricula (Tanner, 1974; Atreya et al., 1986; Shih, 1996).

Huang and Huang (1991) reported that most teachers in Taiwan provided EE in the class at an extremely low level. The experience in inservice EE workshops did not change teaching behavior. Although teachers who attended workshops were more competent at
infusing environmental topics into their teaching, the majority of teachers dealt with environmental materials only by focusing on the knowledge domain. Chiu (1990) reported that inservice secondary teachers in Taipei used few field trips, case studies, and outdoor activities in teaching EE. The outcome from such research provides an insight into how EE is viewed and being taught by teachers in the classroom of Taiwan. However, Taiwan studies were more focused on the investigation of secondary teachers attending EE workshops conducted by faculty members or masters degree students in universities.

In summary, preservice teacher training for EE must be done to promote effective EE. A holistic approach to EE is required in a variety of teaching/learning situations for ensuring its effective implementation. There are two approaches to developing and implementing EE curriculum — infusion/multidisciplinary approach and interdisciplinary approach. In Taiwan, most teachers provided EE in the class at a low level; and nearly all preservice teachers agreed that they should take the responsibility of elementary school in the future.

Teaching and learning strategies of environmental education

The U.S. Office of Education (1970) notes that the basic characteristics of good EE include:

- A multidisciplinary approach, with an emphasis on the interrelationships of man and nature;
- A focus on contemporary problems relating to the urban and rural environment manmade and natural;
- Incorporation of non formal as well as formal education processes and utilization of resources outside the classroom;
- Development of understanding and attitudes as well as information. (cited in Johnson, 1980, p. 12)
The following is a list of recommendations on pre-service training of teachers adopted at the Tbilisi conference:

- Environmental sciences and environmental education should be included in curricula for initial teacher education.
- The staff of teacher education institutions should be assisted to bring this about.
- The courses of preservice training of teachers should include research methodologies for designing and developing methods and instruments which enable teachers to effectively fulfil the objectives of environmental education.
- Teachers in training should be given an understanding of as wide a range as possible of educational materials and aids, with special reference to low-cost materials and opportunities for adaptation in local circumstances.
- Teachers should receive appropriate environmental education training relating to the area, either urban or rural, where they are going to work.
- Training institutions should have the necessary flexibility to enable them to include appropriate aspects of environmental curricula that meet the requirements of an interdisciplinary approach and methodology.
- Teacher-training institutions should undertake research in order to develop low-cost educational methods and materials enabling educators to train or retain themselves on their own (UNESCO, 1978; UNESCO, 1980).

Childress (1979) surveyed the EE curricula of public schools. The results showed that popular strategies included group studies, class discussion, field instruction and visiting community resources. Taking a broader view, the National Institute for Educational Research (NIER, 1993) stated that a holistic approach to EE is required in a variety of teaching/learning situations for ensuring its effective implementation. The following strategies were suggested:

- There is a need to emphasize outdoor experiential learning in developing positive attitudes about the environment.
- Problem centered learning experiences that involve investigative approaches to EE are required to develop a self-realization of human dependence on the environment.
- There is a need to encourage a cooperative learning and student-centered teaching and learning experiences.
• EE ought to be a compulsory component of preservice teacher education programmes so that teachers acquire EE knowledge, skills, attitudes and teaching principles.
• At the pre-school and primary school level, teacher education should provide teachers with the knowledge and the teaching skills to put EE perspectives into all the subjects that they teach.
• EE perspectives ought to be integrated into teacher education to create an environmental ethic whereby teachers become personally informed and capable of acting in ways that are environmentally responsible, socially compatible and ethically defensible.
• An environmental ethic ought to be infused and integrated into all subjects.
• Teachers need to develop expertise in using instructional materials in EE.
• Environmental education centers should be available to schools to provide structured and innovative EE programmes. (pp. 13-20)

We can conclude from the studies above that effective EE should at least include the following dimensions of teaching and learning strategies: philosophy of EE, training/learning strategies, competencies/credits requirement, institutional commitment, teacher’s responsibility, multidisciplinary dimension and curriculum development. In this study, these dimensions are used to explore the preservice teachers’ perception of EE.

Locus of control regarding environmental education

The LOC construct emerged from the expectancy-reinforcement perspective of Rotter’s social learning theory, and has attracted interest during the last several decades among educational researchers (Haury, 1983; Lefcourt, 1991). Also LOC is an important factor affecting preservice teachers’ willingness to learn at college and to transfer new skill, knowledge, and attitude into the future classroom practice.

Definition of Locus of Control (LOC)

Rotter (1966) defined locus of control as the extent to which a person perceives contingency relationships between his or her own personal characteristics and/or action
and experienced outcomes. According to Kremer and Lifmann (1980), LOC refers to the degree to which people perceive reinforcements as due to their own efforts rather than to fate. Essentially, LOC has to do with the strength of one's belief that personal action influences the outcomes of events, and of one's perceptions about who or what can control him/her or can control factors affecting him/her (Hamilton, 1986; Haury, 1986).

The LOC construct describes an aspect of one's belief system and does not rest on whether or not a person actually has any control over the events which follow personal action. One end of the unidimensional continuum is labeled internal, and its opposite labeled external (Rotter, 1966; Haury, 1986).

Rotter (1966) defines internal locus of control as that situation in which individuals feel that some result follows some action on their part. Internals believed their actions can make a difference. They are held to be more active than externals in efforts to shape their environment and appear to possess greater perceptual sensitivity. Internals are also more willing to correct personal shortcomings and apt to exert themselves when engaged in important tasks. Internals take action in reference to their beliefs although such action is not legally mandated (Jurin, 1995).

Phares (1978) reviewed the related literature and believed that increased internality is associated with increased attempts to seek, acquire, utilize, and process information that increases control of one's personal environment. Haury (1983) pointed out that,

In educational settings where achievement is perceived as depending on effort or skill, students having more internal orientations also tend to persist longer than others following repeated failures at assigned tasks. (p. 15)
Therefore, an internal LOC is associated with a more active pursuit of valued goals, as would be manifested in social action (Levenson, 1974; Lefcourt, 1991).

On the other hand, external LOC is defined as that situation in which individuals feel that a result is not caused by any action taken on their part, but rather by the action of some external factors such as luck, fate, or powerful others. Externals may fail to perceive the connection between efforts and outcomes (Rotter, 1966; Hamilton, 1986; Kremer and Lifmann, 1980; Lefcourt, 1991). They need extensive empowerment education before they can begin to be educated on the problems and action skills to make a difference (Jurin, 1995).

In summary, LOC refers to one's expression of beliefs regarding to what extent the outcome of an event is personally influenced. One with a more internal LOC believes that outcome of an event is contingent upon her/his own action. One with a more external LOC feels that outcome of an event is beyond her/his grasp. Essentially, externals and internals have different beliefs about personal control, they may have different perceptions of their environment. These differences in perceptions may influence their responses to their environment. Therefore, preservice teachers with an internal LOC will feel the personal power to make a difference that may aid in increasing their EE attention.

**LOC and environmental education**

In the attempt to ascertain whether ranging personality characteristics can account for varying behaviors in teaching, the LOC construct has been selected as a central variable, because of its potential to relate to crucial issues in education, such as teachers'
autonomy vs. dependence, personal responsibility, initiation and risk taking (Kremer & Kurtz, 1982).

Peyton and Miller (1980) reviewed research on LOC. They obtained the following generalizations related the association between LOC and education: (a) internals more frequently participate in productive action taking than externals; (b) internals differ from externals in their ability to recall relevant material, and in how actively they seek additional information; (c) internals are superior to externals in their utilization of information; (d) internals respond differently to those tasks which they perceive to be skill-related, than to tasks they perceive to be chance-determined; and (e) an individual's perceived LOC is susceptible to change.

Hine et al. (1986/87) took LOC and attitudes as two of the eight most important variables affecting environmental literacy. LOC also might be expected to affect the individuals attitude toward science education (Haury, 1989) and environmental issues (Hamilton, 1986). Hamilton (1986) argued, based on the findings of the study, that EE should endeavor to move people in the direction of internality of LOC regarding environmental problems and issues. He said that:

Knowing about environmental issues and ecological principles will avail society nothing if no one believes that he or she can have any significant control over circumstances that might make a given situation better. If environmental education is to be effective, it must not only teach people about environmental problems and solutions, it must also help to convince people that their behavior can have a genuine impact in an expected and desired direction. (p. 29)
Is LOC changeable within a given situation or subject? Is it specific to situation or subject? Lefcourt (1976) argued that LOC is changeable. Lefcourt et al. (1979) viewed that the perception of LOC is related to circumstance or subject area.

Will a generalized sense of internality contribute positively to specific LOC internality to some degree? Although there is no research conducted in the field of EE, the findings of science education research are inconsistent. Scharmann (1988) has shown that an understanding of the nature of science is more predictable among prospective elementary teachers who have a more internal LOC orientation as measured by Rotter’s (1966) scale. Sci LOC refers to science LOC orientation. Haury (1989) found that though SciLOC orientation is conceived to be a special case of general control orientation, the two may not be strongly correlated or share the same antecedents.

**Evaluating LOC**

Iozzi et al. (n.d.) reported that “in a general sense, approaches to the measurement and assessment of locus of control may be grouped into two categories: (a) those that view LOC as a general, relatively pervasive and enduring personality trait; and (b) those which view LOC as situation specific. Due to the complexities of this personality construct, there appears to be some degree of truth in both positions. Thus, rather than predetermine which view or definition of LOC/efficacy should be used, a number of differing approaches to its measurement and assessment…” (Marcinkowski, 1994, p. 183) are developed, such as the I/P/C scales (Internality/Powerful others/Chance, general individual and group LOC scales, context-specific LOC scales, action-specific LOC scales and environmental action internal control index
Hamilton (1986) argued that instruments that measure LOC for specific situations or subjects should be better predictors of behavior than generalized instruments. Therefore, he developed a subject-specific LOC instrument, named the Environmental Attitude Scale (EAS), to determine subjects' internality or externality regarding causes of and solutions to environmental problems.

In summary, studies mentioned above indicate that LOC is specific to situation or subject. In addition, no existing LOC scale is suitable for examining preservice teachers' LOC of teaching and learning EE. For the purposes of this study, a new instrument is necessary.

**Attitude toward environmental education**

It is fairly well accepted that the behavioral change is motivated by a change in attitude, and attitude is reflected in behavior. Preservice teacher's attitude toward EE is an important factor that staff development planners might assess during the early stages of program development in order to maximize the potential effectiveness of preservice EE training. Attitude toward EE could be a key element affecting preservice teacher's readiness to participate in preservice education and in transferring new skills, knowledge, and attitudes into future classroom practice.

**Definition of attitudes**

There are probably as many definitions of attitude as there is literature on the subject. However, there are some representative definitions as follows.

In traditional personality and social psychology, an attitude is viewed as "a hypothetical construct, intended to explain a person's predisposition to evaluate and, as a

Common definitions of attitudes include both cognitive and affective components, or include affective, cognitive, and behavioral components. In addition, attitudes also include the ideas of responding favorably or unfavorably toward an object or a class of objects (Fishbein and Ajen, 1975; Zimbardo et al., 1977; Flanagan, 1984; Wu, 1996). However, most researchers tend to restrict attitudes as the affective component which refers to attitude as a positive or negative feeling or emotionality associated with some person, object, or issue (Newhouse, 1990).

Rathus (1994) viewed attitudes as enduring mental representations of people, places, or things that evoke feelings and influence behavior. Jurin (1995) defined attitudes as an enduring organization of several beliefs focused on a specific object or situation.

Factors that appear to affect individuals’ attitude formation include: the decision situation, the individual’s experience with the environment, the individual’s perception of their role, and their competence in dealing with its complexity (White, 1966).

In summary, researchers define attitude as an enduring mental organization of several beliefs that influences a person’s choice of personal action. An attitude is considered as a tricomponent model which includes affection, cognition, and behavior. Most research tend to restrict attitudes to the affective component which refers to attitude as a positive or negative feeling.
Attitude toward teaching and learning environmental education

Why are some teachers more committed to educating their students about the environment than other teachers? This question relates to the link between a teacher's commitment to teaching EE and his or her attitudes about teaching EE (Shuman, 1995).

There is an assumption that teachers teach from the point of view of what they know and how they feel. Thus, if teachers had an understanding of EE, they would be more able to meet the challenges of teaching the subject (Yang, 1993). Teacher attitudes have been found to affect teacher classroom behavior which in turn influences students' attitudes towards a specific subject area and achievement in that subject area. Effective EE programs can promote favorable teachers' attitudes (Mosothwane, 1991). Teachers possessing positive attitudes toward EE teaching tend to be personally committed to teaching and would teach the discipline in the class (Jaus, 1978).

Rosenshine (1970) found that teachers' attitudes toward EE could have great effects on students' attitudes and achievement. Ham & Sewing (1987) reported that “if teachers do not have positive attitudes toward EE, very little instruction will occur in the classroom” (p. 18). Iozzi (1989) argued that preservice teachers must possess positive attitudes toward EE. Lack of positive attitudes may produce a dislike for EE and may result in students avoiding further learning of environmental concepts. Supporting this concept mentioned above, Stoner (1986) reported that preservice EE had a positive effect on attitudes.
After reviewing studies about responsible environmental behaviors, Hines et al. (1986/87) found that those individuals with more positive environmental attitudes were more likely to have reported engaging in responsible environmental behaviors than were those with less positive attitudes.

Fazio et al. (1982) argued that strong attitudes are more likely to determine behavior than are weak attitudes. "Two essential categories of attitudes measure can be broadly used concerning a single object: abstract-attitudes toward ecology and the environment as a whole, and concrete-attitudes toward taking environmental action" (Hsu, 1994, p. 21). Attitudes can be changed, but they tend to remain stable unless "shoved" (Shirgley, 1974) Attitudes also can be called "agendas for action," magnifying their behavioral component (Rokeach, 1968; Hauser, 1995).

Flanagan (1984) found that teachers' attitudes toward inservice education appears to be one viable dimension of readiness for staff development which should be assessed prior to designing and implementing professional growth programs. He viewed that beliefs and feelings about the past benefits of inservice training, as well as the potential of inservice for future improvement, are catalysts which promote teachers to behave the way they do with regard to professional growth activities. Suitable use of data relating to teachers' attitudes toward inservice education could help develop programs for education. This information indicates the importance of teachers' attitudes toward EE.

Studies mentioned above indicate that teachers can only inculcate into students a positive attitude towards a subject if they themselves possess positive attitude towards the subject. Therefore, it is important that preservice teachers must develop a positive
attitude towards EE and its teaching; and science educators should become concerned with perservice elementary school teachers' attitudes toward EE. However, literature concerned with preservice teachers' attitudes toward teaching EE is limited.

**Evaluating attitudes**

Although there are instruments available that can be used to assess teachers' attitudes toward science and teaching science, no instrument is available to assess preservice teachers' attitudes toward teaching/learning EE. Hence, it is necessary to develop scales to assess preservice teachers' attitudes toward teaching/learning EE.

Haury (1983) reported that relationships have been demonstrated between a control orientation and many variables of educational interest. Four correlates, in particular, seem most well founded and of special interest: academic performance, level of aspiration, self-concept, and anxiety. He developed the *Expressed Attitudes Toward Teaching Science* (EATTS) as an instrument to measure preservice elementary teachers' attitudes toward teaching science. This instrument EATTS measures only three dimensions—supportiveness, aspirations, and anxiety. Haury (1983) also argued that it seems important to consider in more detail the interaction of these dimensions with LOC orientation.

Teachers and administrators come to inservice activities with a mental set ranging from highly positive to highly negative about the value of such activities. Because attitudes are multifaceted with affective, cognitive, and behavioral components, it seems that teachers would have some: (1) emotional responses to inservice education; (2) factual knowledge about training procedures and results of their prior participation; and (3)
consistent ways of behaving before, during, and after inservice workshops (Zimbardo et al., 1977; Flanagan, 1984).

A number of techniques have been used to evaluate attitudes. The oldest and most commonly used are the scaling methods that devised by Thurstone in 1931 and Likert in 1935 (Eastman, 1973). The Semantic Differential technique (SD) was developed by Osgood et al. (1957) to measure more complex attitudes. The technique deals specifically with the direction of attitude change through respondent’s choices on bipolar adjective scales. Validity and reliability with the technique are greater than .80 (Eastman, 1973).

Numerous studies using the Semantic Differential technique in the social sciences are reported since it began to be used in the mid-1950’s, yet the science education literature remained devoid of its use until 1968 (Eastman, 1973). After 1968, studies have yielded some interesting research findings — all with significant outcomes. These results suggest its potential value in attitude measurement beyond pure research application (Eastman, 1973). Eastman (1973) used the Semantic Differential technique as a direct measure of environmental attitude. He reported that the SD technique is a reliable and valid measurement. The limitations of the Likert and Thurstone technique led to the choice of the Semantic Differential technique as a tool to measure preservice teachers’ environmental attitude in this study.

Perception of environmental education

Vander et al. (1990) defined perception as the understanding of a sensation’s meaning. Gibson (1966) emphasized that perception is an active, information-seeking process which improves with development as the child learns to detect the properties,
patterns, and distinctive features of the environment. Veronica A. Binzley defined perception as the process by which one obtains firsthand information about the environment that enables one to function adaptively (Tudor, 1981). Good (1973) considered perception as a continuous process of integration of present and past sensory experience.

Huffman et al. (1995) saw perception as the process of selecting, organizing, and interpreting sensory data into usable mental representations of the world. Veitch and Arkkelin (1995) argued that:

... perception is not simply a matter of the individual responding to sensation created by energy from stimuli impinging on the sensory organs. Rather, this process is embedded in a cultural context, and various social factors have demonstrated to produce differences in the ways two individuals will perceive the same stimulus. Individual differences in backgrounds, experiences, values, and purposes can have a profound influence on the end result of the processing of information from the world around us. (p. 82)

The definitions cited above indicate that perception is a continuous process of integration of present and past sensory experiences; and this process is embedded in a cultural context. Social factors can influence individual perceptions of the world around us.

Yang (1993) in Taiwan surveyed preservice secondary teachers' perceptions of EE with a questionnaire consisted of 17 items. These 17 items asked the respondents about their opinions toward preservice EE training, e.g., item 6 was with the statement that "Environmental educators can be trained in the framework of our traditional teaching method courses," (p.109). The responses of these 17 items calculated from item 1 to
item 17 totaled as “71.6% of respondents expressed agreement (49.4%) or strong agreement (22.2%), while 15.8% of respondents expressed disagreement (13.8%) or strong disagreement (2.0%), but 12.6% of respondents were neutral” (p. 113). Among these 17 items, what agreed most by the respondents was the statement that “Environmental concerns needed to be reinforced in secondary schools in Taiwan” (p. 109). Moreover, what disagreed most by the respondents was the statement that “The current teaching courses offered in your university have adequately prepared you to conducting environmental education in high schools” (p. 112). With regard to the overall measures, preservice secondary school teachers’ perceptions of EE across the industrial arts majors, science majors, and education majors did not differ significantly. Lack of knowledge and lack of teaching skills were two concerns of preservice secondary school teachers as they faced the challenge of conducting EE. Regarding preservice elementary school teachers’ perceptions of EE, there are no studies in Taiwan. Therefore, study on this topic is needed.

**The relationship between demographic characteristics, locus of control, attitude toward and perception of EE**

**Locus of control, attitude toward and perception of EE**

Rowland and Stuessy (1989) reported that a positive attitude towards science is correlated with an internal of LOC. One would expect an increase in internality to be accompanied by an improvement in attitude towards science.

Burow (1976) explored the relationships among secondary science students’ LOC, views of the tentativeness of science, attitudes toward science instruction, perceptions of
teaching strategies, and science achievement. The results revealed that there was a significant relationship among students' LOC, their attitudes toward science instruction and perceptions of teaching strategies. The more internally oriented individuals had a better attitude toward science instruction and tended to perceive science instruction as being more inquiry oriented.

Cheng (1994) investigated how secondary school teacher's LOC is related to multiple aspects of job attitudes and perceptions of a school's organizational characteristics in Hong Kong. The findings showed that internals tend to have a positive job attitude and also tend to have a more positive perception of school's organizational characteristics.

Kremer and Kurtz (1982) used 200 subjects selected from four types of teacher education programs to study LOC, perceptions, and attributions of student teachers in an educational situation. The result revealed that LOC does influence student teachers' perceptions and attributions. The variance of perceptions and attributions were significantly explained by LOC.

Studies also indicate that environmental factors that can influence teachers' attitudes and behaviors often depend on how they are perceived by the teachers. Therefore, LOC is a critical psychological attribute affecting teachers' perceptions of their job attitudes (Lefcourt, 1982; Spector, 1982).

Soh (1988) found that internal LOC teachers were more flexible and positive toward change and responsibility. Stoner (1986) showed that positive changes in attitude scores reflected changes in preservice teachers' perceptions of the need to teach EE, their level
of comfort with the subject matter and the use of equipment and technology.

Myers (1980) proposed a cycle theory. He suggests that the attitude change - behavior change is cyclical in nature. By linking the LOC construct to the attitude - behavior cycle theory, Flannagan (1984) suggested that:

Those teachers who require a mandate from an external agent to try new behaviors implied through inservice activities are responding differentially to a source of external reinforcement base upon their locus of control. Conversely, teachers who demonstrate self-directed behavior by seeking out professional growth experiences are acting within a context of internal locus of control. The latter group might view external change agents as attempting to remove control of the learning situation from those who are intended to benefit directly from it. (p.15)

According to Hines et al. (1986/87), the understanding of personality factors which include LOC, attitudes, and personal responsibility is essential to understanding and perhaps predicting behaviors in EE. If teachers feel personal power to make a difference, this may help in increasing the EE attention given by preservice teachers. In order to better make policy towards developing EE preservice training programs, staff members should see about these factors among preservice teachers and understand how these affect teachers’ preparation.

Although several studies (reviewed by Smith-Sebasto, 1992) reported that attitude is a direct contributing factor to behavioral intention, Shuman (1995) found that attitude has neither a direct nor an indirect effect on teaching EE. He viewed that attitude, itself, is not a reliable predictor of teachers’ commitment to teaching EE in their classroom. Smith-Sebasto (1992) also found that there was a significant relationship between locus of control of reinforcement and environmentally responsible behavior.
After reviewing literature regarding teacher traits and characteristics, Kremer & Hofman (1979) identified LOC orientation as one of three personality dimensions being most relevant to studies of instructional performance. Haury (1988) reported that a strong, positive relationship exists between SciLOC internality and attitudes toward science teaching.

Kremer and Kurtz (1982) found that LOC was an influential personality variable that affected students' and teachers' perceptions. Radford et al. (1993) reported that preservice teachers' LOC in the educational domain is initially founded upon perceptions that are not based upon real teaching experience.

In summary, the previously mentioned studies indicate that more internally oriented LOC individuals had a better attitude toward science instruction and tended to perceive science instruction as being more inquiry oriented. The variance of perceptions was significantly explained by LOC. LOC is a critical psychological attribute affecting teachers' perceptions of their job. A strong, positive relationship exits between SciLOC internality and attitudes toward science teaching. LOC was an influential personality variable that affected student teacher perceptions.

Demographic variables and locus of control, attitude toward and perception of environmental education

Gender, grade/age, major/academic background, EE experience have been demographic variables included in surveys of environmental attitudes and teachers attitudes toward science and science teaching though the findings were not definitive (e.g., Taiwo, 1981; Yang, 1993). Some studies indicate that factor such as familial
origins, education, and significant life experiences are related to formation of LOC (Haury, 1988; Palmer, 1993).

Wang (1997) investigated the environmental behaviors and its predictors of teachers college students in Taiwan. She found that students who have great sense of personal responsibility, or internal LOC, or high sensitivity, or high perceived strategies and efficacy toward the environmental actions, or with androgynous or female psychological sex role, or have participated in environmental activity within a year, or studying at the Department of Music Education, showed better environmental behavior of management and consumerism. The perceived strategies and efficacy of the students toward the environmental actions were moderate.

Radford et al. (1993) investigated LOC in preservice teachers and reported that there were also no significant differences noted when the students (freshmen) were compared by age and gender. However, experiences in the public school environment in the role of teacher may result in change in LOC.

Smith-Sebasto (1995) compared students of both environmental curriculum experience and no environmental curriculum experience, and found that after taking the course in EE the more the students internal LOC was strengthened, and the more the environmentally responsible behavior of the student they professed. Scharmann (1988) noted a preservice elementary teacher possessing an external LOC orientation may exhibit tendencies that are not conductive to the development of an extensive understanding of nature of science. Therefore,
The early identification of external preservice teachers whereby individualized instructional sequences can potentially maximize the experiences required to facilitate a shift in these preservice teachers toward an internal locus of control. (p. 455).

Exploring the relationship between an internal perceived expectancy of reinforcement and involvement in environmental issues, Whitescarver (1976) found that there were significant differences between females and males, with females scoring higher on the Concern and Verbal Commitment subscales. However, for females only, moderate positive correlations were found between the LOC of reinforcement score and the affect subscale and the knowledge subscale (Smith-Sebasto, 1992).

Shuman (1995) reported that early involvement in EE and action will impact the likelihood of involvement in outdoor recreation experiences and potentially teaching EE. The outdoor recreation experience construct also shows a significant effect on the education and action experience construct. Life experiences are important antecedents to teaching EE (Tanner, 1980; Chawla, 1998).

Haury (1983) found that within the range of experiences currently gained by preservice teachers, SciLOC orientation does not seem to be systematically affected. SciLOC orientation can be modified through rather passive instructional experiences. That is, without changing the actual delivery style of the instructor, courses can be structured to promote SciLOC internality. Haury also found that age is positively related to SciLOC internality, and proposed that successful resolution of life experiences along the pathway to becoming a teacher contributes to a sense of personal efficacy (Haury, 1989).
Attitudes formed through direct experience may be stronger and easier to recall.
(Fazio & Cooper, 1983; Rathus, 1994). Sociologists believe that attitudes are not by
nature instinctive, but rather learned through experience (Hauser, 1995). Walter B. Bohl
concluded from a nation-wide cognitive and attitudinal study of high school students that
environmental attitudes are essentially learned responses and should not be taken as true
beliefs. Perhaps through completion of courses related to the environment, individuals
strengthen their basis for more strongly supported attitudes (Specca & Iozzi, 1984)

Many studies report that teachers generally think and feel that teaching EE is
important (e.g., Wilke, 1980; Van Koevering and Sell, 1983; Ham, et al. 1987; Kunz,
1989; Shuman, 1995), especially after participation in an EE workshop. Johnson et al.
(1974) found that attitudes of their samples become more positive after science
instruction. Taiwo (1981) found that previous exposure to science education is positively
correlated with the favorableness of the population’s attitude toward science teaching.
Gender appears to be an important variable in the determination of the degree of
positiveness of attitudes of preservice undergraduate science teachers towards science
teaching. This was found to be in the favor of the male subjects of the study. It seems
that gender has a strong relationship to the degree of favorableness toward science
teaching than is previous exposure to science education.

Yang (1993) surveyed preservice secondary school teachers’ perceptions of EE in
Taiwan. She found that the overall measures of preservice secondary school teachers’
perception of EE across the industrial arts majors, science majors, and education majors
did not differ significantly. However, on individual items dealing with the need for EE,
the need for curriculum development, willingness of participation, and acceptance of and support for EE, the ratings assigned by education majors were higher than the mean ratings of the industrial arts majors and science majors. Females tended to show more acceptance of and support for EE than males on all individual items. However, no difference was found when exploring responses to items dealing with the acceptance of and support for EE among freshman, sophomore, junior, and senior groups majoring in industrial arts. No significant difference of confidence in the ability to conduct EE was found across grade levels in the industrial arts major. There was a positive correlation between the preservice secondary school teachers' views toward the environment and EE. The perception of readiness to teach environmental concerns differed significantly among the three majors, i.e., industrial art majors, science majors, and education majors. The science majors and education majors indicated that they are most prepared to teach pollution issues, while the industrial art majors reported that they were most prepared to teach about the impact of industrial and technological advances. Lack of knowledge and lack of teaching skills were two concerns of preservice secondary school teachers as they faced the challenge of conducting EE.

The findings of these studies mentioned tend to indicate that there is no significant difference among different ages and between genders regarding preservice teachers' locus of control toward science teaching or EE. After taking courses in EE, students' internal locus of control was strengthened, and resulted in the environmentally responsible behavior. SciLOC orientation does not seem to be systematically affected by experiences
currently gained by preservice teachers. SciLOC orientation can be modified through rather passive instructional experiences.

Attitudes formed through direct experience, or through completion of courses related to the environment or after participation in an EE workshop may be stronger and easier to recall. Gender appears to be an important variable in the attitudes of preservice science teachers towards science teaching. Preservice secondary school teachers’ perception of EE did not differ significantly among different majors. Females tend to show more acceptance of and support for EE than males. There was no significant difference among different grade levels regarding preservice secondary school teachers’ perception of EE.
CHAPTER 3

METHODOLOGY

This chapter presents in detail the methods and procedures of the study. Included in this chapter are the research design, population description, instrument development, validity of the instrument, reliability of the instrument, data collection, hypotheses, and statistics methods.

Research design

A descriptive survey was conducted using a questionnaire to assess preservice teachers’ LOC, attitudes, and perceptions regarding EE. Data were collected to explore how preservice teachers want to be prepared and how they will be able to and plan to implement EE in their classrooms when they begin teaching. Data were used to determine the relationship between preservice teachers’ LOC and their attitudes and perceptions. Also examined was the association of the variables with selected sociodemographic characteristics.

Population description

The population sampled in this study consisted of the preservice teachers in a Taiwan teachers college. The study participants were freshmen and juniors learning at National
Chiayi Teachers College located in the west of Taiwan. The four-year College recruits senior high school graduates who have passed the National College Joint Entrance Examination. In the College, there are seven departments: Elementary Education, Mathematics & Science Education, Music Education, Language & Literature Education, Social Studies Education, Special Education, and Early Childhood Education. Students in each of the seven departments are expected to gain capabilities for teaching elementary school courses in the academic field of their departments. Every student is guaranteed a job placement at an elementary school after graduation.

The structure of the curriculum of the College was a factor in the selection of the subjects for this study. Curricula in the College include a general course, professional courses, and specialized courses. Every student has to take 148 credits. General courses are to meet the needs of preparing elementary homeroom teachers; they are offered to set the foundation for a comprehensive understanding and teaching capability of elementary school subject matter. The courses include language arts, social studies, math, science, arts, and PE. A minimum of 70 credits is required. For Music Education, Special Education, and Early Childhood Education, the minimum is 56 credits.

Professional courses are offered to equip students with professional knowledge and competence in elementary education. Every student needs to complete at least 40 credits of professional courses such as introduction to elementary education, educational psychology, philosophy of education, sociology of education, and methods of teaching.

Specialized courses differ from department to department and are provided for junior and senior students. A minimum of 38 credits is required. However, Music Education,
Special Education, and Early Childhood Education require 52 credits as the minimum. Including required and selected courses, students must take at least 20 credits within their area of specialization. For the remaining credits, students may select the ones outside their department or area of specialization.

In this curriculum structure, it can be seen that freshmen take the comprehensive introductory courses and juniors begin to take specialized courses. Additionally, students with different fields of major in the same department are not allowed to choose courses until their junior year. For this study, then, freshmen and juniors rather than sophomores and seniors were selected as the subjects.

Two of the seven departments have two or more class groups in each grade, compared to the other five departments which have only one class in each grade, because the former have different fields of majors in them. Students with different majors of two studies - math and natural science from Mathematics & Science Education and of five academic areas - school administration, counseling and guidance, teaching resources, physical education, and art education from Elementary Education are not allowed to decide their majors until their junior year. Based on the above-mentioned different fields of majors, the students from these seven departments are divided into twelve groups of majors with two in Mathematics and Science Education, five in Elementary Education, and one for each of the other five departments. In this study, even for freshmen who are not allowed to choose their majors, they were asked to self identify what their majors would be.
Instrument Development

The instrument for this study comprised demographic information, a LOC scale, an attitude scale, and a perception scale (see Appendix D). The survey instrument contained a variable number of questions for each scale (see Table 3.1). These scales were developed to determine what preservice teachers “knew” regarding EE, EE preservice training strategies, and EE learning/teaching; how they felt about these matters and what control they likely perceived. The development, structure, scoring, and item characteristics of these scales are described in the following sections.

The LOC scale

The LOC scale is a domain-specific instrument designed to detect a wide range of preservice teachers’ beliefs regarding control expectancies in situations including EE learning/teaching and advocacy. The 22-item final form was derived from an original pool of 24 items utilizing corrected item-total correlation to identify those items with the greatest internal consistency. The LOC scale used a Likert-type, six-point scale ranging from firmly disagree to firmly agree. Responses were scored from 1 (firmly disagree) to 7 (firmly agree). The higher score reflects higher orientation toward internal control reflected in the efforts of EE learning/teaching and advocacy.

Within the LOC scale, three topic areas were identified on the basis of item content: learning, teaching, and advocacy. Questions in each topic area are identified by number in Table 3.1.
<table>
<thead>
<tr>
<th>Part</th>
<th>Scale</th>
<th>Number</th>
<th>Topic area</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Demographic information</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>grade</td>
</tr>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>EE experience</td>
</tr>
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<td>Two</td>
<td>Locus of control</td>
<td>1, 3, 8, 10, 14, 16, 20, 24</td>
<td>learning</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
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<td></td>
<td>5, 12, 18, 23</td>
<td>advocacy</td>
</tr>
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<td>Three</td>
<td>Attitude</td>
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<td>support</td>
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<td></td>
<td>learning</td>
<td>7, 8, 10</td>
<td>aspiration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2, 6, 9</td>
<td>anxiety</td>
</tr>
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<td></td>
<td>2, 5, 7, 9</td>
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</tr>
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<td>Four</td>
<td>Perception</td>
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<td></td>
<td>2, 7, 11</td>
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<td>teacher's responsibility</td>
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<td></td>
<td>7, 10, 11, 13, 15, 20, 21, 22</td>
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<td></td>
<td></td>
<td>1, 3, 4, 5, 6, 8, 9, 14, 16</td>
<td>multidisciplinary dimension</td>
</tr>
</tbody>
</table>

Table 3.1

Classification of the Questions in the Survey Instrument
The attitude scale

The attitude scale measured feelings toward learning and teaching EE using an Osgood Semantic Differential technique (Osgood et al., 1957). Of interest in this section were to see how much support, aspiration, and anxiety preservice teachers felt in learning and teaching EE. Based on the classification from Haury (1983), in this study “support” indicates one’s feeling regarding their relative importance of, the value of, and time expended in EE learning/teaching; “aspiration” indicates one’s intention and desire toward EE learning/teaching; “anxiety” indicates one’s comfort or distress toward EE learning/teaching.

The feelings are rated using a series scale posed between bipolar adjectives. The 21-item final form using 12 descriptive pairs was derived from an original pool of 24 items utilizing corrected item-total correlation to identify those items with the greatest internal consistency. The 12 descriptive pairs selected to measure one’s feelings of involving EE within learning/teaching were: valuable-worthless; important-unimportant; life long-temporary; not a waste of time-a waste of time; to take too much time-not to take too much time; necessary-unnecessary; capable-incapable; willing-unwilling; favorable-unfavorable; stimulating-boring; appropriate-inappropriate; effortless-difficult; enjoyable-not enjoyable; curious-incurious; and comfortable-uncomfortable. Responses are scored from 1 (negative) to 7 (positive). Total score will range from 11 to 77 based on 11 descriptive pairs for the learning of EE and from 10 to 70 based on 10 descriptive pairs for the teaching of EE. The higher score indicates the more positive attitude, the lower score the more negative attitude.
The perception scale

The perception scale used a Likert-type six-point scale measuring the views in preservice teachers EE training and EE teaching. The 45-item final form regarding EE was derived from an original pool of 49 items utilizing corrected item-total correlation to identify those items with the greatest internal consistency. There were 22 items selected to describe the opinions of learning EE within preservice training and 23 items about teaching EE. The measuring scales ranged from firmly disagree to firmly agree. Responses in items of positive description were scored from 1 (firmly disagree) to 6 (firmly agree) and responses in items of negative description were scored from 6 (firmly disagree) to 1 (firmly agree). The higher score signals the more positive perception of learning and teaching EE.

Validity of the Instrument

Content validity refers to a test of the domain or content to be measured (Ary et al., 1990). Content validity was established by a panel of experts, the dissertation committee (see appendix A). The questionnaire in Chinese version was reviewed by another panel of experts comprised of six professors from teachers training universities/colleges in Taiwan (see appendix B). The comments from the above-mentioned members were used to make the items clear and comprehensive. With the revised instrument, a pilot test was conducted with 120 preservice teachers to assess the accuracy and appropriateness of the instrument. The revised instrument was checked again by the panel of experts and the final instrument was developed.
Reliability of the Instrument

Reliability indicates the consistency which means the measured scores obtained with an instrument accurately represent whatever the instrument measures (Fraenkel & Wallen, 1993). Reliability of the instrument was assessed by computing Cronbach correlation efficient using the data collected from administering the instrument to preservice teachers during the final survey. The computation yielded a reliability coefficient ($\alpha$) of 0.94 for the LOC scale, 0.94 for the attitude scale, and 0.93 for the perception scale. The scales demonstrate sufficient internal consistency. These values clearly show that the instrument is highly reliable.

Data Collection

Permission to administer questionnaires to preservice teachers was solicited and obtained from the chairpersons of the departments at National Chiayi Teachers College by means of a hand-delivered recommendation letter and a copy of the questionnaire. To contact the preservice teachers to ask their permission to be volunteers, the researcher and her colleagues went to the classes of freshmen and juniors to administer the questionnaires. Each participant received a packet containing an introductory letter explaining the study and the procedure, and the research instruments. Respondents are asked to read the description on the cover page and the directions on the top of each part of the instrument before responses are made. Questionnaires were completed in class by the students who agreed to participate. In one class there was insufficient time and students completed the survey to return it the next day.
Of the total 665 individuals comprised freshmen and juniors enrolled at National Chiayi Teachers College, 599 returned the questionnaire. The response rate was 90 percent. All but 20 of the 599 returned questionnaires were useful (all questions were answered on 579 surveys).

Hypotheses

Based on the purpose of this study, the research questions (except the first question which is descriptive statement), and a review of related literature, the following hypotheses were developed:

Ho 1: There is no significant difference between the mean scores of preservice teachers’ LOC on the basis of gender, grade, major, and EE experience.

Ho 2: There is no significant difference between the mean scores of preservice teachers’ attitudes regarding EE on the basis of gender, grade, major, and EE experience.

Ho 3: There is no significant difference between the mean scores of preservice teachers’ perceptions regarding EE on the basis of gender, grade, major, and EE experience.

Ho 4: There is no significant relationship between preservice teachers’ LOC and attitudes regarding EE.

Ho 5: There is no significant relationship between preservice teachers’ LOC and perceptions regarding EE.

Ho 6: There is no significant relationship between preservice teachers’ attitudes and perceptions regarding EE.
Statistical methods

The following statistical methods were used to measure the variety of each variable and test the hypotheses of the study:

1. Means, standard deviations, and percentage were used to show a variety of each variable.

2. One-way ANOVA, and Duncan new multiple range test were used. The dependent variables are gender, major, grade level, and EE experience. The independent variables are LOC, attitude and perception. The difference in the mean scores of LOC, attitudes and perceptions regarding EE among preservice teachers of differing gender, major, grade level, and EE experience were tested.

3. The Pearson product-moment correlation was used to test the correlation between the preservice teachers' LOC, attitude, and perception regarding EE.

4. The .05 level of significance was assigned to test the statistical significance.
CHAPTER 4

FINDINGS

In an attempt to explore what preservice teachers think about EE, data were collected by a questionnaire survey among teacher college students using a self-developed instrument that consists of demographic information, locus of control (LOC) scale, attitude scale and perception scale. The purpose of this study was to examine the domain-specific LOC of preservice teachers, the attitudes of preservice teachers toward EE learning/teaching, and the perceptions of preservice teachers concerning EE preservice training and EE teaching, as well as to look for relationships between preservice teachers’ LOC and their attitudes and perceptions. A description of the population and the research findings are organized in this chapter.

First, a description of the valid 579 respondents’ demographic characteristics will be provided. Then, the responses to items of LOC scale, attitude scale and perception scale will be presented. Afterward, comparisons of variables are presented on the basis of using one-way analysis of variance (ANOVA) and Duncan’s new multiple range test. Finally, relationships between the dependent variables are also described.
Demographic characteristics

Table 4.1 presents the demographic data collected from the 579 preservice teachers, concerning gender, grade, major, and EE experience.

Gender

Of the 579 preservice teachers participating in this study, the majority were females. Females (n = 377) comprised 65.1 percent of the respondents, and males (n = 202) accounted for 34.9 percent.

Grade

The number of freshmen and juniors participating in this study was nearly equal. Freshmen (n = 289) comprised 49.1 percent of the respondents, and juniors (n = 290) accounted for 50.1 percent.

Major

Preservice teachers were asked to self-report their major as (1) language education (2) social education (3) music education (4) special education (5) early childhood education (6) school administration (7) counseling and guidance (8) physical education (9) art education (10) teaching resources (11) mathematics education and (12) natural science education. It was reported that the minority were physical education majors. Physical education majors (n = 20) comprised only 3.5 percent of the respondents, while the other eleven different majors (separate n > 30) comprised a range from 5.5 percent to 10.7 percent (Table 4.1).

As shown in Table 4.1, the larger portion of majors were either of language education, special education, teaching resources, mathematics education, and science
education in nearly equal numbers (around 60), each comprising more than 10 percent of the respondents. Both language education and science education majors had \( n = 62 \) or 10.7 percent of the respondents, teaching resources majors \( (n = 61) \) comprised 10.4 percent, special education majors \( (n = 59) \) comprised 10.2 percent, and mathematics education majors \( (n = 58) \) accounted for 10.0 percent.

The smaller portion of majors have numbers ranging from 32 to 51, either comprising less than 9 percent of the respondents, i.e., 51 social education majors (8.8%), 51 early childhood education majors (8.8%), 43 music education majors (7.5%), 42 school administration majors (7.3%), 38 art education majors (6.6%), and 32 counseling and guidance majors (5.5%). Especially, there are no males in early childhood education majors (Table 4.2).

Experience

Preservice teachers were asked to report whether they have experienced any EE activity (self-defined). The majority of the respondents reported that they did not have experience with EE activities. Those who did have such experiences \( (n = 109) \) comprised 18.8 percent of the respondents; those who have not had experiences \( (n = 470) \) with EE activities accounted for 81.2 percent.
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
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<td></td>
</tr>
<tr>
<td>1. Male</td>
<td>202</td>
<td>34.9</td>
</tr>
<tr>
<td>2. Female</td>
<td>377</td>
<td>65.1</td>
</tr>
<tr>
<td>Grade</td>
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<td></td>
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<tr>
<td>2. Junior</td>
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<td>50.1</td>
</tr>
<tr>
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<td>1. Language education</td>
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<tr>
<td>2. Social education</td>
<td>51</td>
<td>8.8</td>
</tr>
<tr>
<td>3. Music education</td>
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</tr>
<tr>
<td>4. Special education</td>
<td>59</td>
<td>10.2</td>
</tr>
<tr>
<td>5. Early childhood education</td>
<td>51</td>
<td>8.8</td>
</tr>
<tr>
<td>6. School administration</td>
<td>42</td>
<td>7.3</td>
</tr>
<tr>
<td>7. Counseling and guidance</td>
<td>32</td>
<td>5.5</td>
</tr>
<tr>
<td>8. Physical education</td>
<td>20</td>
<td>3.5</td>
</tr>
<tr>
<td>9. Art education</td>
<td>38</td>
<td>6.6</td>
</tr>
<tr>
<td>10. Teaching resources</td>
<td>61</td>
<td>10.4</td>
</tr>
<tr>
<td>11. Mathematics education</td>
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<td>10.0</td>
</tr>
<tr>
<td>12. Natural science education</td>
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<td>10.7</td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>1. Have experience</td>
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</tr>
<tr>
<td>2. No experience</td>
<td>470</td>
<td>81.2</td>
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</table>

Table 4.1

Demographic Characteristics of Preservice Teachers
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total</th>
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<th>Grade</th>
<th>Experience</th>
</tr>
</thead>
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<tr>
<td></td>
<td>N (%)</td>
<td>M</td>
<td>Fe</td>
<td>Fr</td>
</tr>
<tr>
<td>Language education</td>
<td>62 (10.7)</td>
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<td>39</td>
<td>34</td>
</tr>
<tr>
<td>Social education</td>
<td>51 ( 8.8)</td>
<td>19</td>
<td>32</td>
<td>27</td>
</tr>
<tr>
<td>Music education</td>
<td>43 ( 7.5)</td>
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<td>40</td>
<td>19</td>
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<tr>
<td>Special education</td>
<td>59 (10.2)</td>
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<td>31</td>
<td>28</td>
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<tr>
<td>Early childhood education</td>
<td>51 ( 8.8)</td>
<td>0</td>
<td>51</td>
<td>28</td>
</tr>
<tr>
<td>School administration</td>
<td>42 ( 7.3)</td>
<td>16</td>
<td>26</td>
<td>25</td>
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<tr>
<td>Counseling and guidance</td>
<td>32 ( 5.5)</td>
<td>4</td>
<td>28</td>
<td>13</td>
</tr>
<tr>
<td>Physical education</td>
<td>20 ( 3.5)</td>
<td>12</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Art education</td>
<td>38 ( 6.6)</td>
<td>9</td>
<td>29</td>
<td>17</td>
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<td>Teaching resources</td>
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<td>Natural science education</td>
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<td>33</td>
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<td>%</td>
<td>100</td>
<td>34.9</td>
<td>65.1</td>
<td>49.9</td>
</tr>
</tbody>
</table>

Note: N = Number; M = Male; Fe = Female; Fr = Freshman; J = Junior; Ex = Have experience; NoEX = No experience

Table 4.2

Demographic Characteristics of Preservice Teachers of Different Majors
Responses to the Items of LOC Scale, Attitude Scale and Perception Scale

The first research question asked about preservice teachers' concerns of EE learning and teaching. In other words, preservice teachers were asked to report their beliefs, feelings, and views about various aspects of EE learning/teaching situations in the role of student currently and of teacher in the future. To address the related issues, the scales of LOC, attitude, and perception in Question 1 are EE specific. The responses to each item of LOC scale, attitude scale, and perception scale from the participants are presented by group means and standard deviations.

Additionally, some items which have highest mean scores and lowest mean scores are further discussed based on percentage rate in order to show the differences between degree of concerns.

Responses to the LOC Scale

The LOC scale with its 24 items on a 6-point scale was used to assess preservice teachers' beliefs about the efforts they could make for EE learning and teaching. Preservice teachers were asked to indicate the extent to which they believe their actions related to advocacy and learning/teaching to offer EE could influence responsible behaviors among elementary students. Table 4.3 describes the subjects' responses on the items of LOC scale. The mean scores for the LOC scale were all higher than 4.30. All of the responses were positive. Preservice teachers self-reported that they slightly to firmly agreed their actions to offer EE could bring desirable outcomes in EE.
The mean scores of its top five items are higher than 5.30 receiving a high percentage of agreement (Table 4.4). About half of the respondents firmly agreed (scale value 6) their actions related to conducting hands-on experiences (item 13) and outdoor experiences (item 14), using appropriate environmental topics for learning (item 3) and for teaching (items 2, 21) could influence responsible behavior among their future elementary students.

In contrast, the response to each of items 10 and 16 presents a high percentage of disagreement among the respondents (Table 4.4). Nearly 1 out of 5 respondents disagreed that the actions of including mathematics within EE learning (scale value from 1 to 3 totals 19.8% for item 10) and EE teaching (scale value from 1 to 3 totals 18.2% for item 16) had the potential to bring desirable outcomes in EE.
<table>
<thead>
<tr>
<th>Item and Item Summary</th>
<th>Mean</th>
<th>SD</th>
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</thead>
<tbody>
<tr>
<td><strong>I could influence environmentally responsible behavior among students if I were to</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Take EE credits</td>
<td>4.74</td>
<td>0.98</td>
</tr>
<tr>
<td>*2. Incorporate environmental topics</td>
<td>5.48</td>
<td>0.67</td>
</tr>
<tr>
<td>*3. Learn ecological concepts</td>
<td>5.36</td>
<td>0.80</td>
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<tr>
<td>4. Teach citizen participation skills</td>
<td>4.87</td>
<td>0.94</td>
</tr>
<tr>
<td>5. Convince institutions to implement EE</td>
<td>5.01</td>
<td>0.89</td>
</tr>
<tr>
<td>6. Use teaching materials from TV</td>
<td>5.14</td>
<td>0.90</td>
</tr>
<tr>
<td>7. Cooperate to develop teaching materials</td>
<td>4.91</td>
<td>0.97</td>
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<tr>
<td>8. Attend EE teacher training programs</td>
<td>4.81</td>
<td>0.91</td>
</tr>
<tr>
<td>9. Relate EE to spiritual side</td>
<td>4.92</td>
<td>0.95</td>
</tr>
<tr>
<td>10. Learn to quantify data to make decision</td>
<td>4.32</td>
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</tr>
<tr>
<td>11. Teach math through environmental situation</td>
<td>4.83</td>
<td>1.08</td>
</tr>
<tr>
<td>12. Convince institutions to support EE</td>
<td>4.90</td>
<td>0.94</td>
</tr>
<tr>
<td>*13. Use hands-on experience</td>
<td>5.31</td>
<td>0.78</td>
</tr>
<tr>
<td>*14. Attend outdoor training programs</td>
<td>5.30</td>
<td>0.88</td>
</tr>
<tr>
<td>15. Teach music through environmental concern</td>
<td>4.93</td>
<td>1.09</td>
</tr>
<tr>
<td>16. Use math to measure interaction</td>
<td>4.36</td>
<td>1.04</td>
</tr>
<tr>
<td>17. Convince institutions to require teachers EE</td>
<td>4.83</td>
<td>1.02</td>
</tr>
<tr>
<td>18. Incorporate resources into teaching</td>
<td>5.27</td>
<td>0.82</td>
</tr>
<tr>
<td>19. Convince colleagues to incorporate EE</td>
<td>4.84</td>
<td>0.97</td>
</tr>
<tr>
<td>20. Learn more EE</td>
<td>5.17</td>
<td>0.84</td>
</tr>
<tr>
<td>*21. Select appropriate curriculum materials</td>
<td>5.34</td>
<td>0.77</td>
</tr>
<tr>
<td>22. Promote societal environmental ethic</td>
<td>5.28</td>
<td>0.80</td>
</tr>
<tr>
<td>23. Convince institutions to provide data service</td>
<td>4.96</td>
<td>0.96</td>
</tr>
<tr>
<td>24. Cooperate to teach elementary EE</td>
<td>4.89</td>
<td>0.95</td>
</tr>
</tbody>
</table>

N = 579

Scale: (6) = firmly agree, (5) = moderately agree, (4) = slightly agree, (3) = slightly disagree, (2) = moderately disagree, (1) = firmly disagree

*The top five items with mean scores > 5.30

Table 4.3

Means and Standard Deviations (SDs) for The LOC Scale by Item
<table>
<thead>
<tr>
<th>Item and Item Description</th>
<th>*Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6</td>
</tr>
</tbody>
</table>

**High percentage of agreement**

*I could influence environmentally responsible behavior among students if I were to*

2. Incorporate environmental topics 0.2 0.0 0.7 6.4 36.6 56.1

3. Learn ecological concepts 0.2 0.5 1.4 11.4 33.7 52.8

13. Use hands-on experience 0.2 0.2 1.2 13.5 37.0 48.0

14. Attend outdoor training programs 0.3 0.3 2.2 15.7 29.2 52.2

21. Select appropriate curriculum materials 0.2 0.3 0.9 12.1 36.6 49.9

**High percentage of disagreement**

*I could influence environmentally responsible behavior among students if I were to*

10. Learn to quantify data to make decision 1.0 4.1 14.7 37.0 28.3 14.9

16. Use math to measure interaction 1.0 2.9 14.3 35.6 32.6 13.5

* 1 = firmly disagree; 2 = moderately disagree; 3 = slightly disagree; 4 = slightly agree; 5 = moderately agree; 6 = firmly agree.

Table 4.4

Items Receiving a High Percentage of Agreement/Disagreement Responses

in the LOC Scale
Responses to the Attitude Scale Related to Learning Environmental Education

There were 11 bi-polar adjective pairs in the attitude scale to assess how much support (items 1, 3, 4, 5, 11), aspiration (items 7, 8, 10), and anxiety (items 2, 6, 9) preservice teachers felt about involving EE within learning. Table 4.5 describes the subjects' responses to the attitude toward learning EE. The mean scores for the attitude scale related to EE learning were all higher than 4.56. Preservice teachers pointed out that learning in EE matched positive indicators such as valuable, willing, and appropriate.

Among all the items reported, the top four items with mean scores higher than 6 such as valuable, important, necessary, and life-long that the respondents concerned most about learning EE are supportive traits. Around half of the respondents strongly expressed (scale value 7) supportive feelings related to the value of EE learning experience, the relative importance of EE competencies, the need to enhance EE, and the amount of learning time devoted to EE. The frequency of responses to each of these supportive traits are given in Table 4.6.

In contrast, item 6 pertaining to an anxiety trait reveals a high percentage of negative response among the respondents. Nearly 1 of 5 (scale value from 1 to 3 totals 18.9%) of the respondents expressed an anxiety in situations involving the learning of EE, i.e., it seems difficult.
<table>
<thead>
<tr>
<th>Item and Item Description</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What I feel about learning EE is</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Valuable - Worthless</td>
<td>6.30</td>
<td>0.96</td>
</tr>
<tr>
<td>2. Appropriate - Inappropriate</td>
<td>5.99</td>
<td>1.03</td>
</tr>
<tr>
<td>*3. Important - Unimportant</td>
<td>6.29</td>
<td>0.94</td>
</tr>
<tr>
<td>*4. Life-long - Temporary</td>
<td>6.08</td>
<td>1.17</td>
</tr>
<tr>
<td>*5. Necessary - Unnecessary</td>
<td>6.22</td>
<td>0.97</td>
</tr>
<tr>
<td>6. Effortless - Difficult</td>
<td>4.56</td>
<td>1.45</td>
</tr>
<tr>
<td>7. Favorable - Unfavorable</td>
<td>5.38</td>
<td>1.23</td>
</tr>
<tr>
<td>8. Willing - Unwilling</td>
<td>5.55</td>
<td>1.20</td>
</tr>
<tr>
<td>9. Exciting - Boring</td>
<td>4.88</td>
<td>1.30</td>
</tr>
<tr>
<td>10. Curious - Incurious</td>
<td>5.06</td>
<td>1.41</td>
</tr>
<tr>
<td>11. A waste of time - Not a waste of time</td>
<td>5.53</td>
<td>1.49</td>
</tr>
</tbody>
</table>

N = 579
Scale: (7) = closely describes on positive traits, (6) = moderately describes on positive traits, (5) = slightly describes on positive traits, (4) = neutral, (3) = slightly describes on negative traits, (2) = moderately describes on negative traits, (1) = closely describes on negative traits.

*The top mean scores with mean scores > 6

Table 4.5

Means and Standard Deviations for the Attitude Scale by Item

Related to Learning Environmental Education
<table>
<thead>
<tr>
<th>Item and Item Description</th>
<th>*Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2   3</td>
</tr>
<tr>
<td>High percentage of positive response</td>
<td></td>
</tr>
<tr>
<td><strong>What I feel about learning EE is</strong></td>
<td></td>
</tr>
<tr>
<td>1. Valuable - Worthless</td>
<td>0.2   0.0</td>
</tr>
<tr>
<td>3. Important - Unimportant</td>
<td>0.0   0.2</td>
</tr>
<tr>
<td>4. Life-long - Temporary</td>
<td>0.7   1.2</td>
</tr>
<tr>
<td>5. Necessary - Unnecessary</td>
<td>0.2   0.5</td>
</tr>
<tr>
<td>High percentage of negative response</td>
<td></td>
</tr>
<tr>
<td><strong>What I feel about learning EE is</strong></td>
<td></td>
</tr>
<tr>
<td>6. Effortless - Difficult</td>
<td>3.3   6.4</td>
</tr>
</tbody>
</table>

* 1 = closely describes on negative traits; 2 = moderately describes on negative traits; 3 = slightly describes on negative traits; 4 = neutral; 5 = slightly describes on positive traits; 6 = moderately describes on positive traits; 7 = closely describes on positive traits.

Table 4.6

Items Receiving a High Percentage of Positive/Negative Responses in

The Attitude Scale Related to Learning Environmental Education
Responses to the Attitude Scale Related to Teaching Environmental Education

There were 10 bi-polar adjective pairs in the attitude scale to assess how much support (items 1, 3, 4), aspiration (items 2, 6, 8, 10) and anxiety (items 2, 5, 7, 9) preservice teachers feel in teaching EE. Table 4.7 describes subjects’ responses on the items of attitude toward teaching EE. The mean scores indicated by the subjects in this study were all higher than 4.41. Preservice teachers reported that they felt that their teaching in EE was positive related to concepts of valuable, enjoyable, and appropriate.

Among all the items reported, the top three items (valuable, important, and necessary) about teaching EE were supportive traits with mean scores higher than 6. More than half of the respondents strongly expressed (scale value 7) supported feelings related to the value of EE teaching effort, the relative importance of EE as a school subject, and the need to implement EE in elementary schools. The frequencies of responses to each of these supportive traits are given in Table 4.8.

In contrast, item 5 pertaining to an anxiety trait reveals a high percentage of negative response among the respondents. More than 1/5 (scale value from 1 to 3 totals 23.8%) of the respondents expressed an anxiety in situations involving EE teaching, i.e., difficult.
<table>
<thead>
<tr>
<th>Item and Item Description</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What I feel about teaching EE is</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*1. Valuable–Worthless</td>
<td>6.33</td>
<td>0.94</td>
</tr>
<tr>
<td>2. Appropriate–Inappropriate</td>
<td>5.85</td>
<td>1.15</td>
</tr>
<tr>
<td>*3. Important–unimportant</td>
<td>6.27</td>
<td>1.00</td>
</tr>
<tr>
<td>*4. Necessary–Unnecessary</td>
<td>6.26</td>
<td>0.96</td>
</tr>
<tr>
<td>5. Effortless–Difficult</td>
<td>4.41</td>
<td>1.47</td>
</tr>
<tr>
<td>6. Willing–Unwilling</td>
<td>5.69</td>
<td>1.22</td>
</tr>
<tr>
<td>7. Capable–incapable</td>
<td>4.99</td>
<td>1.25</td>
</tr>
<tr>
<td>8. Enjoyable–Not enjoyable</td>
<td>5.84</td>
<td>1.08</td>
</tr>
<tr>
<td>9. Stimulating–Boring</td>
<td>4.64</td>
<td>1.27</td>
</tr>
<tr>
<td>10. Favorable–Unfavorable</td>
<td>5.41</td>
<td>1.25</td>
</tr>
</tbody>
</table>

N = 579  
Scale: (7) = closely describes on positive traits, (6) = moderately describes on positive traits, (5) = slightly describes on positive traits, (4) = neutral, (3) = slightly describes on negative traits, (2) = moderately describes on negative traits, (1) = closely describes on negative traits

* The top mean scores with mean scores > 6

Table 4.7

**Means and Standard Deviations for the Attitude Scale by Items**

**Related to Teaching Environmental Education**
<table>
<thead>
<tr>
<th>Item and Item description</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What I feel about teaching EE is</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Valuable—Worthless</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>5.4</td>
<td>10.5</td>
<td>26.3</td>
<td>56.8</td>
</tr>
<tr>
<td>3. Important—Unimportant</td>
<td>0.0</td>
<td>0.2</td>
<td>1.4</td>
<td>6.0</td>
<td>12.4</td>
<td>24.0</td>
<td>56.0</td>
</tr>
<tr>
<td>4. Necessary—Unnecessary</td>
<td>0.0</td>
<td>0.2</td>
<td>0.9</td>
<td>5.4</td>
<td>13.1</td>
<td>27.5</td>
<td>53.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What I feel about teaching EE is</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Effortless—Difficult</td>
<td>3.6</td>
<td>6.9</td>
<td>13.3</td>
<td>27.8</td>
<td>26.6</td>
<td>12.6</td>
<td>9.2</td>
</tr>
</tbody>
</table>

* 1 = closely describes on negative traits; 2 = moderately describes on negative traits; 3 = slightly describes on negative traits; 4 = neutral; 5 = slightly describes on positive traits; 6 = moderately describes on positive traits; 7 = closely describes on positive traits.

Table 4.8

Items Receiving a High Percentage of Positive/Negative Response in the Attitude Scale Related to Teaching Environmental Education
Comparison of learning and teaching attitude scores by the same descriptive pairs

Table 4.9 is to compare preservice teachers' EE learning and teaching attitudes. There are only 8 out of the 12 descriptive pairs distributed over the attitude scale have the same item description related to learning and teaching EE and they offer an opportunity for comparison.

Basically the responses to learning EE related to all of the eight descriptive pairs were very close to that of teaching EE, especially the first four ones which match the concepts of important, valuable, necessary, and appropriate (Table 4.9). More interesting is on the responses of the last four ones which match the concepts of stimulating, effortless, appropriate, and willing. Preservice teachers are not quite as willing to learn EE as they are to teach EE, although learning EE is quite stimulating, effortless, and appropriate when compared to teaching EE.

<table>
<thead>
<tr>
<th>Item description</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Learning</td>
</tr>
<tr>
<td>Important-Unimportant</td>
<td>6.29</td>
</tr>
<tr>
<td>Valuable-Worthless</td>
<td>6.30</td>
</tr>
<tr>
<td>Necessary-Unnecessary</td>
<td>6.22</td>
</tr>
<tr>
<td>Favorable-Unfavorable</td>
<td>5.38</td>
</tr>
<tr>
<td>Stimulating-Boring</td>
<td>4.88</td>
</tr>
<tr>
<td>Effortless-Difficult</td>
<td>4.56</td>
</tr>
<tr>
<td>Appropriate-Inappropriate</td>
<td>5.99</td>
</tr>
<tr>
<td>Willing-Unwilling</td>
<td>5.55</td>
</tr>
</tbody>
</table>

Table 4.9

Comparison of Learning and Teaching attitude by the same descriptive pairs
Response to the Perception Scale Related to Environmental Education training

In the perception scale, there were 22 items pertaining to preservice teachers’ perception of EE training. Preservice teachers were asked to indicate their degree of agreement/disagreement with statements about EE preservice training in a teacher college. The statements related to EE training include: (1) the learning/training strategies, (2) the competencies/credits requirement, (3) institution commitment to offer EE, (4) teachers responsibility, and (5) training in a multidisciplinary way. Table 4.10 describes subjects’ responses to the perception scale related to EE training. The mean scores indicated by the respondents were all over a $M = 4.48$. Preservice teachers reported that they slightly to firmly agreed with the statements, e.g., the outcome of an EE workshop (item 4), the need to require EE competency (item 17), the effort of institutional commitment to support EE (item 15), the importance to prepare EE educators (item 1), and the way to learn EE in a multidisciplinary dimension (item 7).

The top mean scores of four items (2, 11, 13, 15) are higher than 5.00, indicating a high percentage of agreement with of including EE preservice training in a teacher college (Table 4.11). Nearly one third of the participants strongly agreed (scale value 6) with the opportunity to offer EE preservice training (item 2) and to offer an EE center (item 11) and to environmentalize teachers’ instruction (item 15). Moreover, half of the participants (50.9%) strongly agreed (scale value 6) with the need to train and motivate teachers in EE (item 13).
<table>
<thead>
<tr>
<th>Item and Item Summary</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Key to successful EE</td>
<td>4.85</td>
<td>1.14</td>
</tr>
<tr>
<td>2. EE preservice training</td>
<td>5.02</td>
<td>0.98</td>
</tr>
<tr>
<td>3. Teachers' knowledge and skills</td>
<td>4.25</td>
<td>1.39</td>
</tr>
<tr>
<td>4. EE workshop</td>
<td>4.76</td>
<td>0.99</td>
</tr>
<tr>
<td><strong>5. Non science majors' competencies</strong></td>
<td>4.69</td>
<td>1.35</td>
</tr>
<tr>
<td>6. The role of art</td>
<td>4.40</td>
<td>1.22</td>
</tr>
<tr>
<td>7. Existing teaching method courses</td>
<td>4.94</td>
<td>0.89</td>
</tr>
<tr>
<td>8. Citizen participation skills</td>
<td>4.75</td>
<td>0.99</td>
</tr>
<tr>
<td>9. Learning experience in art</td>
<td>4.85</td>
<td>0.94</td>
</tr>
<tr>
<td>10. Creative writing</td>
<td>4.64</td>
<td>1.04</td>
</tr>
<tr>
<td>*11. EE center</td>
<td>5.00</td>
<td>0.86</td>
</tr>
<tr>
<td>12. Existing training courses</td>
<td>4.87</td>
<td>1.00</td>
</tr>
<tr>
<td>*13. Well trained and motivated</td>
<td>5.21</td>
<td>0.84</td>
</tr>
<tr>
<td>**14. Teachers' responsibility</td>
<td>4.43</td>
<td>1.34</td>
</tr>
<tr>
<td>*15. Environmentalize teacher instruction</td>
<td>5.01</td>
<td>0.84</td>
</tr>
<tr>
<td>16. The role of language arts</td>
<td>4.30</td>
<td>1.08</td>
</tr>
<tr>
<td>17. A necessary component</td>
<td>4.73</td>
<td>0.91</td>
</tr>
<tr>
<td>18. EE credits requirement</td>
<td>4.28</td>
<td>1.26</td>
</tr>
<tr>
<td>19. Competency versus credits</td>
<td>4.88</td>
<td>1.20</td>
</tr>
<tr>
<td>20. Infusing versus definite subject</td>
<td>4.72</td>
<td>1.22</td>
</tr>
<tr>
<td>21. Environmental issue analysis</td>
<td>4.89</td>
<td>0.87</td>
</tr>
<tr>
<td>22. Credit for EE workshop</td>
<td>4.47</td>
<td>1.18</td>
</tr>
</tbody>
</table>

N = 579

Scale: (6) = firmly agree, (5) = moderately agree, (4) = slightly agree,
(3) = slightly disagree, (2) = moderately disagree, (1) = firmly disagree

*The top three items with mean scores > 5

**Negative description scored from 6 (firmly disagree) to 1 (firmly agree)

Table 4.10

Means and Standard Deviations for Perception Scale

Related to Learning Environmental Education
<table>
<thead>
<tr>
<th>Item and Item Summary</th>
<th>*Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1  2  3  4  5  6</td>
</tr>
<tr>
<td><strong>High percentage of agreement</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Learning</strong></td>
<td></td>
</tr>
<tr>
<td>2. EE preservice training</td>
<td>1.2 1.2 3.1 18.1 41.8 34.5</td>
</tr>
<tr>
<td>11. EE center</td>
<td>0.3 0.5 1.6 25.9 40.2 31.4</td>
</tr>
<tr>
<td>13. Well trained and motivated</td>
<td>0.7 1.0 4.8 14.2 28.3 50.9</td>
</tr>
<tr>
<td>15. Environmentalize teachers' instruction</td>
<td>0.2 0.5 1.9 23.8 42.5 31.1</td>
</tr>
<tr>
<td><strong>High percentage of disagreement</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Learning</strong></td>
<td></td>
</tr>
<tr>
<td>3. Teachers' knowledge and skills</td>
<td>5.5 5.0 17.8 23.3 27.3 21.1</td>
</tr>
<tr>
<td><strong>14. Teachers' responsibility</strong></td>
<td></td>
</tr>
<tr>
<td>18. EE credits requirement</td>
<td>4.5 4.3 13.0 31.4 30.4 16.4</td>
</tr>
</tbody>
</table>

1 = firmly disagree; 2 = moderately disagree; 3 = slightly disagree; 4 = slightly agree; 5 = moderately agree; 6 = firmly agree

** Negative description valued from 6 (firmly disagree) to 1 (firmly agree)

Table 4.11

**Items Received a High Percentage of Agreement/Disagreement Responses in Perception Scale Related to Learning Environmental Education**

In contrast, the response of items 3, 14 and 18 reveals a high percentage of disagreement with the statements regarding EE preservice training. More than 1 out of 5 respondents disagreed with the usefulness of EE knowledge and skills in developing EE programs (scale value from 1 to 3 totals 27.8% for item 3), the teacher responsibility to develop EE programs (scale value from 1 to 3 totals 22.2% for item 14), and the requirement to take EE credits (scale value from 1 to 3 totals 21.8% for item 18).
Response to the Perception Scale Related to Teaching Environmental Education

In the perception scale, there were 22 items pertaining to preservice teachers' perceptions of EE teaching. Preservice teachers were asked to indicate their agreement or disagreement with the statements related to the teaching of EE in an elementary school. The statements related to EE teaching include: (1) their philosophy of EE teaching, (2) the way to develop curriculum, and (3) the way to teach EE in a multidisciplinary dimension. Table 4.12 describes subjects' responses on the items of perception regarding EE teaching. All the mean scores for the perception scale related to EE teaching were high (M > 4.15) except the mean score on item 22 (M = 3.81). Preservice teachers in this study reported that they slightly to strongly agreed with the statement, e.g., providing outdoor experience is the best for EE teaching (item 18), writing on environmental problems is good to begin EE in the classroom (item 10), teaching EE across the disciplines of science and others (item 14). However, they did not quite know how to find people to help them develop teaching materials (item 22).

The top mean scores of four items such as item 2, 3, 13, 18, 23 are higher than 5.00 receiving a high percentage of agreement with the philosophy of teaching EE (Table 4.13). Around 45% of the respondents strongly agreed (scale value 6) with the statement about emotional aspects (44.0% for item 13) and spirituality expectation (44.7% for item 23). Moreover, over half of the respondents strongly agreed (scale value 6) with the statement about the use of hands-on experience (59.2 % for item 2), the potential of
science to provide ecological concepts (59.1 % for item 3) and the preference to conduct outdoor experience (57.9 % for item 18).

In contrast, the responses to items 6, 11 and 22 reveal a high percentage of disagreement among the respondents. Approximately one third of the respondents disagreed with the statement about including mathematics value within EE teaching (scale value from 1 to 3 totals 26.3% for item 6), the possibility to incorporate environmental issue analysis into elementary curriculum (scale value 1 to 3 totals 28.4% for item 11), and the ability to find people to help in developing EE teaching materials (scale value from 1 to 3 totals 36.9% for item 22).
<table>
<thead>
<tr>
<th>Item and Item Summary</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teaching</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Science versus EE</td>
<td>5.04</td>
<td>1.00</td>
</tr>
<tr>
<td>*2. Hands-on experience</td>
<td>5.46</td>
<td>0.76</td>
</tr>
<tr>
<td>*3. Ecological concepts in science</td>
<td>5.46</td>
<td>0.76</td>
</tr>
<tr>
<td>4. Music and story telling</td>
<td>5.03</td>
<td>0.93</td>
</tr>
<tr>
<td>5. Data interpretation</td>
<td>4.59</td>
<td>0.97</td>
</tr>
<tr>
<td><strong>6. Math teaching</strong></td>
<td>4.19</td>
<td>1.29</td>
</tr>
<tr>
<td><strong>7. Early survey on needs</strong></td>
<td>4.86</td>
<td>1.29</td>
</tr>
<tr>
<td>8. A goal of EE</td>
<td>4.67</td>
<td>1.00</td>
</tr>
<tr>
<td>9. Social studies</td>
<td>4.81</td>
<td>0.94</td>
</tr>
<tr>
<td>10. Writing environmental problems</td>
<td>4.82</td>
<td>0.95</td>
</tr>
<tr>
<td><strong>11. Environmental issue investigation</strong></td>
<td>4.15</td>
<td>1.33</td>
</tr>
<tr>
<td>12. Societal environmental ethic</td>
<td>5.14</td>
<td>0.82</td>
</tr>
<tr>
<td>*13. Emotional aspects</td>
<td>5.24</td>
<td>0.82</td>
</tr>
<tr>
<td>14. Multidimensional approach</td>
<td>5.17</td>
<td>0.82</td>
</tr>
<tr>
<td>15. Higher thinking skills</td>
<td>4.74</td>
<td>0.86</td>
</tr>
<tr>
<td>16. Language arts</td>
<td>4.75</td>
<td>0.90</td>
</tr>
<tr>
<td>17. Intellectual and spiritual side</td>
<td>4.85</td>
<td>0.94</td>
</tr>
<tr>
<td>*18. Prefer outdoor experiences</td>
<td>5.43</td>
<td>0.79</td>
</tr>
<tr>
<td>19. Prefer societal environmental ethics</td>
<td>4.87</td>
<td>0.98</td>
</tr>
<tr>
<td><strong>20. Availability of people to help</strong></td>
<td>4.39</td>
<td>1.31</td>
</tr>
<tr>
<td>21. Teaching materials resources</td>
<td>4.46</td>
<td>0.90</td>
</tr>
<tr>
<td>22. Ability to find people to help</td>
<td>3.81</td>
<td>1.23</td>
</tr>
<tr>
<td>*23. Spirituality expectation</td>
<td>5.26</td>
<td>0.80</td>
</tr>
</tbody>
</table>

N = 579
Scale: (6) = firmly agree, (5) = moderately agree, (4) = slightly agree, (3) = slightly disagree, (2) = moderately disagree, (1) = firmly disagree

**The top five items with mean scores > 5.24**

**Negative description valued from 6 (firmly disagree) to 1 (firmly agree)**

Table 4.12

Means and Standard Deviations for Perceptions Scale by Item

Related to Teaching Environmental education
<table>
<thead>
<tr>
<th>Item and Item Summary</th>
<th>*Value</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High percentage of agreement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Teaching</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Hands-on experience</td>
<td>0.2</td>
<td>0.2</td>
<td>1.2</td>
<td>10.0</td>
<td>29.2</td>
<td>59.2</td>
<td></td>
</tr>
<tr>
<td>3. Ecological concepts in science</td>
<td>0.2</td>
<td>0.3</td>
<td>1.4</td>
<td>8.6</td>
<td>30.4</td>
<td>59.1</td>
<td></td>
</tr>
<tr>
<td>13. Emotional aspects</td>
<td>0.2</td>
<td>0.5</td>
<td>1.7</td>
<td>14.5</td>
<td>39.0</td>
<td>44.0</td>
<td></td>
</tr>
<tr>
<td>18. Prefer outdoor experience</td>
<td>0.3</td>
<td>0.2</td>
<td>1.7</td>
<td>9.2</td>
<td>30.7</td>
<td>57.9</td>
<td></td>
</tr>
<tr>
<td>23. Spirituality expectation</td>
<td>0.2</td>
<td>0.5</td>
<td>0.7</td>
<td>15.5</td>
<td>38.3</td>
<td>44.7</td>
<td></td>
</tr>
<tr>
<td><strong>High percentage of disagreement</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Teaching</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>6. Math teaching</strong></td>
<td>2.9</td>
<td>7.9</td>
<td>15.5</td>
<td>32.3</td>
<td>23.1</td>
<td>18.2</td>
<td></td>
</tr>
<tr>
<td><strong>11. Environmental issue investigation</strong></td>
<td>3.5</td>
<td>10.2</td>
<td>14.7</td>
<td>27.3</td>
<td>28.7</td>
<td>15.7</td>
<td></td>
</tr>
<tr>
<td>22. The ability to find people to help</td>
<td>4.0</td>
<td>11.4</td>
<td>20.9</td>
<td>34.4</td>
<td>21.8</td>
<td>7.6</td>
<td></td>
</tr>
<tr>
<td><strong>1 = firmly disagree; 2 = moderately disagree; 3 = slightly disagree; 4 = slightly agree; 5 = moderately agree; 6 = firmly agree.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>**<strong>Negative description valued from 6 (firmly disagree) to 1 (firmly agree)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.13

Items receiving a High Percentage of Agreement/Disagreement Responses in Perception Scale Related to Teaching Environmental Education
Comparison of LOC by Gender, Grade, Major, and EE experience

The second research question asked to what extent are preservice teachers’ perceptions differentiated by gender, grade level, major, or EE experience. To address Question 2, a comparison of the responses in the LOC scale by independent variables was determined using one-way analysis of variance (ANOVA). Independent variables included gender, grade, major, and experience. Since “major” was composed of multichotomous independent variables, a two pairwise comparison was employed by Duncan’s new multiple range test when the ANOVA result was significantly different.

By gender

The within-gender descriptive statistics for the LOC and its ANOVA results are summarized in Table 4.14. There was a significant difference noted when the mean scores in LOC scale were compared by gender. Females have significantly higher mean score (M = 121.72) than do males (M = 116.11). The result indicated that the females have a higher internality toward advocacy and learning/teaching EE than the males.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td>20.66</td>
<td>0.000***</td>
</tr>
<tr>
<td>Male</td>
<td>202</td>
<td>116.11</td>
<td>15.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>377</td>
<td>121.71</td>
<td>13.18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***P < 0.001

Table 4.14

Means, Standard Deviations, and ANOVA of LOC by Gender
**By grade**

Table 4.15 summarizes the means, standard deviations, and ANOVA of LOC by grade. A statistically significant difference exists between the mean scores of LOC by freshmen and juniors participating in this study. Freshmen have significantly higher mean scores ($M = 121.24$) than do juniors ($M = 118.29$).

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
<td>6.18</td>
<td>0.013*</td>
</tr>
<tr>
<td>Freshman</td>
<td>289</td>
<td>121.24</td>
<td>13.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior</td>
<td>290</td>
<td>118.29</td>
<td>15.06</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P < 0.05

**Table 4.15**

**Means, Standard Deviations, and ANOVA of LOC by Grade**

**By major**

Table 4.16 summarizes the means, standard deviations, and ANOVA of LOC by major. There was a statistically significant difference noted when the mean scores of the twelve different "majors" were compared. A multiple comparison analysis using a Duncan’s new multiple range test indicated that there was statistically significant difference between many of these twelve different "majors" (Table 4.17).
As shown in Table 4.17, the mean scores (M > 120) indicated by physical education majors (M = 126.60), early childhood education majors (M = 124.14), arts education majors (M = 123.55), school administration majors (M = 122.71), teaching resource majors (M = 121.98), and special education majors (M = 120.54) are statistically significant higher than that of mathematics education majors (M = 114.33). The mean score indicated by physical education majors (M = 126.60) is also statistically significant higher than that of social education majors (M = 117.25), counseling and guidance majors (M = 117.13), and music education majors (M = 116.93). The mean score indicated by early childhood education majors (M = 124.14) is statistically significant higher than that of social education majors (M = 117.25) and of music education majors (M = 116.93).

The result indicated that six out of the twelve different "majors," i.e., physical education majors, early childhood education majors, arts education majors, school administration majors, teaching resources majors, and special education majors have a higher internality than mathematics education majors. Besides, physical education majors with their highest mean scores also have a higher internality than the other three majors", i.e., social education majors, counseling and guidance majors, and music education majors. Moreover, early childhood education majors with their next to the highest mean scores have a higher internality than both social education majors and music education majors. Overall, it can be seen that physical education majors and early childhood education majors were the highest internality compared to the other ten "majors."
<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major</td>
<td></td>
<td></td>
<td></td>
<td>2.71</td>
<td>0.002**</td>
</tr>
<tr>
<td>Language education</td>
<td>62</td>
<td>118.65</td>
<td>14.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social education</td>
<td>51</td>
<td>117.25</td>
<td>14.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Music education</td>
<td>43</td>
<td>116.93</td>
<td>13.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special education</td>
<td>59</td>
<td>120.54</td>
<td>15.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early childhood education</td>
<td>51</td>
<td>124.14</td>
<td>11.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School administration</td>
<td>42</td>
<td>122.71</td>
<td>13.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counseling and guidance</td>
<td>32</td>
<td>117.13</td>
<td>13.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical education</td>
<td>20</td>
<td>126.60</td>
<td>14.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Art education</td>
<td>38</td>
<td>123.55</td>
<td>13.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching resources</td>
<td>38</td>
<td>121.98</td>
<td>11.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematic seducation</td>
<td>61</td>
<td>114.33</td>
<td>16.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural science education</td>
<td>62</td>
<td>118.29</td>
<td>17.07</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**P < 0.01

Table 4.16

Means, Standard Deviations, and ANOVA of LOC by Major
<table>
<thead>
<tr>
<th>Mean</th>
<th>Group</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>114.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>116.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>117.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>117.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>118.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>118.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120.54</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>121.98</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>122.71</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>123.55</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>124.14</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>126.60</td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>

*indicates significant difference between the pair of groups

Group 1 = language education majors; Group 2 = social education majors;
Group 3 = music education majors; Group 4 = special education majors;
Group 5 = early childhood education majors; Group 6 = school administration majors;
Group 7 = counseling and guidance majors; Group 8 = physical education majors;
Group 9 = arts education majors; Group 10 = teaching resources majors;
Group 11 = mathematics education majors; Group 12 = natural science majors.

Table 4.17

**Duncan's New Multiple Range Test of Mean Scores on LOC by Major**
By experience

Table 4.18 summarizes the means, standard deviations, and ANOVA of LOC by experience. No statistically significant difference exists between the group who reported experience with EE activity (M = 121.10) and that with no experience (M = 119.45).

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have</td>
<td>109</td>
<td>121.10</td>
<td>13.02</td>
<td>1.17</td>
<td>0.281</td>
</tr>
<tr>
<td>No</td>
<td>470</td>
<td>119.45</td>
<td>14.67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.18

Means, Standard Deviations, and ANOVA of LOC by Experience
Summary of LOC by Gender, Grade, Major, and EE experience

Table 4.19 shows a summary of LOC by gender, grade, major, and EE experience. Significant differences of preservice teachers' LOC scores are found to exist between gender, grade, and major. Females scored higher than males. Freshmen scored higher than juniors. Physical education majors and early childhood education majors scored higher than the other ten majors. No significant difference of preservice teachers' LOC scores are found to exist between those with and without EE experience.

Based on the data presented on Tables 4.14, 4.15, 4.16, 4.17, 4.18, Hypothesis 1: "There is no significant difference between the mean scores of preservice teachers' LOC in terms of gender, grade, major, and EE experience" is partially rejected. The analysis of preservice teachers' LOC by gender, grade, and major is rejected. However, the analysis of preservice teachers' LOC by EE experience failed to be rejected.

<table>
<thead>
<tr>
<th>Group</th>
<th>Comparison of LOC Scores</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Females were scoring higher than males</td>
<td>20.66</td>
<td>0.000*</td>
</tr>
<tr>
<td>Grade</td>
<td>Freshmen were scoring higher than juniors</td>
<td>6.88</td>
<td>0.013</td>
</tr>
<tr>
<td>Major</td>
<td>Physical education majors and early childhood education majors were scoring higher than the other ten majors</td>
<td>2.71</td>
<td>0.002**</td>
</tr>
<tr>
<td>Experience</td>
<td>No significant difference</td>
<td>1.17</td>
<td>0.281</td>
</tr>
</tbody>
</table>

*P < 0.05
**P < 0.01

Table 4.19

Summary of LOC by Gender, Grade, Major, and Experience

79
Comparison of Attitude by Gender, Grade, Major, and EE experience

The third research question asked to what extent are preservice teachers' attitudes differentiated by gender, grade level, major, or EE experience. To address Question 3, a comparison of attitude by independent variables was determined using one-way analysis of variance (ANOVA). Independent variables include gender, grade, major, and experience. Since "major" consisted of a multichotomous independent variables, a two pairwise comparison was employed by the Duncan's new multiple range test when the ANOVA result was significantly different.

By gender

Table 4.20 summarizes the means, standard deviations, and ANOVA of attitude by gender. A statistically significant difference was found when the mean scores of females and males were compared. The females have significantly higher mean scores (M = 118.70) than do the males (M = 115.33).

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
<td>5.16</td>
<td>0.024*</td>
</tr>
<tr>
<td>Male</td>
<td>202</td>
<td>115.33</td>
<td>16.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>377</td>
<td>118.70</td>
<td>17.17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P < 0.05

Table 4.20

Means, Standard Deviations, and ANOVA of Attitude by Gender
**By grade**

Table 4.21 summarizes the means, standard deviations, and ANOVA of attitude by grade. There was significant difference noted when the mean scores of attitude between freshmen and juniors were compared. Juniors have significantly higher mean scores ($M = 119.14$) in attitude scale than do freshmen ($M = 115.89$).

![Table 4.21](image)

*Table 4.21

**Means, Standard Deviations, and ANOVA of Attitude by Grade**
By major

Table 4.22 summarizes the means, standard deviations, and ANOVA of attitude by major. There is a statistically significant difference between majors. A multiple comparison analysis using a Duncan's new multiple range test indicates that there is a statistically significant difference between many of the twelve different "majors" (Table 4.23).

As shown in Table 4.23, the mean scores ($M > 119$) indicated by early childhood education majors ($M = 123.04$), art education majors ($M = 120.89$), natural science majors ($M = 119.82$), special education majors ($M = 119.25$), and teaching resources majors ($M = 119.25$) are statistically significant higher than that of music education majors ($M = 111.33$). The mean score indicated by music education majors ($M = 123.04$) is also statistically significant higher than that of mathematics education majors ($M = 113.76$). The mean score for the attitude scale indicated by early childhood education majors ($M = 123.04$) is statistically significant higher than that of social education majors ($M = 114.24$) as well.

The result indicates that five out of the twelve different "majors", i.e., early childhood education majors, physical education majors, natural science education, and teaching resources majors have more positive attitude than music education majors. Besides, early childhood education majors with their highest mean scores also have more positive attitude than both mathematics education majors and social education majors. Moreover, early childhood education majors with their next to the highest mean scores have more positive attitude than both social education majors and music education majors.
either. Totally, it can be seen that early childhood education majors held the most positive attitudes compared to the other eleven "majors."

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major</td>
<td></td>
<td></td>
<td></td>
<td>1.928</td>
<td>0.034*</td>
</tr>
<tr>
<td>Language education</td>
<td>62</td>
<td>116.03</td>
<td>18.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social education</td>
<td>51</td>
<td>113.76</td>
<td>16.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Music education</td>
<td>43</td>
<td>111.33</td>
<td>20.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special education</td>
<td>59</td>
<td>119.25</td>
<td>17.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early childhood education</td>
<td>51</td>
<td>123.04</td>
<td>14.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School administration</td>
<td>42</td>
<td>118.69</td>
<td>14.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counseling and guidance</td>
<td>32</td>
<td>114.94</td>
<td>17.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical education</td>
<td>20</td>
<td>118.50</td>
<td>20.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Art education</td>
<td>38</td>
<td>120.89</td>
<td>17.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching resources</td>
<td>38</td>
<td>119.15</td>
<td>15.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics education</td>
<td>61</td>
<td>114.24</td>
<td>17.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural science education</td>
<td>62</td>
<td>119.82</td>
<td>14.42</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P < 0.05

Table 4.22

Means, Standard Deviations, and ANOVA of Attitude by major
<table>
<thead>
<tr>
<th>Mean</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td>111.33</td>
<td></td>
</tr>
<tr>
<td>113.76</td>
<td></td>
</tr>
<tr>
<td>114.24</td>
<td></td>
</tr>
<tr>
<td>114.94</td>
<td></td>
</tr>
<tr>
<td>116.03</td>
<td></td>
</tr>
<tr>
<td>118.50</td>
<td></td>
</tr>
<tr>
<td>118.69</td>
<td></td>
</tr>
<tr>
<td>119.15</td>
<td>10</td>
</tr>
<tr>
<td>119.25</td>
<td>4</td>
</tr>
<tr>
<td>119.82</td>
<td>12</td>
</tr>
<tr>
<td>120.89</td>
<td>9</td>
</tr>
<tr>
<td>123.04</td>
<td>5</td>
</tr>
</tbody>
</table>

*indicates significant difference between the pair of groups

Group 1 = language education majors; Group 2 = social education majors;
Group 3 = music education majors; Group 4 = special education majors;
Group 5 = early childhood education majors; Group 6 = school administration majors;
Group 7 = counseling and guidance majors; Group 8 = physical education majors;
Group 9 = arts education majors; Group 10 = teaching resources majors;
Group 11 = mathematics education majors; Group 12 = natural science majors.

Table 4.23

Duncan's New Multiple Range Test of Mean Scores on Attitude by Major
By experience

Table 4.24 summarizes the means, standard deviations, and ANOVA of attitude by experience. A statistically significant difference exists between the group who has had experience with EE activity and those with no experience. Preservice teachers with experience in EE ($M = 120.63$) have higher mean scores for attitude scale than do those with no experience ($M = 116.80$).

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience</td>
<td></td>
<td></td>
<td></td>
<td>4.49</td>
<td>0.035*</td>
</tr>
<tr>
<td>Have</td>
<td>109</td>
<td>120.63</td>
<td>15.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>470</td>
<td>116.80</td>
<td>16.88</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P < 0.05

Table 4.24

Means, Standard Deviations, and ANOVA of Attitude by Experience
Summary of Attitude by Gender, Grade, Major, and EE experience

Table 4.25 shows a summary of attitude by gender, grade, major, and EE experience. Significant difference of preservice teachers' attitude scores was found to exist between gender, grade, major, and EE experience. Females scored higher than males. Juniors were scoring higher than freshmen. Early childhood education majors scored higher than the other eleven majors. Preservice teachers with EE experience scored higher than those with no experience.

Based on the data presented on Tables 4.20, 4.21, 4.22, 4.23 and 4.24, Hypothesis 2: “There is no significant difference between the mean scores of preservice teachers' attitudes regarding EE on the basis of gender, grade, major, and EE experience” was rejected.

<table>
<thead>
<tr>
<th>Group</th>
<th>Comparison of Attitude Scores</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Females were scoring higher than males</td>
<td>5.16</td>
<td>0.000***</td>
</tr>
<tr>
<td>Grade</td>
<td>Juniors were scoring higher than freshmen</td>
<td>5.28</td>
<td>0.022*</td>
</tr>
<tr>
<td>Major</td>
<td>Early childhood education majors were scoring higher than the other eleven majors</td>
<td>1.93</td>
<td>0.034*</td>
</tr>
<tr>
<td>Experience</td>
<td>With EE experience scored higher than no EE experience</td>
<td>4.49</td>
<td>0.035*</td>
</tr>
</tbody>
</table>

*P < 0.05
***P < 0.001

Table 4.25

Summary of Attitude by Gender, Grade, Major, and Experience
Comparison of Perception by Gender, Grade, Major, and EE experience

The fourth research question asked to what extent are preservice teachers’ perceptions differentiated by gender, grade level, major, or EE experience. To address Question 4, a comparison of perception by independent variables was determined using one-way analysis of variance (ANOVA). Independent variables include gender, grade, major, and experience. Since "major" was a multichotomous independent variable, a two pairwise comparison was employed using the Duncan’s new multiple range test when the ANOVA result was significantly different.

By gender

Table 4.26 summarizes the means, standard deviations, and ANOVA of preservice teachers’ perceptions by gender. A statistically significant difference exists between males and females. Females have significantly higher mean scores (M = 217.12) than do males (M = 211.33).

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td>8.50</td>
<td>0.004**</td>
</tr>
<tr>
<td>Male</td>
<td>202</td>
<td>211.33</td>
<td>24.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>377</td>
<td>217.12</td>
<td>22.22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**P < 0.01

Table 4.26

Means, Standard Deviations, and ANOVA of Perception by Gender
By grade

Table 4.27 summarizes the means, standard deviations, and ANOVA of attitude by grade. No statistically significant difference exists between the mean scores of freshmen and juniors even though freshmen had higher mean scores (M = 216.41) than do juniors (M = 213.89).

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>289</td>
<td>216.41</td>
<td>23.90</td>
<td>1.69</td>
<td>0.194</td>
</tr>
<tr>
<td>Junior</td>
<td>290</td>
<td>213.89</td>
<td>22.58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P < 0.05

Table 4.27

Means, Standard Deviations, and ANOVA of Perception by Grade
Table 4.28 summarizes the means, standard deviations, and ANOVA of perception by major. There is a statistically significant difference between the mean scores of majors. A multiple comparison analysis using a Duncan’s new multiple range test indicated that there was a statistically significant difference between many of the twelve different majors” (Table 4.29).

As shown in Table 4.29, the mean perception score (M > 221.9) of arts education majors (224.58) and that of school administration majors (M = 221.98) are statistically significantly higher than that of mathematics education majors (M = 209.95). The mean score indicated by arts education majors (M = 224.58) is also statistically significantly higher than that of language education mathematics education majors (M = 209.97), Music education majors, and special education majors (M = 213.46). The mean score of school administration majors (M = 221.98) is statistically significantly higher than that of mathematics education majors (M = 209.97) as well.

The result indicated that two out of the twelve different “majors,” i.e., arts education majors and school administration majors have more positive perception than language education majors. Besides, arts education majors with their highest mean scores also have more positive perceptions than mathematics education majors, music education majors, and social education majors. Moreover, early childhood education majors with their next to the highest mean scores have more positive perceptions than that of
mathematics education majors. Overall, it can be seen that art education majors and school administration majors held the most positive perceptions compared to the other ten majors.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major</td>
<td>1.928</td>
<td>0.034*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language education</td>
<td>62</td>
<td>209.95</td>
<td>23.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social education</td>
<td>51</td>
<td>214.18</td>
<td>21.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Music education</td>
<td>43</td>
<td>210.55</td>
<td>19.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special education</td>
<td>59</td>
<td>213.46</td>
<td>23.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early childhood education</td>
<td>51</td>
<td>217.66</td>
<td>27.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School administration</td>
<td>42</td>
<td>221.98</td>
<td>22.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counseling and guidance</td>
<td>32</td>
<td>212.38</td>
<td>24.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical education</td>
<td>20</td>
<td>221.85</td>
<td>27.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Art education</td>
<td>38</td>
<td>224.58</td>
<td>20.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching resources</td>
<td>38</td>
<td>216.43</td>
<td>20.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics education</td>
<td>61</td>
<td>209.97</td>
<td>25.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural science education</td>
<td>62</td>
<td>216.31</td>
<td>20.52</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P < 0.05

Table 4.28

**Means, Standard Deviations, and ANOVA of Perception by major**
Table 4.29

Duncan’s New Multiple Range Test of Mean Scores on Perception by Major

<table>
<thead>
<tr>
<th>Mean</th>
<th>Group</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 1 1 3 7 4 2 12 10 5 8 6 9</td>
<td></td>
</tr>
<tr>
<td>209.95</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>209.97</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>210.55</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>212.38</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>213.46</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>214.18</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>216.31</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>216.43</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>217.66</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>221.85</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>221.98</td>
<td>6</td>
<td>*  *</td>
</tr>
<tr>
<td>224.58</td>
<td>9</td>
<td>*  *  *  *</td>
</tr>
</tbody>
</table>

*indicates significant difference between the pair of groups

*Group 1 = language education majors; Group 2 = social education majors;
Group 3 = music education majors; Group 4 = special education majors;
Group 5 = early childhood education majors; Group 6 = school administration majors;
Group 7 = counseling and guidance majors; Group 8 = physical education majors;
Group 9 = arts education majors; Group 10 = teaching resources majors;
Group 11 = mathematics education majors; Group 12 = natural science majors.
By experience

Table 4.30 summarizes the means, standard deviations, and ANOVA of perception by EE experience. No statistically significant difference exists between the mean score of the group who have had EE activity experience ($M = 218.60$) and those with no experience ($M = 214.34$).

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience</td>
<td></td>
<td></td>
<td></td>
<td>4.52</td>
<td>0.086</td>
</tr>
<tr>
<td>Have</td>
<td>109</td>
<td>218.60</td>
<td>18.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>470</td>
<td>214.34</td>
<td>24.14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.30

Means, Standard Deviations, and ANOVA of Perception by Experience
Summary of perception by gender, grade, major, and EE experience

Table 4.31 shows a summary of perception by gender, grade, major, and EE experience. Preservice teachers’ perceptions are higher than males. Art education majors and school administration majors scored higher than the other ten majors. No significant difference of preservice teachers’ perception scores was found to exist between grade and EE experience.

Based on the data presented on Tables 4.22, 4.23, 4.24, 4.25 and 4.26, Hypothesis 3: “There is no significant difference between the mean scores of preservice teachers’ perceptions on the basis of gender, grade, major, and EE experience” was partially rejected. The analysis of preservice teachers’ perceptions by gender and major was rejected. However, the analysis of preservice teachers’ perceptions by grade and EE experience failed to be rejected.

<table>
<thead>
<tr>
<th>Group</th>
<th>Comparison of Perception Scores</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Females were scoring higher than males</td>
<td>8.50</td>
<td>0.004**</td>
</tr>
<tr>
<td>Grade</td>
<td>No significant difference</td>
<td>1.69</td>
<td>0.194</td>
</tr>
<tr>
<td>Major</td>
<td>Art education majors and school administration education majors were scoring higher than the other ten majors</td>
<td>1.93</td>
<td>0.034*</td>
</tr>
<tr>
<td>Experience</td>
<td>No significant difference</td>
<td>4.52</td>
<td>0.086</td>
</tr>
</tbody>
</table>

*P < 0.05  
**P < 0.01

Table 4.31

Summary of perception by gender, grade, major, and EE experience
Relationship between LOC, Attitude, and Perception regarding EE

The bivariate relationship between preservice teachers' LOC, attitudes and perceptions regarding EE was submitted to a Pearson product moment correlation analysis. Table 4.32 summarized the interaction between LOC, attitudes, and perception regarding EE.

LOC and Attitude

The fifth research question addressed by this study asked if there is a significant relationship between preservice teachers' LOC and expressed feelings regarding EE. The data in Table 4.32 indicate that a relationship does exist. A correlation of 0.55 was found as a significant positive relationship between LOC and attitudes regarding EE (P < .001). The relationship indicates that the greater the internality regarding effort of learning/teaching EE, the more positive the attitude toward learning/teaching EE.

Based on the data presented in Table 4.32, Hypothesis 4: "There is no significant relationship between preservice teachers' LOC and attitudes regarding EE" was rejected.

<table>
<thead>
<tr>
<th></th>
<th>LOC</th>
<th>Attitude</th>
<th>Perception</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOC</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude</td>
<td>0.5514**</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>Perception</td>
<td>0.6648**</td>
<td>0.5912**</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

**0.001 level of significance

Table 4.32

Pearson Product-Moment Correlation among Preservice Teachers'

Locus of Control, Attitudes and Perceptions
LOC and Perception

The sixth research question addressed by this study asked if there is a significant relationship between preservice teachers’ LOC and perceptions of EE. In this study, the data in Table 4.32 indicate a relationship does exist. A correlation of 0.66 was found as a significant positive relationship between LOC and perceptions regarding EE (P < 0.001). In other words, the more internal those individuals would be regarding the EE effort, the more positive EE dimension is perceived to be by individuals.

Based on the data presented on Table 4.32, Hypothesis 5: “There is no significant relationship between preservice teachers’ LOC and perceptions regarding EE” was rejected.

Perception and Attitude

The seventh research question addressed by this study asked if there is a significant relationship between perception and attitude regarding EE. In this study, a correlation of 0.59 was found as a significant positive relationship between attitude and perception regarding EE (P < 0.001). The more positive EE dimensions are perceived to be by individuals, the more positive the attitudes toward learning/teaching EE.

Based on the data presented on Table 4.32, Hypothesis 6: “There is no significant relationship between preservice teachers’ perceptions and attitudes regarding EE” was rejected.
Comparison of the Relationship between LOC, Attitude and Perception

by Demographic Characteristics

In comparing relationships among all independent variables, significant relationships exist among all independent variables (Table 4.33). Most correlations are moderate (r = 0.40 - 0.60) to very strong (r = 0.60 - 0.80). The relationship between LOC and perceptions of mathematics education majors (r = 0.8577) and of school administration majors is very strong (r = 0.8523). However, the associations of LOC to perceptions of and to attitudes of early childhood education majors, and to attitudes of natural science education majors are moderately weak.

Further Exploration of Interaction Effects

The eighth research question addressed by this study asked whether the preservice teachers' demographic characteristics and LOC can be used to predict attitudes and perceptions regarding EE. A stepwise multiple regression was conducted to ascertain if there were predictors of attitudes and perceptions regarding EE. These regressions were run to determine if the correlation identified and reported above had stronger or different interaction effects. The findings of these regressions supported the findings of the correlations and clarify but do not change these findings.
<table>
<thead>
<tr>
<th>Group</th>
<th>Dependent variable-Independent variable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOC–Perception</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0.6607**</td>
</tr>
<tr>
<td>Female</td>
<td>0.6578**</td>
</tr>
<tr>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>0.6747**</td>
</tr>
<tr>
<td>Junior</td>
<td>0.6577**</td>
</tr>
<tr>
<td>Major</td>
<td></td>
</tr>
<tr>
<td>Language education</td>
<td>0.6324**</td>
</tr>
<tr>
<td>Social education</td>
<td>0.6585**</td>
</tr>
<tr>
<td>Music education</td>
<td>0.6506**</td>
</tr>
<tr>
<td>Special education</td>
<td>0.7335**</td>
</tr>
<tr>
<td>Early childhood education</td>
<td>0.3850*</td>
</tr>
<tr>
<td>School administration</td>
<td>0.8523**</td>
</tr>
<tr>
<td>Counseling and guidance</td>
<td>0.6808**</td>
</tr>
<tr>
<td>Physical education</td>
<td>0.6302**</td>
</tr>
<tr>
<td>Art education</td>
<td>0.7831**</td>
</tr>
<tr>
<td>Teaching resources</td>
<td>0.7424**</td>
</tr>
<tr>
<td>Mathematics</td>
<td>0.8577**</td>
</tr>
<tr>
<td>Natural science</td>
<td>0.4559**</td>
</tr>
<tr>
<td>Experience</td>
<td></td>
</tr>
<tr>
<td>Have</td>
<td>0.7103**</td>
</tr>
<tr>
<td>No</td>
<td>0.6573**</td>
</tr>
</tbody>
</table>

* 0.01 level of significance
** 0.001 level of significance

Table 4.33

Comparison of the Bivariate Relationships between LOC, Attitude and Perception

by Demographic Characteristics
A stepwise multiple regression was conducted to ascertain if there were predictors of attitudes toward EE. The entered independent variables included gender, grade level, major, EE experience, LOC, and perception. The result of the stepwise multiple regression (Table 4.34) indicated that perception of EE, LOC regarding EE, and grade level were ascertained to be the best predictors (significant at .05 level) to predict attitudes toward EE. Perception of EE, the best predictor, explained 34.95% of the variance in attitudes toward EE; LOC regarding EE explained 4.50% of the variance; perception of and LOC regarding EE explained 39.45% of the variance; grade level explained 2.13% of the variance; perception of EE, LOC regarding EE, and grade level explained 41.58% of the variance in attitude toward EE. Gender, major, and EE experience were not significant predictors (P > .05).

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable</th>
<th>MultR</th>
<th>Rsq</th>
<th>F(Eqn)</th>
<th>SigF</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Perception</td>
<td>0.5912</td>
<td>0.3495</td>
<td>308.458</td>
<td>0.000***</td>
<td>0.5912</td>
</tr>
<tr>
<td>2</td>
<td>LOC</td>
<td>0.6281</td>
<td>0.3945</td>
<td>186.668</td>
<td>0.000***</td>
<td>0.2839</td>
</tr>
<tr>
<td>3</td>
<td>Grade</td>
<td>0.6449</td>
<td>0.4158</td>
<td>135.724</td>
<td>0.000***</td>
<td>-0.1468</td>
</tr>
</tbody>
</table>

***P <.001

Table 4.34

Stepwise Multiple Regression of Attitude toward Environmental Education on the Significant Variables
Relationships between Perception of Environmental Education and Other Variables

A stepwise multiple regression was conducted to ascertain if there are the best predictors of perception of EE. The entered variables included gender, grade level, major, EE experience, LOC regarding EE, and attitude toward EE. The result of the stepwise multiple regression (Table 4.35) indicated that LOC regarding EE, and attitude toward EE were ascertained to be the best predictors (significant at .05 level) to predict perception of EE. LOC regarding EE, the best predictor, explained 44.20% of the variance in perception of EE; attitudes toward EE explained 7.45% of the variance; LOC regarding EE and attitude toward EE explained 51.45% of the variance. Gender, grade level, major, and EE experience were not significant predictors (P > .05).

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable</th>
<th>MultR</th>
<th>Rsq</th>
<th>F(Eqn)</th>
<th>SigF</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LOC</td>
<td>0.6648</td>
<td>0.4420</td>
<td>454.605</td>
<td>0.000***</td>
<td>0.6648</td>
</tr>
<tr>
<td>2</td>
<td>Attitude</td>
<td>0.7173</td>
<td>0.5145</td>
<td>303.569</td>
<td>0.000***</td>
<td>0.3228</td>
</tr>
</tbody>
</table>

***P < .001

Table 4.35

Stepwise Multiple Regression of Perception of Environmental Education on the Significant Variables
CHAPTER 5

SUMMARY, DISCUSSION, IMPLICATIONS AND RECOMMENDATIONS

This chapter consists of four parts: a summary of the study, a discussion of the results and their implications for practice, recommendations for EE teacher training in Taiwan and suggestions for further research in the area of the study.

Summary of the Study

 Purposes of the Study

The primary reason for doing the study was to assess potential for increasing EE in elementary school by means of preservice teacher education. If we know the characteristics of preservice EE training, perhaps we can work with them more effectively to encourage their use of EE opportunities. This study was designed to answer the following research questions:

1. What do preservice teachers think about including EE within learning and teaching?
2. Does preservice teachers’ LOC regarding EE differ according to gender, grade level, major, or EE experience?
3. Do preservice teachers’ attitudes toward EE differ according to gender, grade level, major, or EE experience?

4. Do preservice teachers’ perceptions of EE differ according to gender, grade level, major, or EE experience?

5. Is there a significant relationship between preservice teachers’ LOC and attitudes regarding EE?

6. Is there a significant relationship between preservice teachers' LOC and perceptions regarding EE?

7. Is there a significant relationship between preservice teachers’ attitudes and perceptions regarding EE?

8. Can preservice teachers’ demographic characteristics and LOC regarding EE be used to predict attitudes toward and perceptions regarding EE?

Research method and procedures

The population of this study consisted of the preservice teachers in a Taiwan teachers college. The study participants were all of the 665 freshmen and juniors enrolled at National Chiayi Teachers College, and 599 returned the questionnaire. The response rate was 90 percent. All but 20 of the 599 returned questionnaires were usable. In the National Chiayi Teachers College, there are seven departments: Elementary Education, Mathematics & Science Education, Music Education, Language & Literature Education, Social Studies Education, Special Education, and Early Childhood Education.

In this study the survey was comprised of two parts: (a) demographic information, and (b) the questionnaire. A demographic information sheet was used to collect
information concerning gender, grade, major or department, and EE experience. The questionnaire consisted of three scales: (a) LOC scale, (b) Attitude Scale, and (c) Perception Scale. These scales were developed to determine what the preservice teacher "knew" regarding EE, EE preservice training strategies, and EE learning/teaching; how they felt about it; and what perceived control they likely held.

The Statistical Package for the Social Science (SPSS) was used to analyze the data. Means, standard deviations, and percentage were used to describe each variable. One-way ANOVA, Duncan new multiple range test, Pearson product-moment correlation coefficient and multiple regression analysis were used to test the hypotheses of this study. The .05 level of significance was assigned to test the statistical significance.

Summary of findings

Based on the data analysis, the findings of this study were as follows:

1. Preservice teachers moderately agreed that their planned actions to offer EE could bring desirable outcome in EE; and preservice teachers possess a positive attitude and a positive perception regarding EE learning and EE teaching. Basically the attitudes toward learning EE were very close to those of teaching EE.

2. A high percentage of respondents firmly agreed that the actions they plan to take (related to conducting hands-on experiences and outdoor experiences, using appropriate environmental topics for learning and for teaching) could influence responsible behavior among their future elementary students. However, nearly 1 out of 5 respondents disagreed that the action of including mathematics within EE learning and teaching had the potential to bring desirable outcomes in EE.
3. Preservice teachers are not quite as willing to learn EE as they are to teach EE, although learning EE is quite stimulating, effortless, and appropriate when compared to teaching EE.

4. Nearly 1 of 5 of the respondents expressed concern that EE teaching seems difficult and boring; and preservice teachers did not quite know how to find people to help them develop teaching materials.

5. Significant differences of preservice teachers’ LOC scores are found to exist among subjects differing in gender, grade, and major. Females scored higher than males; freshmen scored higher than juniors; physical education majors and early childhood education majors scored higher than the other ten majors. No significant difference of preservice teachers’ LOC scores is found to exist between those with and without EE experience.

6. Significant differences of preservice teachers’ attitude scores are found to exist among subjects differing in gender, grade, and EE experience. Females scored higher than males; juniors scored higher than freshmen; early childhood education majors scored higher than the other eleven majors; preservice teachers with EE experience scored higher than those with no experience.

7. Significant differences of preservice teachers’ perception scores are found to exist among subjects differing in gender and major. Females scored higher than males; and art education majors and school administration majors scored higher than the other ten majors. No significant difference of preservice teachers’ perception scores is found to exist between grades and different EE experience.
8. A significant positive relationship between preservice teachers' LOC and attitudes regarding EE was found. The greater the internality regarding effort of learning/teaching EE, the more positive the attitude toward learning/teaching EE.

9. A significant positive relationship between preservice teachers' LOC and perceptions regarding EE was also found. The more internal those individuals regard EE effort, the more positive EE dimensions are perceived to be by individuals.

10. A significant positive relationship between preservice teachers' attitudes and perceptions regarding EE was found. The more positive the EE dimension is perceived to be by individuals, the more positive the attitude toward learning/teaching EE.

11. Among the variables examined, preservice teachers' LOC regarding EE, perception of EE, and grade level are predictive of attitudes toward EE (collectively explained 41.58% of the variance, with perception of EE as the best predictor). Preservice teacher's perception of EE is predicted by LOC, and attitude toward EE (collectively explained 41.58% of the variance with LOC as the most powerful predictor).

Discussion and Implications for Practice

Some important demographic relationships were revealed:

1. Preservice teachers moderately agreed that their actions to offer EE could bring desirable outcomes in EE; preservice teachers possess a positive attitude toward and a positive perception regarding EE learning and teaching. Basically the attitudes toward learning EE were very close to that of teaching. The finding seems to indicate that preservice teachers are receptive to EE. It seems also to demonstrate that EE in Taiwan has made some progress.
2. The study showed the high internality of most of the preservice teachers who knew and accepted useful strategies for learning and for teaching EE. However, they were not convinced that they could infuse EE content into mathematics or include mathematics within EE learning and EE teaching. The possible explanation is that in secondary school instruction of Taiwan, there are few teachers who include mathematics within their teaching except science teachers. Preservice teacher's EE training in Taiwan ought to address this fact and make efforts to improve it. Perhaps some US materials such as AIMS, incorporated into the curriculum, could provide examples for teachers to follow.

3. Nearly 1 of 5 of the respondents saw EE teaching as difficult and boring. Preservice teachers are not quite as willing to learn EE as they are to teach EE, although learning EE is quite stimulating, effortless, and appropriate when compared to teaching EE. This finding seems to tell us that preservice EE training program should focus on interesting topics and use innovative methods so that learning is perceived as valuable and fun. Project WET has examples that should be modified for Asian audience. Otherwise, preservice teachers' understanding and supporting the nature and the need of EE learning and teaching do not certainly promote their strong attitude toward EE action.

4. Preservice teachers did not quite know how to find people to help them develop teaching materials. The possible explanation is that preservice teachers training did not offer sufficient information on people and institution resource for developing teaching materials.
5. Preservice teachers, who are females, freshmen, physical education major or early childhood education major, appear to have a higher internality toward EE learning and teaching than those of males, juniors, and the other ten majors.

The findings were in accordance with what was previously found by Haury (1983; 1984), Smith–Sebasto (1995), and Whitescarver (1976) in regard to the effect of age and gender on LOC; but were not consistent with Radford et al. (1993) in regard to the effect of gender and age on LOC.

Haury (1983) found that within the range of experiences currently gained by preservice teachers, SciLOC orientation does not seem to be systematically affected. He also found that age is positively related to SciLOC internality, and proposed that successful resolution of life experiences along the pathway to becoming a teacher contributes to a sense of personal efficacy (Haury, 1984).

Smith-Sebasto (1995) found that after taking EE coursework, students’ internal LOC was strengthened, and resulted in greater environmentally responsible behavior. Whitescarver (1976) found that there were significant differences between females and males, with females scoring higher on the Concern and Verbal Commitment subscales.

Radford et al. (1993) investigated LOC in preservice teachers and reported that there were no significant differences noted when the students (freshmen) were compared by age and gender. Females may have a higher internality toward EE learning and teaching than males. Probably that is because females take more environmental responsibility as one of their roles both at home and at school in Taiwan. As for the difference between grades, the possible explanation is that freshmen have been at teachers college for a shorter time.
than juniors. More recent the student graduate from high school years, the lesser the
effects of previous experiences on their internal LOC weakens. During high school years,
all students are required to clean their classroom and schoolyard. They make
contributions on beautifying the environment and perceive that they can affect
environmental change. Such experiences during high school help them appear to have a
higher internality toward EE. Teachers colleges should reinforce the positive behaviors
done in high schools.

Physical education majors appear to have a higher internality toward EE learning and
teaching. The possible explanation is that they realized one of their teachers who was
being a coordinator of EE center to do the EE things such as workshops for inservice EE
training. Staff members of physical education also emphasize the students' action for the
school campus environment and more environmental activities. Physical education majors
also have more opportunities to take outdoor trips for EE.

Also early childhood education majors appear to have a higher internality toward EE
learning and teaching. Among all different majors, early childhood education majors are
also the only ones who ever went to kindergarten doing practical teaching that includes
beautifying the environment. Perhaps these factors are helpful in developing their higher
internality.

6. Preservice teachers comprised of females, juniors, early childhood education
majors, or with EE experience appeared to have a more positive attitude toward EE
learning and teaching than those of males, freshmen, the other eleven majors, or those
with no EE experience.
The findings were in accordance with what was previously found by Johnson et al. (1974), Taiwo (1981), Hauser (1995) and Specca & Iozzi (1984) in regard to the effect of experience on attitude; but were not consistent with Taiwo (1981) in regard to the effect of gender on attitude.

Johnson et al. (1974) reported that attitudes of their samples become more positive after science instruction. Taiwo (1981) found that previous exposure to science education is positively correlated with the favorableness of the population’s attitude toward science teaching. Early childhood education majors in this study also show higher scores on LOC, attitude, and perception scales than the other majors who did not take EE credits. Early childhood education majors are required to take the course “environmental science” when they are juniors. The other majors enrolling at the other departments of the College are not offered and required to take environmental science” credits except the science education majors when they are seniors. Moreover, teaching young children involves more interdisciplinary-multidisciplinary activities and more service activities, almost the same as EE does.

Hauser (1995) reported that attitudes are not by nature instinctive, but rather learned through experience. Specca & Iozzi (1984) suggest that perhaps through completion of courses related to the environment, individuals strengthen their basis for more strongly supported attitudes.

Why do preservice juniors have a more positive attitude toward EE learning and teaching than those of freshmen? The possible explanation is that juniors have more EE information and know the importance of EE more than freshmen. Perhaps we also could
use the reasons mentioned above for LOC to explain why preservice teachers comprised of females, and early childhood education majors appeared to have a more positive attitude toward EE learning and teaching than those of males, and the other eleven majors. Additionally, perhaps the EE experience is helpful in increasing the understanding of EE and its importance, and to promote preservice teachers' positive attitudes toward EE learning and teaching.

7. Females, art education majors and school administration education majors appeared to have a more positive perception of EE learning and teaching than those of males, and the other ten majors.

The findings were in accordance with that previously found by Yang (1993) in regard to the effect of gender and major on attitude. Yang found that on individual items dealing with the need for EE, the need for curriculum development, willingness of participation, and acceptance of and support for EE, the ratings assigned by education majors were higher than the mean ratings of the industrial arts majors and science majors. Females tended to show more acceptance of and support for EE than males on all individual items. No significant difference in confidence in the ability to conduct EE was found across grade levels in industrial arts major. The perception of readiness to teach environmental concerns differed significantly among the three majors.

What could explain why females appeared to have a more positive perception of EE learning and teaching than those of males? Applying the reasons for females' higher LOC scores mentioned as above that females in Taiwan are concerning with how to maintain and improve environment and teaching their children to do environmental work than
males, it can be expected that females appeared to have a more positive perception regarding EE learning and teaching than males.

As to the difference in majors, art education majors generally like beautiful environment and have more opportunity to participate in designing and beautifying the school environment. School administration education majors, comparatively understand the importance of EE more than those of the other majors because they realize that keeping the school environment beautiful and comfortable is an important work for a school. Maybe these factors influence the respondents to have a more positive perception of EE learning and teaching than the other majors.

If EE is perceived primarily as making the environment beautiful, the results are not surprising. Perhaps teachers colleges need to broaden what EE is in the students’ minds, so more people can invest energy in it. Androgyny is a predictor of behavior, so males need to feel they have power over something important to them (not just flower garden).

8. The findings related to internality and positive attitudes were in accordance with Rowland and Stuessy (1989), Burow (1976), Soh (1988), and Haury (1988, 1989) in regard to the association between LOC and attitude toward instruction.

Rowland and Stuessy (1989) reported that a positive attitude towards science is correlated with an internal of LOC. One would expect an increase in internality to be accompanied by an improvement in attitude towards science.

Burow (1976) found that there was a significant relationship among secondary science students’ LOC and their attitudes toward science instruction. The more internally oriented individuals had a better attitude toward science instruction and tended to
perceive science instruction as being more inquiry oriented.

Soh (1988) reported that internal teachers were more flexible and positive toward change and responsibility. Haury (1989) found that SciLOC orientation is a major contributor to attitudes expressed toward science teaching among preservice elementary teachers.

The finding seems to support the reports and viewpoints of previously mentioned research that a positive association exists between LOC and attitudes. The studies all related to science attitudes. EE is most often considered a science related study. Perhaps focusing EE preservice instruction in the required science courses would be most effective in increasing EE across majors. With limited space in the preservice curriculum, a focus in one area may be better than diffusion of efforts across all curricula.

9. The more internal individual LOC scores are, the more positive the EE dimensions are perceived to be by individuals. Internality could be increased for more teachers if behavior options were available. If colleges introduce the kinds of environmental behavior from research such as Smith-Sebasto (1992), Hsu (1995), or Liu (1996), teachers will learn there are many behaviors available (not just school beautification). There is more opportunity to develop internals.

10. The more positive the EE dimension is perceived to be by individuals, the more positive attitude toward learning/teaching EE. The findings were in accordance with Stoner (1986) regarding the association between attitude toward and perception of learning/teaching EE. Stoner (1986) found that positive changes in attitude scores reflected changes in preservice teachers’ perception of the need to teach EE, their level of
comfort with the subject matter and the use of equipment and technology. If Taiwan teachers colleges were to work on these latter changes to increase student comfort with a diverse set of tools and techniques for learning/teaching EE, the result might be more positive attitudes.

This finding seems to support the reports and viewpoints of previously mentioned research that positive associations exist between the attitude toward and perception of learning/teaching.

11. Among the variables examined, preservice teachers' LOC regarding EE, perceptions of EE and grade level can have explicit prediction of attitudes toward EE (perception of EE is the best predictor); LOC regarding EE and attitude toward EE can have explicit prediction of preservice teachers' perception of EE (LOC of EE was the most powerful predictor). The finding revealed that variables of demographic characteristics such as gender, major and EE experience are not powerful predictors. It seems also to support the tight relationship between preservice teachers' LOC regarding EE, attitude toward EE and perception of EE. Of course, the further study is necessary. In the meantime, however, organizers of preservice curriculum should be concerned that EE experience is not a predictive factor. The character and quality of EE workshops should be evaluated, probably by an external observation, and strengthened to become empowering and facilitating experience for the participants. Successful models include the “national” curriculum of Project Wild, etc., and the inservice training by Fortner and Miller (1997), Mayer & Fortner (1993) and Lane, et al. (1994).
Recommendations for Practice

Based on the findings and their implications, the following recommendations are suggested for the curricula used in and the teaching and learning strategies of EE in Chiayi teachers college in Taiwan.

1. Male preservice teachers scored lower than females in LOC, attitudes toward and perceptions of EE scales. Preservice EE training should be strengthened for males by uncoupling EE from school beautification and focusing it instead on the learning of subject matter in an environmental context. The active, outdoor aspects of physical education could be used in other curricula.

2. As there is a significant positive relationship between preservice teachers’ LOC, attitude toward and perceptions of EE, preservice EE training should enhance externals’ training to become aware of the many kinds of environmental behavior and instances over which they have control.

3. Environmental educators and teachers training institutions should examine their EE curricula and teaching strategies to determine how an internal LOC may be best developed in preservice teachers. Teachers may not all foresee EE in the same way. Perhaps assignments in curriculum construction would focus attention on how EE fits in their areas.

4. Music education majors scored lower than those from most other departments, especially regarding attitudes toward EE; and natural science education majors did not score high. Preservice EE training institutions ought to explore the real reasons to this deficiency and design suitable EE curricula/activities for promoting the students’ positive
changes in LOC, attitude and perception regarding EE in all subject areas. Again, some international models could be emulated.

5. Preservice EE training institutions and elementary schools should establish an EE center which offers enough EE materials and information to help preservice and inservice teachers learn EE. Let them feel that learning EE is not so difficult and helpless, and encourage them to be willing to learn EE. Good models and eager assistance to teachers could result in more enthusiasm for EE.

6. Nearly 1 of 5 of the respondents believed EE teaching seems difficult and boring. Preservice EE training institutions should examine their programs to assure that they are providing interesting instruction. Students who like to learn help develop a stronger attitude toward EE action.

7. Preservice teachers did not quite know how to find people to help them develop teaching materials. Preservice EE training should develop students' information finding skills and offer ample resource information on people and institutions to help preservice teachers nurture expertise in developing and using instructional materials.

Suggestions for further research

Several suggestions are recommended for further research:

1. Additional research should be conducted to compare the difference between preservice teachers' and inservice teachers' LOC, attitudes and perceptions regarding EE to explore the effect of teachers training on classroom practice.

2. In order to get a more complete set of predictors between background factors and preservice teachers' LOC of, attitude toward and perception of EE, additional
research could be conducted by investigating other variables such as family region of residence, parents' occupation, mass media use.

3. This study should be enhanced and replicated with other teachers colleges student populations. Findings from such studies would provide the further information for determining the extent to which the data from this study may be generalized to this population.

4. A study exploring whether significant differences exist between preservice teachers of science major and non-science major regarding LOC, attitude, and perception of EE is suggested. Findings from such study would provide the further information for understanding the influence of science instruction on teachers' LOC, attitude toward, and perception of EE.
BIBLIOGRAPHY


APPENDIX A

PANEL OF EXPERTS FOR ESTABLISHING VALIDITY

OF THE INSTRUMENT IN ENGLISH VERSION
Panel of experts for establishing validity of the instrument of English version

Rosanne W. Fortner, Ed.D.  Professor, School of Natural Resources  The Ohio State University

David L. Haury, Ph.D.  Professor, School of Teaching and Learning  The Ohio State University

Joseph E. Heimlich, Ph.D.  Professor, School of Natural Resources  The Ohio State University
APPENDIX B

PANEL OF EXPERTS FOR ESTABLISHING VALIDITY

OF THE INSTRUMENT IN CHINESE VERSION
Panel of experts for establishing validity of the instrument in Chinese version

Hwa-Wei Ko, Ph.D.  Professor, Department of Psychology  
National Chung Cheng University

Jung-Jing Jeng, Ph.D  Professor, Department of Biology;  
Graduate Institute of Science Education  
National Taiwan Normal University

Shun-Mei Wang, Ph.D.  Professor, Graduate Institute of Environmental Education  
National Taiwan Normal University

Ming-Ching Shih, Ed.D  Professor, Department of Math & Science Education  
National Hualien Teachers College

Mao-Neng Li, Ph.D  Professor, Department of Elementary Education  
National Chiayi Teachers College

Chao-Yang Chen, Ed.D.  Professor, Graduate Institute of Elementary Education  
National Chiayi Teachers College
Dear expert,

The clarity and comprehensibility of the enclosed questionnaire need your help. The questionnaire is to identify preservice teachers’ locus of control, attitude toward and perception of environmental education (EE) in a teachers college. Thank you for taking time out of your busy agenda to read the questionnaire.

Locus of control items intend to measure a belief in one’s control and group control over the efforts of EE if that individual were to learn and to teach EE. Attitude items are to measure one’s feelings toward learning and teaching EE; how much support, aspiration, and anxiety preservice teachers means to learn and to teach EE is of interest. Perception items are to measure one’s opinions toward learning and teaching EE as well. To establish the content validity of the instrument, please respond to the following questions:

1. Do the items measure intended content areas?

2. Are the description on the cover page and the directions preceding each section clear?

3. Are the description/wording of the items clear? Which items need to be clarified again?

4. Is the format appropriate? Does it need any change?

5. Is the questionnaire easy to use?

Please feel free to write other comments on the questionnaire. Your comments will be helpful for this instrument and are greatly appreciated.

Respectfully,

Bao-Lian Chang

Associate professor, Mathematics and Science, National Chiayi Teachers College
Ph.D. candidate, College of Education, The Ohio State University
APPENDIX D

LETTER TO CHAIRPERSON
Dear chairperson,

We are asking for your permission and support in allowing us to distribute four questionnaire forms to students in your departments. Enclosed is a set of the materials to which students will be asked to respond.

Students will be informed that their participation is earnestly solicited, their involvement is strictly voluntary, their responses will be treated in the aggregate (not individually) and with the strictest of confidence, and that their participation, or lack thereof, will in no way have an effect on their evaluation.

Again, your permission, cooperation and support are earnestly solicited for this research effort.

Respectfully,

Rosanne W. Fortner, Ed.D.  Bao-Lian Chang
Professor, School of Natural Resources  Ph.D. Candidate, College of Education
The Ohio State University  The Ohio State University
Dear participant,

Thank you for taking time out of your busy courses to answer the questionnaire. The influence of environmentally responsible individuals among students will be determined in great part by the willingness of elementary teachers, especially you. In the future you are expected to join with environmental educators to facilitate the efforts of environmental education (EE) in Taiwan. Your participation this time is one starting point.

EE is an educational process that helps people gain the knowledge, skills, value, motivation, and commitment to take responsibility for maintaining a quality environment. EE typically needs to use other content areas as vehicles for promoting environmental knowledge and skills and for infusing environmental content without threatening course integrity. Considerable number of educators and institutions propose training teachers in infusion techniques. Moreover, the majority of inservice teachers in Taiwan recommend that teacher training schools offer EE courses to preservice teachers.

The main purpose of this study is to discover your EE-related feelings. We are asking you to complete the questionnaire which has four sections: locus of control, attitude toward EE, perception of EE, and demographic information. In the beginning of each section you will find directions on how to complete the section. Please respond to all sections carefully and completely. The information you provide is crucial to an effort of developing EE training programs to meet the needs of preservice teachers.

Your answers are important regardless of how much you think you will do or do not know about EE. There are no right or wrong answers per se; the only right answers are ones that best reflect your true personal feelings. Please answer with your true feelings, not with what you think is right, or morally or socially correct. Your responses will be kept in the strictest of confidence.

Thank you for your cooperation and help.

Respectfully

Rosanne W. Fortner, Ed.D.       Bao-Lian Chang
Professor, School of Natural Resources       Ph.D. Candidate, College of Education
The Ohio State University       The Ohio State University
PART ONE: Demographic Information

DIRECTION: Please provide demographic information by placing a check (✓) in the place by each of the following questions.

1. Your gender
   □ (1) Male
   □ (2) Female

2. Your grade
   □ (1) Freshman
   □ (2) Junior

3. What is your major or department? (Note: if you are freshman of Mathematics and Science Education or Elementary Education, please circle the one which you will choose in your junior year, but if you are junior of them now, please circle the one you have chosen)?
   □ (1) Language and Literature Education
   □ (2) Social Studies Education
   □ (3) Music Education
   □ (4) Special Education
   □ (5) Early Childhood Education
   □ (6) School administration
   □ (7) Counseling and guidance
   □ (8) Physical education
   □ (9) Arts education
   □ (10) Teaching Resources
   □ (11) Mathematics
   □ (12) Natural science

4. Have you ever had experience with EE activities?
   □ (1) Yes
   □ (2) No

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PART TWO: Preservice Teachers' Locus of Control

**DIRECTION:** The purpose of this section is to measure the extent you believe your personal or group action can influence the outcome of environmental education (EE) efforts. There are no right or wrong answers per se. You should respond to the next statements by marking the number that best agrees with your thoughts, you have six choices:

<table>
<thead>
<tr>
<th></th>
<th>1 = Firmly Disagree (FD)</th>
<th>2 = Moderately Disagree</th>
<th>3 = Slightly Disagree</th>
<th>4 = Slightly Agree</th>
<th>5 = Moderately Agree</th>
<th>6 = Firmly Agree (FA)</th>
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<td>1</td>
<td>I could influence environmentally responsible behavior among students if I were to:</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>Take credits in EE</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Incorporate environmental topics into the curriculum I will be teaching to students</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Learn about ecological concepts from science courses</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Teach skills in citizen participation</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Convince my teaching schools to have commitment to EE</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Use environmental video sources from public television service as teaching materials</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>Work with others to develop EE curriculum materials for elementary students</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>Attend EE training programs in a teachers college</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>10</td>
<td>Relate EE to the intellectual and spiritual side of students</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>Learn from math courses how to quantify environmental problems to convince decision makers</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>12</td>
<td>Teach math through environmental situations</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>Convince teachers college to support EE</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
I could influence environmentally responsible behavior among students if I were to:

<table>
<thead>
<tr>
<th></th>
<th>13. Use carefully monitored hands-one experience as the route to quality EE</th>
<th>14. Attend outdoor training programs</th>
<th>14. Teach music through creating a symphony of rainforest sounds to promote students a concern about the fate of rainforest in the world</th>
<th>15. Use math to measure interaction among/between the parts of the environment</th>
<th>16. Convince institutions to require preservice teachers to demonstrate competencies in EE</th>
<th>17. Use recorded music resources into teaching EE</th>
<th>18. Learn more about EE</th>
<th>21. Select the appropriate curriculum materials to the teaching of EE in elementary schools</th>
<th>22. Promote a predetermined societal environmental ethic among students I will be teaching to</th>
<th>23. Convince institutions to conduct an EE information data exchange and service center</th>
<th>24. Work with others to teach EE in elementary schools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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PART THREE: Attitudes Toward Environmental Education

DIRECTION: The purpose of this section is to measure your personal attitude toward learning and teaching environmental education (EE). There are several descriptive scales below and each scale is based on two concepts such as good and bad.” There are no right or wrong answers per se. You should respond to the next scales to by placing one check (✓) that best match with your true feelings, you have 7 choices:

<table>
<thead>
<tr>
<th>If example is:</th>
<th>Means your answer is:</th>
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</table>

What I feel about learning environmental education is:

If example is:

<table>
<thead>
<tr>
<th>good</th>
<th>bad</th>
<th>Means your answer is:</th>
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<tr>
<td>_</td>
<td>_</td>
<td>Very good</td>
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<td>_</td>
<td>_</td>
<td>Moderately bad</td>
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<td>Slightly good</td>
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<td>_</td>
<td>_</td>
<td>Equally between them</td>
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<td>_</td>
<td>_</td>
<td>Slightly bad</td>
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<tr>
<td>_</td>
<td>_</td>
<td>Moderately bad</td>
</tr>
<tr>
<td>_</td>
<td>_</td>
<td>Very bad</td>
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</table>

What I feel about teaching environmental education is:

valuable ___:___:___:___:___:___:___ worthless
appropriate ___:___:___:___:___:___:___ inappropriate
important ___:___:___:___:___:___:___ unimportant
necessary ___:___:___:___:___:___:___ unnecessary
effortless ___:___:___:___:___:___:___ difficult
to take much time ___:___:___:___:___:___:___ not to take much time
willing ___:___:___:___:___:___:___ unwilling
comfortable ___:___:___:___:___:___:___ uncomfortable
capable ___:___:___:___:___:___:___ incapable
enjoyable ___:___:___:___:___:___:___ not enjoyable
stimulating ___:___:___:___:___:___:___ boring
favorable ___:___:___:___:___:___:___ unfavorable
PART FOUR: Preservice Teachers' Perceptions Toward Learning and Teaching Environmental Education

DIRECTION: The purpose of this section is to determine your opinions toward learning and teaching environmental education (EE). There are no right or wrong answers per se. You should respond to the next statements by marking the number that best agrees with your views, you have six choices:

1 = Firmly Disagree (FD)
2 = Moderately Disagree
3 = Slightly Disagree
4 = Slightly Agree
5 = Moderately Agree
6 = Firmly Agree (FA)

A. EE preservice learning/training

1. The key to successful K-12 EE is the classroom teachers
   FD 2 3 4 5 6

2. Institutions should provide an inventory of preservice training in EE programs
   FD 2 3 4 5 6

3. Teachers who lack EE knowledge and skills will not develop EE programs
   FD 2 3 4 5 6

4. EE workshops are an excellent way to increase knowledge of EE
   FD 2 3 4 5 6

5. Nonscience majors should not be required to have competencies in EE
   FD 2 3 4 5 6

6. The role of art in a teachers college can develop in preservice teachers an aesthetic awareness and sensibility to the environment
   FD 2 3 4 5 6

7. Linking EE concepts and methods into existing teaching method courses is the perfect way to begin EE in a teachers college
   FD 2 3 4 5 6

8. There is a current need to prepare teachers to teach skills for citizen participation in environmental problem solving
   FD 2 3 4 5 6

9. Art programs in a teachers college should link environmental topics into learning experiences offered to students
   FD 2 3 4 5 6
A. EE preservice learning/training

10. Creative writing on environmental topics is an excellent way to incorporate EE into language arts

11. A teachers college should have an EE center that can offer students a complete and quality program in EE

12. All existing training courses in a teachers college can and should be concerned with the conservation of natural resources and contamination of the environment

13. Without well trained and motivated teachers, the best designed curricular programs will not lead to successful EE

14. It is acceptable that teachers feel no responsibility to develop environmental education

15. It is necessary to provide teachers with EE competencies to environmentalize their instruction

16. All aspects of the language arts in a teachers college have an important role to play in EE for preservice teachers

17. Achievement of preservice teachers' competencies in EE is a necessary component of teacher education

18. It is right that all preservice teachers in a teacher college are required to take a minimum number of credits in EE

19. I would rather be required to emphasize the EE competencies in preservice training courses than to specify a minimum number of credits in EE

20. I would rather let EE be incorporated into existing preservice training courses than to be added to as a separate subject area

21. I think institutions should incorporate environmental issue analysis/investigation into preservice EE training

22. I am looking forward to taking a workshop that has credit in EE
B. EE teaching

<p>| | | | | | |</p>
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</thead>
<tbody>
<tr>
<td>1. You do not have to be good in science to be good at teaching EE</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<tr>
<td>2. Hands-on experiences are a good way for elementary students to learn about the environment</td>
<td>1</td>
<td>2</td>
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<tr>
<td>3. Science has many opportunities for developing ecological concepts in the area of EE</td>
<td>1</td>
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<tr>
<td>4. Music and story telling are particularly effective tools for teaching EE</td>
<td>1</td>
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<td>5. Mathematics has many opportunities for data interpretation in the area of EE</td>
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<tr>
<td>6. Math in elementary school can not be taught through environmental situation</td>
<td>1</td>
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<td>7. It is not necessary to survey students’ and teachers’ need early before EE teaching materials are developed</td>
<td>1</td>
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<td>8. Any subject area can be EE because the goal of EE is to prepare citizens capable of acting on behalf of the environment</td>
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<tr>
<td>9. Social studies has many opportunities for developing citizenship action skills in environmental problem solving</td>
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<td>10. Writing on environmental problems occurring in the community is a good way to begin EE in my classroom</td>
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<tr>
<td>11. Incorporating environmental issue analysis/investigation into existing courses in elementary schools is impossible</td>
<td>1</td>
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<tr>
<td>12. It is right to develop a social ethic about the environment</td>
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<td>13. EE involving pre-school and early primary school children should concentrate on the emotional aspects of environmental appreciation</td>
<td>1</td>
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<td>14. EE is issue-oriented, therefore, it provides a multidimensional approach across the disciplines of science and others</td>
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B. EE teaching

15. Environmental topics facilitate the development of process and higher level thinking skills while engaging learners in the construction and application of knowledge

16. Language arts has many opportunities for identifying environmental problems through creative writing

17. I prefer to teach environmental education in elementary schools by relating environmental education to the intellectual and spiritual side of students

18. I prefer to teach EE in elementary schools by providing students more outdoor experiences or field trips

19. I prefer to teach EE in elementary schools by promoting a predetermined societal environmental ethic

20. I do not think people can help me develop EE teaching materials

21. I think I can find some curriculum materials for teaching EE in elementary schools

22. I know how to find people who can help me develop EE teaching materials

23. There is a spiritual side of EE that I am looking forward to teaching in elementary schools because it helps students become more conscious about the environment

*Does the questionnaire promotes you any thinking about teaching EE?

☐ (1) No

☐ (2) Yes (If you have any thinking about EE teaching, please write down your thoughts in the following blanks)

THANK YOU for your participation!

Please check your answers! Thanks again!
APPENDIX F

QUESTIONNAIRE (A VERSION IN CHINESE)
親愛的嘉義師院同學：

您好！這份問卷是想了解您對環境教育的想法及看法。所謂的「環境教育」是指藉由教育過程，促使公眾提高環境品質。教師們的教育意願，通常會影響環境教育的努力成果。師生的您將被期待加入環境教育陣容，您的這次參與可說就是一個開始。無論您對環境教育是否有深入的了解，您提供的資料，對環境教育職前訓練如何符合職前教師的需求，是很重要的。

本問卷共有四個部分：（1）個人基本資料；（2）職前教師的認知信念；（3）職前教師對環境教育之決議與學術態度；（4）職前教師對環境教育之決議與學的看法。請您認真每一部分的敘述和作答說明後再填答。

本問卷並沒有對或錯的答案，請按你個人的想法與看法作答。您所填寫的資料，僅供學術研究用，絕對保密。謝謝您的協助與合作！

敬祝
學業進步，事事如意！

美國俄亥俄州立大學
自然資源學院暨
教育學院教授
Dr. Rosanne W. Fortner

國立嘉義師範學院
數理教育系副教授

美國俄亥俄州立大學
博士候選人

張寶連 敬上

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環境教育問卷

環境教育教導人們有能力和責任去維持一個有品質的環境。例如如何立下一個河川潔淨計畫，如何讓學生在作文課裡以環境污染為題，如何小心地施用農藥，如何多種樹來減少水土流失，以及如何寫信給決策者表現公民參與技能，都是實際在為環境作教育工作。

環境教育通常需要融入其他課程領域裡，去推動環境知識和技能，而不影響這些課程的原來狀態。所以，有相當多的教育家和機構，建議訓練老師們這種融入的技術。更有進者，絕大多數在台灣的在職教師，建議師院及師大提供環境教育職前訓練課程。

第一部份：個人基本資料

作答說明：請將您個人資料勾選於適當□中

1. 性別： □(1)男 □(2)女
2. 年級： □(1)大一 □(2)大三
3. 系組別：（初教系、數理系一年級同學，組別請選以後可能選的組別）
   □(1)語文系 □(2)社會系 □(3)音教系 □(4)特教系 □(5)幼教系
   □(6)初教系行政組 □(7)初教系輔導組 □(8)初教系體育組
   □(9)初教系美勞組 □(10)初教系數學資源組
   □(11)數理系數學組 □(12)數理系自然組
4. 有無參與過環境教育活動？ □(1)有 □(2)無

第二部份：職前教師的制握信念

作答說明：這部份的所謂制握信念問卷，是用來測量您對您以個人或團體行動方式，可影響學生產生有責任的環境行為的您的自信程度。下面的問題其答案並無對錯，請按您個人的看法，圈選最符合您意見的答案，您有六個選擇：

非常不同意 .................. 1
中度不同意 .................. 2
稍微不同意 .................. 3
稍微同意 .................... 4
中度同意 .................... 5
非常同意 .................... 6
一、我能夠影響學生產生有責任的環境行爲，如果我...

非 中 稍 稍 中 非
常 度 微 微 度 常
不 不 不 同 同
同 同 同 同 意 意 意
意 意 意

1. 修環境教育課程的學分...........................................1 2 3 4 5 6
2. 將環境題材融入我將來要教給學生的課程中......1 2 3 4 5 6
3. 從自然科學課程中學習生態概念.........................1 2 3 4 5 6
4. 教公民參與的技能..................................................1 2 3 4 5 6
5. 說服任科學校實施環境教育.................................1 2 3 4 5 6
6. 使用公共電視的視聽媒介資源作爲教材............1 2 3 4 5 6
7. 以和別人合作的方式去發展小學的環境教育課程教材...1 2 3 4 5 6
8. 參加師院舉辦的環境教育訓練課程....................1 2 3 4 5 6
9. 導引環境教育至學生的理性及精神層面..............1 2 3 4 5 6
10. 從數學科目中學習如何量化環境問題
    ，以便說服作決定者...........................................1 2 3 4 5 6
11. 透過環境情境來教數學...................................1 2 3 4 5 6
12. 說服師院支持環境教育...................................1 2 3 4 5 6
13. 透過親身blend的動手做經驗，以達到有品質的環境教育......1 2 3 4 5 6
14. 參加戶外環境教育訓練課程..............................1 2 3 4 5 6
15. 在上音樂課時，引導學生製造森林中蟲鳴鳥叫風聲雨聲
    的交響聲音，以促進學生對森林遭濫砍濫伐的關心.....1 2 3 4 5 6
16. 使用數學來測量環境各部份之間的交互作用.........1 2 3 4 5 6
17. 說服學校要求職前教師具有環境教育的基本能力....1 2 3 4 5 6
18. 將生活、錄音帶音樂，故事，和社區藝術資源
    放進環境教育的教學中..................................1 2 3 4 5 6
19. 說服自己給的國小同業將環境教育融入既有的課程中....1 2 3 4 5 6
20. 學習更多的環境教育...........................................1 2 3 4 5 6
21. 在國小環境教育的教學中，選擇適當的教材........1 2 3 4 5 6
22. 促使我將來要教的學生具有社會環境倫理道德觀......1 2 3 4 5 6
23. 說服學校設置環境教育資源資料交換及服務中心......1 2 3 4 5 6
24. 以和別人合作的方式去教小學環境教育.............1 2 3 4 5 6

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第三部份：職前教師對環境教育的教與學態度

作答說明：這個部份問卷的目的是測量您對環境教育與教環境教育的態度。下面有一些問題敘述，每個問題建立在兩個概念上，如「好」與「不好」，答案並無對錯，重要的是您的感覺。回答這些問題時，請勾選最符合您感覺的答案。您有七個選擇：

如選的是：

表示您的答案是：

好：好
不好：不好

一、我覺得我教環境教育是:

1. 值得的
2. 合適的
3. 重要的
4. 終身的
5. 需要的
6. 容易的
7. 喜歡的
8. 有意願
9. 興奮的
10. 好奇的
11. 浪費時間

不值得的
不合適的
不重要的
暫時的
不需要的
困難的
不喜歡的
沒有意願
無聊的
不好奇的
不浪費時間

二、我覺得我教環境教育是:

1. 值得的
2. 合適的
3. 重要的
4. 需要的
5. 容易的
6. 有意願
7. 膽任的
8. 樂意的
9. 刺激的
10. 喜歡的

不值得的
不合適的
不重要的
不需要的
困難的
沒有意願
不膽任的
不樂意的
枯燥的
不喜歡的
第四部份：職前教師對環境教育之教與學的看法

作答說明：這部份問卷的目的是要了解您對環境教育的師資養成及課程有關方面的意見，下面的問題，答案並無對錯，重要的是您的看法。回答這些問題時，請圈選最符合您看法的號碼。您有六個選擇：

非常不同意
中度不同意
稍微不同意
稍微同意
中度同意
非常同意

一、 對學環境教育的看法

1. 級任老師或導師是幼稚園到高中實施環境教育成功的关键
2. 師院應提供一個環境教育職前訓練的詳細計畫
3. 缺乏環境教育知識和技能的教師不容易取得環境教育計畫
4. 環境教育研習班是一種推進環境教育知識非常好的方法
5. 非科學科修者不應要求他具備環境教育基本能力
6. 師院的藝術課程，可以發展職前教師對環境的審美意識及敏感性
7. 將環境教育的概念和方法融入各科教材德法
8. 師院開始環境教育的最好方法
9. 培養教師及公民參與之技能
10. 師院藝術課程提供的學習經驗，應與環境主題相結合
11. 師院應該設有環境教育中心以提供學生完善的環境教育計畫
12. 所有師院既有的訓練課程，可以且應該
13. 如果沒有訓練良好及富有熱忱的教師，一個
14. 教師覺得沒有責任推展環境教育是可以接受的
15. 培養教師環境教育基本能力，使其能將教學環境化是必要的

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16. 師院的語文課程，可以在職前教師的環境教育扮演
重要角色。 ................................................................. 1 2 3 4 5 6
17. 職前教師在環境教育的基本能力表現，是師資養成教育
不可或缺的一部份。 ................................................................. 1 2 3 4 5 6
18. 要求所有師院學生最少修幾個環境教育學分是適當的。 ............ 1 2 3 4 5 6
19. 我銷售被學校要求加強環境教育所必備的基本能力，
而非被指定最少需修幾個環境教育學分。 ................................................................. 1 2 3 4 5 6
20. 我銷售讓環境教育融入既有的職前訓練科目中，
而非讓環境教育單獨成一門課。 ................................................................. 1 2 3 4 5 6
21. 我認爲學校應該使環境議題的分析調查，融入
職前環境教育訓練。 ................................................................. 1 2 3 4 5 6
22. 我希望參加由給學科的環境教育活動班。 ................................................................. 1 2 3 4 5 6

二、對教環境教育的看法

1. 你不必一定要科學能力好才可以把環境教育教得好。 ............ 1 2 3 4 5 6
2. 動手做的經驗，是適可學生學習有關自然環境的最好方法。 ... 1 2 3 4 5 6
3. 自然科有許多機會去發展生態概念。 ................................................................. 1 2 3 4 5 6
4. 音樂和故事是教環境教育很有效的工具。 ................................................................. 1 2 3 4 5 6
5. 在環境教育領域裡，數學科有很多機會去解釋資料。 ............ 1 2 3 4 5 6
6. 國小數學不能透過環境問題來教。 ................................................................. 1 2 3 4 5 6
7. 在發展環境教育教材之前，不必調查學生與教師的需要。 .... 1 2 3 4 5 6
8. 所有的課程領域都可算是環境教育，因環境教育的
目標在培養能代表環境來行動的公民。 ................................................................. 1 2 3 4 5 6
9. 社會科在環境問題解決方面，有許多發展公民行動技能
的機會。 ................................................................. 1 2 3 4 5 6
10. 以社區中發生的環境問題做為作文的題材，
是在我班級開始進行環境教育的好方法。 ................................................................. 1 2 3 4 5 6
11. 將環境議題專題論點的分析調查，融入國小既有的科目是
不可能的。 ................................................................. 1 2 3 4 5 6
12. 發展校園環境學裡的道德觀是適當的。 ................................................................. 1 2 3 4 5 6
13. 學前兒童和國小低年級兒童的環境教育，
應著重在環境的感覺與愛惜之情感面。 ................................................................. 1 2 3 4 5 6
14. 環境教育是議題導向，所以它提供一個
跨科學和其他學科的多元化途徑。 ................................................................. 1 2 3 4 5 6
15. 在幫助學習者建構與應用知識時，環境教育題材
   有助於過程及高層次思考技能之發展                      1 2 3 4 5 6
16. 語文科透過創作，有很多辨識環境問題的機會          1 2 3 4 5 6
17. 在小學的環境教育教學中，我比較喜歡將環境教育與
   學生之理性的和精神的層面相連結                           1 2 3 4 5 6
18. 在小學的環境教育教學中，我比較喜歡提供更多戶外
   經驗或實地參觀調查                                        1 2 3 4 5 6
19. 在小學的環境教育教學中，我比較喜歡提昇學生的社
   會環境倫理道德觀                                         1 2 3 4 5 6
20. 我不認為別人大可以幫助我發展環境教育的教材          1 2 3 4 5 6
21. 我想我可以找到一些國小環境教育的教材                1 2 3 4 5 6
22. 我知道如何找到可以幫助我發展環境教育教材的          1 2 3 4 5 6
23. 我期望在國小環境教育課程時能融入精神
   層面，因爲它能幫助學生變得更具環境意識              1 2 3 4 5 6

※本問卷有無促使您更進一步思考環境教育教學的問題？

□(1)無

□(2)有（如果有，請將您的想法寫在下面）

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

謝謝您的參與！
請再一次檢查有無漏答的地方。感激不盡！