ENVIRONMENTAL LITERACY: OUTDOOR EDUCATION TRAINING AND ITS EFFECT ON KNOWLEDGE AND ATTITUDE TOWARD THE ENVIRONMENT

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Abstract

Environmental learning presents a diverse range of training and program length to students. This training includes instruction by individual classroom teachers, interpretive centers providing partial day instruction, to residential centers providing up to week long instruction. Some programs provide exclusively natural and/or cultural history interpretation while others include adventure oriented components. In addition, staff training ranges from on-site learning to advanced degrees. The result is a potential for diverse outcomes for participant learning.

The level of environmental literacy in Minnesota sixth grade students was assessed. In addition, predictors of environmental literacy were determined using a non-equivalent control group design (Campbell and Stanley, 1963). Five different instruments were used to determine environmental literacy. They were a multiple choice questionnaire measuring conceptual knowledge; four semantic differentials measuring attitudes toward the concepts "Environment", "Human Population", "Water Pollution", and "Acid Rain". Results indicated subjects were moderately literate (50% correct responses on conceptual knowledge). In addition, respondents showed a higher conceptual knowledge toward environmental issues than ecological principles. The best predictors of environmental literacy were length of time spent at a nature center plus the interactive effects of site acreage, biodiversity, and quality of facilities.

Data were compiled and recorded by Jodi Stone, an undergraduate research assistant working under an Undergraduate Research Opportunity Program grant.
Introduction

Since the first Earth Day, many children and adults have received education in and about the environment. In turn, many outdoor educational programs have been developed since the 1970's. Environmental learning presents a diverse range of training and program length to students. Programs vary from partial day field trip type activities to multi-week residential experiences (Swan, 1985a). Some programs provide exclusively natural and/or cultural history interpretation while others include adventure oriented components such as canoe trips, rock climbing, and/or high ropes courses.

The presentation of the programs ranges from informal to formal with diverse subject matter (Mullins, 1984). In addition, staff training ranges from on-site learning to advanced degrees. Numerous studies have been conducted to attempt to measure the kinds and degree of environmental learning that has occurred through outdoor education (Marcinkowski, 1984; Swan, 1985a; Hanna, 1988). One of the goals of outdoor education has been to establish a level of “environmental literacy”. Rentsch (1973) developed an instrument to measure conceptual knowledge levels which would determine a person to be environmentally literate. Sia, et. al., (1985) established predictors of “responsible environmental behavior”. Similarly, some researchers have sought to determine which concepts are fundamental to environmental education (Roth, 1969; Townsend, 1982).

Participants gain such outcomes as better student-teacher relationships, improved self concept, and a positive attitude toward the natural world (Swan, 1985c). Further research has indicated that an educational experience in the outdoors can improve a person's knowledge and attitude toward the environment (Marcinkowski, 1984; Lozzi, 1984; Hanna, 1988).

Yet, with the efforts made by outdoor educators, certain questions persist. Questions such as how environmentally literate are people? Which kind of experience is most effective?

While educators strive to reach their students, the demands on the earth's resources continues to multiply at an alarming rate. The United States' worst oil spill has recently decimated the pristine waters along the Alaskan coastline. Irreparable damage may have destroyed vital spawning and feeding grounds for a major proportion of fish and wildlife of the region (Lemonik, 1989).

Acid deposition is destroying forests and aquatic ecosystems worldwide. The ozone layer of the atmosphere is threatened by chlorofluorocarbon (CFC) emissions. Population growth is threatening habitat diversity worldwide. Tourism and industrial demands are destroying wilderness areas at alarming rates (Brown, et. al., 1987). What impact do these implications have on individuals? What impact does outdoor education have on these individuals' behavior?

In the educational process, Roth (1969) has implied that an environmentally literate citizen is one which is:
1. Knowledgeable about the interrelated biophysical and socio-cultural environment of which man is a part.
2. Aware of the environmental problems which affect man.
3. Motivated to work toward an environment that is optimum for living.

To be environmentally literate is to possess a certain attitude and knowledge in order to behave responsibly toward the environment.

Although several studies have been conducted toward determining outdoor education and its effects upon environmental literacy, very few have been conducted since the 1970's. Further, no studies have compared the extent of environmental literacy gained to which type of environmental learning is received (Lozzi, 1984).

Within formal education, a student can receive education about the environment in the following ways:

1. Classroom instruction.
2. Field trip (partial day) experience.
3. Residential outdoor experience of a 2-3 day duration.
4. Residential outdoor experience of a 4-7 day duration.
5. Residential outdoor education of greater than one week.
6. Any combination of the above. (Swan, 1985b).

Although any age group does participate in outdoor educational programs, the majority of formal outdoor educational programs are utilized by elementary age children. One reason for this is because of greater time flexibility with intact classrooms. In addition, of elementary students, sixth grade students are most developmentally ready to comprehend concrete environmental concepts (Horvat, 1974; Backman, 1984; Engleison, 1985).

Therefore, this study attempted to explore and describe the change in environmental literacy in sixth grade students in Minnesota after participating in one of four different levels of environmental education training. Environmental literacy in the areas of conceptual knowledge and attitudes toward general ecological concepts and current environmental problems were measured. In addition, the relationship of the variables: level of environmental education, teacher training in environmental education, program staff training in environmental education, acreage of the site, biodiversity of the site, and quality of the physical plant as predictors of environmental literacy were investigated.

This study addressed the following research questions:

* Do the differences in the levels of training in environmental education a sixth grade student receives have a relationship to the level of the students' environmental literacy as measured by conceptual knowledge and attitudes toward the environment?

* What variables make a difference upon the degree of environmental education?
What factors can be used to predict environmental literacy?

The independent variables in this study were:

1. The level (duration) of training a student receives in environmental education.
2. The level of training of the teacher in environmental education.
3. The training level of the program staff in environmental education.
4. The program philosophy (adventure education and/or environmental education).
5. Acreage of the site.
7. The quality of the physical plant.

Demographic variables of interest were:

1. Students' gender.
2. Residence (urban, suburban, rural).
3. Race.
4. Achievement level (low, average, or high)

Methods

The research design used in this study is a Non-equivalent control group design (Campbell and Stanley, 1963). Four different kinds of instructional experiences were used to determine which kind of outdoor education yields the most literate student in the State of Minnesota. They were:

1. Classroom only (control) (n=89) (3 intact classrooms)
2. Field trip (one day field experience only) (n=93) (4 intact classrooms)
3. Weekend residential (2-3 days) (n=137) (5 intact classrooms)
4. Week long residential (4-7 days) (n=129) (5 intact classrooms)

Five classrooms from each category were randomly selected from a list of Outdoor Education Centers of Minnesota (Minnesota Naturalist's Association, 1989). With the average size classroom being 25 students (N=448), each student received a 31 item questionnaire. The instrument was administered on a pretest, posttest, and three month delayed posttest basis. The instrument was designed to measure attitudes and conceptual knowledge toward selected environmental issues and general ecological concepts. A semantic differential type instrument was used with four different attitude measures toward the environment. They were the concepts "Environment", "Human Population", "Acid Rain", and "Water Pollution". Cronbach's alpha was used to determine reliability of the attitude measures while a KR-20 alpha was used to determine the scores on the conceptual knowledge instrument (see table...
1 for reliability alphas). Thus, five different instruments were combined to serve as the determinant of environmental literacy. Data were analyzed with General Linear Modeling utilizing the procedures of multiple regression, ANCOVA, and the Tukey's studentized range post hoc test.

Table 1: Reliability alphas for each of the five instruments

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Field Test (n = 15)</th>
<th>Pretest (n=448)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>.71</td>
<td>.80</td>
</tr>
<tr>
<td>Human Population</td>
<td>.89</td>
<td>.85</td>
</tr>
<tr>
<td>Acid Rain</td>
<td>.83</td>
<td>.83</td>
</tr>
<tr>
<td>Water Pollution</td>
<td>.61</td>
<td>.91</td>
</tr>
<tr>
<td>Conceptual Knowledge</td>
<td>.75</td>
<td>.83</td>
</tr>
</tbody>
</table>

Results

The following items were the major findings toward environmental literacy.

* No single variable can be used to determine environmental literacy. Rather, it is the combined (interactive) effects of different variables that best predict and measure environmental literacy.

* A residential type field experience provided the greatest gain in students' conceptual knowledge. Conversely, there were no statistically significant differences in conceptual knowledge between the control group and the field trip type experience.

* The greatest effects on students' attitudes toward the environment were: predisposing factors; place of residence; and achievement level.

* Race was not found to be a factor determining environmental literacy.

* The interactive effects of gender by achievement level by residence was the best predictor of attitudes toward the concept "Environment". Girls from the country with either average or high achievement levels, and boys with high achievement levels from the city, had the most positive attitude scores.
* Students' attitudes toward the concept "Acid Rain" were most influenced from events outside the scope of the study.

* The nature center attributes most effecting students' environmental literacy were the interactive effects of acreage by biodiversity by quality of the facilities. No school sites provided adequate attributes to enhance student's environmental literacy through direct experience.

* Students were more aware of and knowledgeable about environmental issues than ecological principles.

* 8% of the respondents correctly identified decomposers as part of the food chain.

* Attitude scores were as follows:

  Environment: Slightly positive (mean = 4.6-5.6)  
  Human Population: Neutral (mean = 4.0)  
  Acid Rain & Water Pollution: Strong negative (mean = 2.0)

* Conceptual knowledge: moderate (mean = 50% correct responses)

* Nature centers used adventure education activities in 14% of their activities. 100% of the study sites responded that adventure education activities were not used to increase environmental literacy.

* Students retained their knowledge and attitudes from their field experience after three months.

* Staff training had an influence on student's knowledge in the posttest but was not a significant factor in the delayed posttest.

**Conclusion**

The number of independent and dependent variables created a study of large scope. There were several different conclusions made from the findings. They were as follows:

* The majority of classroom teachers in Minnesota have neither the training nor facilities to provide adequate environmental education.

* Nature centers, both residential and non-residential, need to play a key role in assisting student's learning about the environment. This implies that nature centers need to take a more deliberate role in being active members of the formal (K-12) education system.
* The longer a student is exposed to environmental education with direct experience, the more environmentally literate they will be.

* As in any form of literacy, there are several different factors affecting environmental literacy with no single factor being the greatest effect.

* Minnesota sixth grade students’ need to raise their conceptual knowledge toward basic ecological principles. Attitudes toward issues without adequate knowledge make finding solutions difficult. For instance, students may be aware that waste disposal is a problem. Yet, if role of decomposers in the food chain are not recognized, then behavioral change toward preventing the waste problem will be harder to achieve.

* Students' personal attributes (gender, residence, achievement level) indicated that there are differing perceptions toward environmental issues rather than one group being more or less literate than another.

* Children from the city showed a more negative attitude toward the concept "Human population" than children from the country. Children from the city and suburbs had more negative attitudes toward the concept "water pollution" than rural children. Conversely, children from the country had more positive attitudes toward the concept "environment".

* The strongest nature center predictors were the combined effects of acreage, biodiversity, and quality of facilities. There are few schools in Minnesota that provide any of the above attributes. Thus, the role of nature centers is emphasized in serving as a field site for classroom teachers. Most important, however, is how the facility is used as well as having a variety of resources available. There is no single kind of habitat or type of facility that best predicts environmental literacy. It is more important that the facility provide education appropriate to the bio-region.

* Students learn more about the environment when with an adequately trained instructor.

* Adventure education activities should be more deliberately incorporated into students education about the environment. Adventure activities often provide the greatest opportunity for learning through personal meaning.

* Non-residential nature centers have an opportunity to work more closely and frequently with classroom teachers. They have the greatest access to students because of their proximity to individual schools. It appears that preparatory and follow-up lessons for single day experiences are inadequate. This is not a reflection on the quality of education. Quantity of education is also a factor effecting one's literacy level.
Finally, this study provided a baseline for environmental education in the 90's. There still needs to be research conducted on the environmental literacy of the greater population. The opportunity exists for educators to become more deliberate in achieving an outcome of a more environmentally literate student by having a greater understanding of those factors that most effect a student's literacy.
References


Swan, M. D. (1985, December). The research on the organization, administration, and delivery of resident outdoor education. (pp. 1-47). The Lorado Taft Field Campus.
