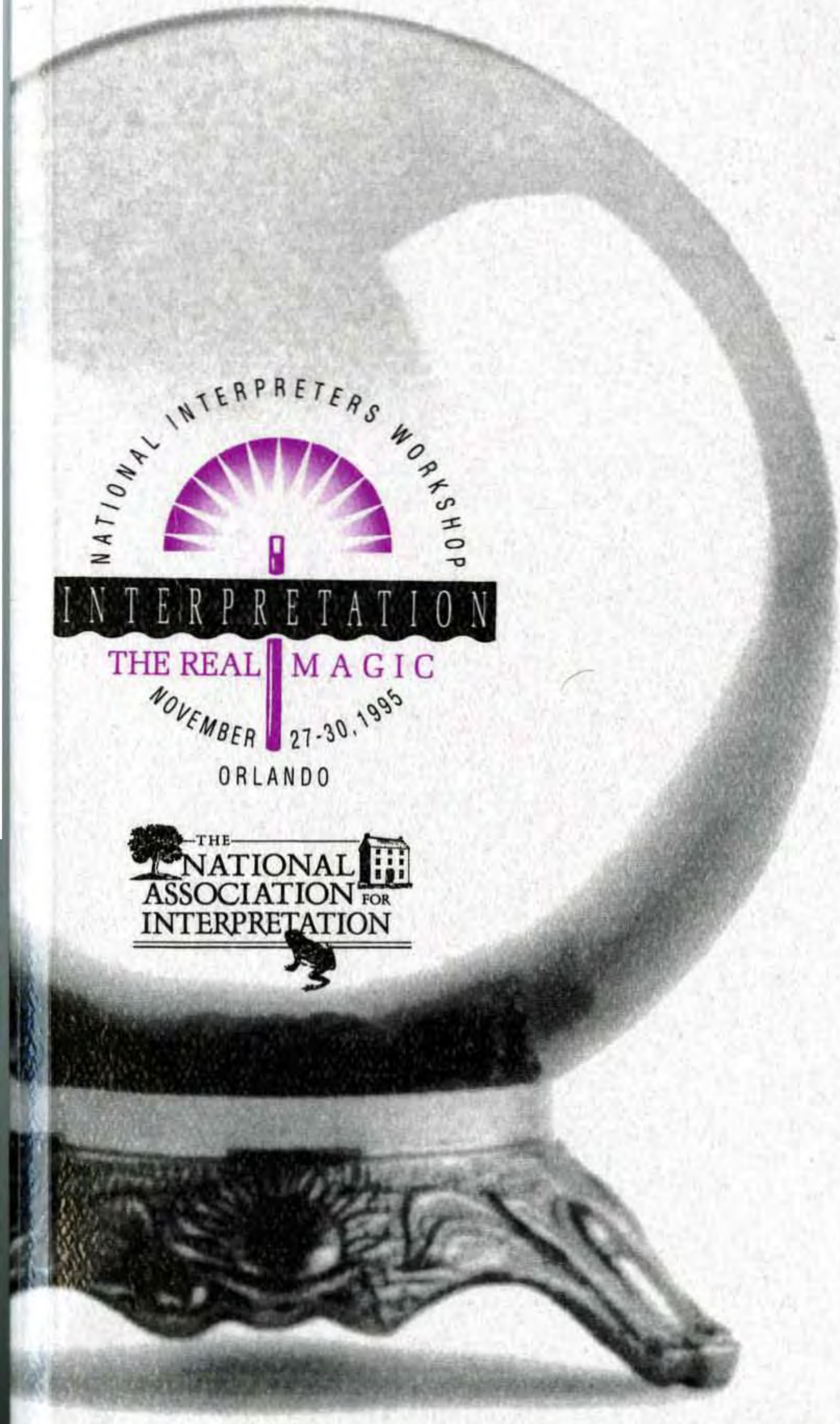
1995

An Ecological Vocabulary Essential to Environmental Education

James L. Isleib
Stephen F Austin State University

The 1995 Interpretive Sourcebook



NATIONAL INTERPRETERS WORKSHOP

INTERPRETATION

THE REAL MAGIC

NOVEMBER 27-30, 1995

ORLANDO

THE NATIONAL ASSOCIATION FOR INTERPRETATION

AN ECOLOGICAL VOCABULARY ESSENTIAL TO ENVIRONMENTAL EDUCATION

James L. Isleib, Executive Director
Piney Woods Conservation Center
Stephen F. Austin State University
Nacogdoches, TX 75929

ABSTRACT: This study verified a basic ecological vocabulary essential to environmental education and measured the effect of Texas Environmental Education Advisory Committee (TEEAC) endorsed teacher inservice programs on participants' ecological vocabulary. The study results may be used in the development and assessment of environmental interpretation programs.

KEY WORDS: environmental education, ecology, environmental interpretation, teacher inservices

Introduction

Environmental Education and Ecology

April 22, 1990, the twentieth anniversary of Earth Day, marked a renewal of America's concern for the environment. In Texas, one result of this concern was an increased interest in integrating environmental education (EE) into public school curricula. Unfortunately, there is no preservice EE teacher training requirement. Also, there is no assurance that EE inservice programs provide comprehensive EE knowledge, skills, and techniques because there are no standardized developmental guidelines or program evaluation tools.

The purpose of this study was to provide information for EE guideline development and develop an EE assessment tool. The study focused on the changes in the ecological vocabulary of teachers participating in EE inservice programs. The objectives of the study were to:

- Establish a basic ecological vocabulary
- Evaluate the effectiveness of an instrument measuring the extent of change in participants' ecological vocabulary resulting from exposure to Texas Environmental Education Advisory Committee (TEEAC) programs

Environmental Education Defined

The credibility of this study was based upon the relationship between ecological vocabulary, ecological knowledge, and environmental education. Evidence of this relationship is found in EE definitions, goals, and research.

Delegates assembled at the 1977 United Nations Intergovernmental Conference in Tblisi, Georgia, USSR, agreed upon the following definition of EE:

Environmental education is a process of developing a world population that is aware of and concerned about the total environment and its associated problems, and which has the knowledge, skills, attitudes, motivation and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones (UNESCO 1978).

In the United States, the National Environmental Education Act of 1990 defined and outlined support for EE. Concepts included in the definition are that EE is intended to promote an awareness and understanding of the environment, the wise use of natural resources, and the recognition and acceptance of personal responsibility in decision-making and stewardship toward the environment (U.S. Senate 1990).

Borrowing from these definitions, TEEAC defines EE as "a process that promotes awareness, understanding and responsible

decision making regarding humankind's relationships in the environment" (TEEAC 1993).

In each of these definitions, knowledge and understanding of the environment are directly or indirectly implied as principal components of EE. However, ecology must not be equated with EE or with EE goals (Hungerford 1975). Most EE professionals agree that their ultimate goal is the involvement of citizens in understanding, solving, and preventing environmental problems. Roth (1968) initially applied the term "environmental literacy" to this involvement and stated that the goal of EE was to produce environmentally literate citizens who were properly informed to be able to read their environment, diagnose its ills, apply first aid when needed, and bring in experts to handle more complex problems. Disinger and Monroe (1994) distinguished environmental literacy from other literacies by its action perspective. They further noted that while most literacies are measured in terms of cognition, the measures of environmental literacy challenge the assumption that behavioral change follows directly from the development of necessary knowledge and skills. This seemingly places environmental literacy, and EE, at odds with the traditional educational goals of knowledge, understanding, and skill development. However, another perspective is that EE incorporates traditional education goals. Reflecting this perspective, a substantive framework has been developed by Hungerford, Peyton, and Wilke (1980). Their framework involves four distinct levels, incorporating traditional educational goals while contributing to environmental literacy development. Level One is a broad framework of ecological concepts. Levels Two, Three, and Four are: Conceptual Awareness; Issue Investigation and Evaluation; and Environmental Action Skills. The sequential priority of achieving these EE goals places primary importance on ecological knowledge.

EE researchers repeatedly cite the importance of ecological literacy within EE (Ramsey and Rickson 1976, Clark 1975, Hungerford and Volk 1990 and Childress 1978). If knowledge of ecology is a cornerstone of EE, why is EE cited and criticized for having little or no scientific, ecological foundation (Ramsey et al. 1992, Hendee 1972, London 1984, Poore 1993)? The answer lies with the principal implementor of EE, the teacher. The enthusiasm of classroom teachers plays an integral role in any EE program (Simmons 1988). However, enthusiastic participation is not enough to ensure that EE is done correctly, specifically with a scientific foundation (Ham and Sewing 1987, Adams 1975, Johnson 1980, Lane et al. 1994). To ensure this, the teacher must receive preservice or inservice training. Texas inservice training was overseen by TEEAC.

The Texas Environmental Education Advisory Committee

History and mission of TEEAC. In May, 1991, legislation amended the Texas Education Code by mandating the Commissioner of Education to "foster the development and dissemination of" EE activities and materials. It is worth emphasizing that TEA is not mandated to require EE in public schools, nor required to provide any funding or staffing.

This legislation also established TEEAC, officially formed in late 1991. TEEAC members represent state agencies, environmental and EE organizations, and teacher organizations. Many tasks have been accomplished by the volunteer TEEAC members and its affiliated endorsed programs, despite having only one full-time coordinator and no legislated funding. Program standards have been established, teacher inservice programs endorsed and implemented; an ongoing list of EE resource material has been compiled, reviewed, and made available to teachers; and some funding has been found. One task that remains is to evaluate the ongoing teacher education programs.

Teacher inservice programs. TEEAC is charged with endorsing EE inservice programs. Program endorsement is based on the program's ability to educate and impart instructional strategies to teachers in two content areas: ecological principles and humanity's interaction with the environment. It should be noted that TEEAC established, but did not dictate, environmental concepts and issues taught by endorsed programs. Endorsed programs are usually site based, conducted at zoos, museums, nature and EE centers, and universities across the state. A program may be 3 to 45 hours in length. Endorsed programs are

responsible for registering participants, implementing and evaluating the program, and awarding the participants with TEEAC recognition credit.

Teachers accumulating up to forty-five contact hours at endorsed EE sites and programs receive a document of formal TEEAC recognition. Also, principals and administrators associated with recognized teachers are informed by TEEAC of the teachers' accomplishment.

Methods

Test Design and Sampling Procedure

Data was collected using pre-post test instruments. The instruments consisted of a fill-in-the-blank question form requesting demographic information and pre and post program statement forms testing ecological terms. The ecological testing instrument was divided into two sections, one of 16 matching statements and one of 41 multiple choice statements.

Twenty TEEAC sites, offering a total of 40 endorsed programs during the months of June, July, and August, 1994, were contacted and solicited to participate in the Ecological Vocabulary Survey (EVS). Four program sites agreed to implement the survey during a total of nine programs. Both pre and post test forms were completed at the participating TEEAC endorsed program sites. The pre-test instrument recorded demographic information and pre-program ecological knowledge levels of program participants. The post test recorded post-program knowledge levels. At the completion of each program, the program facilitator(s) completed a test form indicating which post-test questions they believed the participants should be able to answer following instruction.

Survey instruments. To develop the EVS, a list of 87 ecological terms were compiled from Smith's *Elements of Ecology* (1992), Miller's *Living in the Environment* (1988), and the Project WILD and Project Learning Tree activity guides. The goal of the term selection process was a comprehensive list of basic ecology terms, essential to EE, from which a test instrument of reasonable length could be produced. The term selection objectives were to develop an ecological vocabulary list which was:

- Comprehensive but limited to terms describing natural systems.
- "Teacher friendly." Simple terminology was used when possible, and the length of the test was considered.
- Applicable to TEEAC programs. Terms which could be applied to the diverse Texas biomes were given priority. Also the amount of time needed to administer the test was considered.

The vocabulary list was reviewed by a panel of ecologists and teacher education specialists and mailed, in survey form, to all TEEAC endorsed programs. A revised list of 57 ecological terms was used to develop the EVS. The survey instrument was reviewed by the professorial panel and two Texas state certified teachers, and changes were made according to their advice.

Statistical Analysis

The data collected were analyzed for frequency of response in order to obtain demographic characteristics. One-way ANOVA, t-tests, and multiple t-tests were administered to detect significance of differences in response due to demographic characteristics.

Results and Discussion

Establishing an Ecological Vocabulary

Ecology term selection. TEEAC programs were surveyed to ascertain which of the 87 terms were fully, partially, or not defined during their programs. A total of 65 TEEAC sites were solicited for a survey response. Of the 30 sites (46%) responding, six had multiple programs. Therefore, the total survey response represented 47 TEEAC endorsed programs.

Using the data from the TEEAC program survey, 57 terms were selected for developing the EVS. This list was compared to lists established by the NAAEE (NAAEE 1990), by professional ecologists from the British Ecological Society (BES) (Cherrett 1989), and the ranked TEEAC program terms (Table 1, located at end of article). Obviously, all of the EVS terms matched the TEEAC survey, therefore the EVS

terms were compared and ranked by the highest number of matches with the BES and NAAEE lists. Overall, 52 of the 57 EVS terms (91%) matched terms in either the BES or the NAAEE lists and were selected by an average of 48% of the TEEAC programs. Twenty-five of the EVS terms (44%) matched both the BES and NAAEE lists and were selected by an average of 54% of the TEEAC programs. Twenty-two of the EVS terms (39%) matched only the NAAEE lists and were selected by an average of 47% of the TEEAC programs. Five of the EVS terms (9%) matched only the BES list and were selected by an average of 31% of the TEEAC programs. Five of the EVS terms did not match either the BES or the NAAEE lists and were selected by 33% of the TEEAC programs.

Ecological Vocabulary Survey Results

For each of the 148 participants, the average number of correct responses to the 57 statements was 37 (65%) on the pre test, significantly increasing to 46 (81%) on the post test. There was a significant gain between the pre and post test statements of all groups formed by descriptive variables. There were significant changes between correct pre test statements and correct post test statements within several variable groups, particularly variables describing participants' educational and teaching experience. There was a positive difference between the number of correct pre and post test responses to all but two of the EVS statements. The average number of correct pre test responses was 96, a percentage score 65%, and the average number of correct post test responses was 120, a percentage score of 81%.

These response figures are based on all 148 participants responding to all 57 survey statements, a total of 8,436 responses. However, not all of the 57 ecological terms used in the survey were taught during any one program implementing the survey. Therefore, a more accurate indication of the survey measure of changes in ecological vocabulary, due to exposure to the TEEAC program, was derived from responses to statements containing ecological terms taught during the program, as indicated by the program facilitator. There were 5,162 responses to facilitator-selected statements, 61% of the total survey responses. Of these responses, the average number of correct pre test responses was 61, a percent score of 67%, and the average number of correct post test responses was 80, a percent score of 88%. Therefore, it can be inferred that 79% of the correct responses were related to facilitator-selected statements. In other words, the Ecological Vocabulary Survey measured nearly 80% of the change in participants' ecological vocabulary resulting from exposure to TEEAC programs.

Conclusions and Recommendations

Establishing an Ecological Vocabulary

Fifty-two of the 57 EVS terms (91%) matched terms in either or both of the NAAEE and BES lists. Only 8 of the TEEAC survey terms, matching NAAEE or BES terms, were not included in the EVS. Therefore it was recommended that at least 52 of the EVS terms constitute a Basic Ecological Vocabulary (BEV) essential to EE. It is further recommended that the 25 EVS terms matched by both NAAEE and BES terms comprise a Most Essential Ecological Terms category. The 27 EVS terms matched by either NAAEE or BES terms should comprise an Essential Ecological Terms category. It is recommended that the five EVS terms not matching NAAEE or BES terms be omitted from the EVS. There is no recommendation for adding any ecological terms.

Success of the Pre - Post Test Instrument

Considered as a whole, the survey instrument was successful in detecting an increase in the correct responses to ecological vocabulary statements, measuring 80% of the difference in correct pre and post test responses resulting from exposure to the TEEAC program.

Recommendations for Implementation

The Ecological Vocabulary Survey may be implemented as an evaluation tool and as a database for developing EE programs and curricula. It is recommended that the Basic Ecological Vocabulary be utilized as a standard for teacher inservice providers and teachers to evaluate attainment of an ecological foundation essential to EE. The Most Essential and Essential categories of the Basic Ecological Vocabulary allows some flexibility in program and curriculum development and allows teachers to set feasible goals as they seek to achieve ecological and environmental literacy.

References Cited

Adams, C.E.; Biddle, B.A.; Thomas, J.K. (1988). Present status of environmental science in Texas public schools. Journal of Environmental Education, 19(3),19-24.

Cherrett, J.M. (1989). Key concepts: the results of a survey of our members' opinions. *In* Ecological concepts, J.M. Cherrett, (Ed.), (p. 1-16). Oxford, England: Blackwell Scientific Publications.

Childress, R.B. (1978). Public school environmental education curricula: a national profile. Journal of Environmental Education, 9(3),2-12.

Clark, E. (1975). Good education is environmental. Journal of Environmental Education, 6(4),1-5.

Ham, S.H.; Sewing, D.R. (1987). Barriers to environmental education. Journal of Environmental Education, 19(2),17-24.

Hendee, J.C. (1972). Challenging the folklore of environmental education. Journal of Environmental Education, 3(3),72-74.

Hungerford, H.R. (1975). Myths of environmental education. Journal of Environmental Education, 7(2),21-26.

Hungerford, H.R.; Peyton, R.B.; Wilke, R. (1980). Goals for curriculum development in environmental education. Journal of Environmental Education, 11(3),42-47.

Hungerford, H.R.; Volk, T.L. (1990). Changing learner behavior through environmental education. Journal of Environmental Education 21(3),8-21.

Johnson, W.D. (1980). Teacher's perceptions and circumstances that influence willingness to teach environmental studies. PH.D. Dissertation, University of Illinois, Urbana-Champaign.

Lane, J.; Wilke R.; Champeau, R.; Sivek, D. (1994). Environmental education in Wisconsin: a teacher survey. Journal of Environmental Education 25(4),9-17.

London, H. (1984). Why are they lying to our children? Briarcliff Manor, New York: Stein and Day, Pub.

Miller, G.T., Jr. (1988). Living in the Environment (fifth edition). Belmont, California: Wadsworth, Inc., Pub.

NAAEE. (1990). Section a: natural systems. *In* Essential learnings in environmental education: a database for building activities and programs, M. Ballard and M. Pandya, eds., p.17-62. Troy, Ohio: North American Association for Environmental Education.

Poore, P. (1993). Enviro education. Is it science, civics, or just plain propaganda? Garbage: the Practical Journal for the Environment 5(2),26-31.

Ramsey, C.E.; Rickson, R.E. (1976). Environmental knowledge and attitudes. Journal of Environmental Education 8(1), 10-18.

Ramsey, J.M.; Hungerford, H.R.; Volk, T.L. (1992). Environmental education in the k-12 curriculum: finding a niche. Journal of Environmental Education 23(2),35-45.

Roth, C.E. (1968). Curriculum overview for developing environmentally literate citizens. Lincoln, Massachuesetts: Liberty Council of Schools Conservation Education Center/Massachusetts Audubon Society, Pub.

Simmons, D.A. (1988). The teacher's perspective of the resident environmental education experience. Journal of Environmental Education 19(2),35-42.

Smith, R.L. 1992. Elements of ecology (third edition). New York: Harper Colns Publishers Inc.

UNESCO. (1978). Final report, intergovernmental conference on environmental education. Tblisi, USSR, p. 14-26 Unesco.

U.S. Senate. April 18, 1990. Revised draft of the national environmental education act. Washington, D.C.: Committee on Environmental and Public Works. S. 1076, Report No. 101.

Table 1. Ecological vocabulary terms ranked by TEEAC endorsed programs and compared to Ecological Vocabulary Survey (EVS), North American Association for Environmental Education (NAAEE), and the British Ecological Society (BES).

No.	Vocabulary Terms (from TEEAC)	TEEAC (% ranking)	EVS	NAAEE	BES
1	adaptation	96	X	X	X
2	food chain	85	X	X	X
3	ecosystem	93	X	X	X
4	community	80	X	X	X
5	prey	74	X	X	X
6	herbivore	74	X	X	X
7	food web	72	X	X	X
8	predation	70	X	X	X
9	competition	69	X	X	X
10	biodiversity	67	X	X	X
11	species diversity	67	X	X	X
12	niche	60	X	X	X
13	carrying capacity	59	X	X	X
14	indicator species	45	X	X	X
15	keystone species	45	X	X	X
16	limiting factor	43	X	X	X
17	energy flow	42	X	X	X
18	productivity	36	X	X	X
19	succession	34	X	X	X
20	parasitism	32	X	X	X
21	biome	30	X	X	X
22	biosphere	29	X	X	X
23	evolution	28	X	X	X
24	trophic	24	X	X	X
25	biogeochemical cycle	13	X	X	X
26	habitat	96	X	X	
27	environment	91	X	X	
28	ecology	76	X	X	
29	population	73	X	X	
30	decomposer	72	X	X	
31	extinction	70	X	X	
32	carnivore	69	X	X	
33	omnivore	56	X	X	
34	photosynthesis	53	X	X	
35	climate	48	X	X	
36	indigenous species	45	X	X	
37	nutrient	39	X	X	

38	symbiosis	38	X	X	
39	abiotic (non living)	36	X	X	
40	natural selection	36	X	X	
41	endemic	33	X	X	
42	biomass	29	X	X	
43	selection	26	X	X	
44	edge effect	20	X	X	
45	biological magnification	13	X	X	
46	macro/micro nutrients	11	X	X	
47	homeostasis	7	X	X	
48	species (threatened, endangered)	64	X		X
49	resource (renewable and non-renewable)	57	X		X
50	sustained yield	16	X		X
51	keystone species	11	X		X
52	density independent/dependent	4	X		X
53	indigenous	55	X		
54	fauna/flora	51	X		
55	mutualism	22	X		
56	nutrient cycle	18	X		
57	entropy	18	X		