THE INFLUENCE OF WILDLIFE-RELATED VARIABLES ON TEACHER ADOPTION OF ENVIRONMENTAL EDUCATION

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ABSTRACT.

A study was undertaken to identify characteristics of teachers and school systems related to adoption of environmental education (with emphasis on wildlife ecology education) in K-12 public schools in California. A survey questionaire was mailed to a sample of 526 teachers. Response rate was 62.4 percent. A total of 60.1 percent of the teachers were currently incorporating or at one time incorporated environmental themes into their curricula. Variables having significant influence on adoption of environmental education included participation in wildlife activities, wildlife knowledge, sex, age, subject taught, and exposure to in-service training. Non-consumptive activities were more popular with teachers than consumptive activities. Teachers correctly answered an average of 58.0 percent of wildlife knowledge items.

INTRODUCTION

Problems related to environmental quality and ecological balance have become issues of great public concern in recent years. Environmental problems can be solved only by sound environmental management programs that are supported by an informed public. Schoenfeld (1957:70) noted, however, that "The development of public opinion has not been kept in pace with the development of scientific knowledge." Support for this statement comes from a 1969 Gallup Poll. Conducted nationwide for the National Wildlife Federation, the poll asked the general public "What action should be taken to perpetuate wildlife populations?" The two most common responses were to 1) provide better law enforcement and 2) curtail or eliminate hunting (Keefe, 1973). People plainly did not understand the importance of wildlife habitat.

One of the keys to creating an environmentally informed citizenry is formal environmental education in public schools. Environmental education is defined as a multidisciplinary approach to teaching the interrelationships between people and their natural and man-made environments. The goal of environmental education as used in this study is the development of a citizenry that has the knowledge, skills, and motivation to work toward solutions to environmental problems.

The Environmental Education Act (PL 91-516), which was signed into law by President Nixon on October 30, 1970, is proof of the national significance of environmental education. In California, legislation (Senate Bill 1, 1968) requires that wise use of natural resources and protection of the environment be taught in appropriate grade levels (K-12) and subjects.

Although increasing attention has been placed on environmental education, the status of current programs is dismal. Rudy Schafer (personal communication, 1975), environmental education coordinator for the California Department of Education, indicated that of 50 major educational programs in the state, environmental education ranked number 43 with respect to funding.

The evidence above points toward the need to diffuse environmental education programs more widely in public schools. Yet, little research emphasis has been placed upon determining

what factors influence the incorporation of environmental themes into curricula, evaluating the quality of existing programs, or imporving programs through teacher training and development of curriculum materials.

The primary purpose of this study was to identify characteristics of teachers and school systems related to adoption of environmental education in public schools (K-12) in California. The research concentrates on one component of a well-balanced environmental education program, namely wildlife ecology. Wildlife ecology education was defined as that aspect of environmental education concerned with the study of the wise use and management of non-domesticated animals and their habitats for the benefit of all the plants and animals in the community. Only a few studies have emphasized the role of wildlife ecology in environmental education programs (Capps, 1940; Curtis, 1942, Selim, 1951; Giles, 1958; Shaw, 1961; George, 1967; Richmond and MOrgan, 1977; Pomerantz, 1977; and Dahlgren et al., 1977) reported the lack of research in this area. Only the research conducted by Curtis (1942) and Selim (1951) has concerned wildlife education in California schools.

MATERIALS AND METHODS

A survey instrument was designed in cooperation with an advisory committee to collect data on teacher and school system variables. Questionaire design and administration was guided by the recommendations published by Dillman (1978). The instrument was pretested in nine schools in three California cities to evaluate questionaire design. Using membership lists of the California Federation of Teachers and California Teachers Association, a sample population was selected via sequential sampling. Questionaires were mailed with a personally signed cover letter and stamped, pre-addressed return envelope. A follow-up postcard was sent to all teachers one week after the initial mailing. A second follow-up involving a cover letter with a second copy of the questionaire was sent to non-respondents seven weeks after the initial mailing. Of 526 valid questionaires, 328 were returned (62.4%). Telephone interviews were conducted with 30 non-respondents to determine if non-response bias existed. Statistical tests showed no significant differences between respondents and non-respondents.

RESULTS

Descriptive Analysis

Moderate levels of teacher adoption of environmental education were found in this study. A total of 60.1% of the teachers were currently incorporating or at one time incorporated environmental themes into their curricula. However, less than 50% of the sample (45.8%) was currently incorporating environmental themes. Discontinuance of adoption was a considerable problem with 14.3% of the teachers falling in this category.

In the study, 91.2% of the teachers made their own decision to incorporate environmental themes independent of their principal and/or teaching staff. A "collective" decision was made by the entire teaching staff in 5.1% of the cases. Teachers made their own decisions but only after the principal or curriculum committee had approved the new program (a "contingent" decision) in 2.3% of the cases. "Authority" decisions occurred for .5% of the sample where the school principal made the decision.

The situation was different for decisions related to other educational innovations. Individual decisions were predominant in only 14.3% of the schools. Collective decisions (38.2%) and contingent decisions (35.1%) were most common in schools for general innovation adoption decisions. Authority decisions occurred in 11.5% of the schools.

One of the major factors constraining incorporation of environmental education was teachers lacking the time to develop curricula. More than 50% of teachers marked this as a limiting factor. Other limiting factors included lack of instructional materials, insufficient room in the curricula, lack of curriculum guides, and inadequate training. These factors also played important roles in causing teachers to discountinue incorporation of environmental themes.

Teacher levels of wildlife knowledge were not very high with teachers correctly answering an average of only 58.0% (8.7 of 15) of the wildlife knowledge items. Teachers were fairly knowledgeable about wildlife concepts related to predation, population dynamics, and causes of species endangerment (Table 1). Low to moderate knowledge was demonstrated of the importance of habitat in maintaining and increasing wildlife populations. Teachers expressed considerable confusion about the concepts related to "edge effect" (e.g. wildlife is more abundant where field sizes are smaller and more types of crops are grown), wildlife stocking programs, and exotic species introductions. The lack of teacher knowledge of the legal mandate in California that environmental education be taught in all appropriate grade levels and subject matters was especially discouraging. Less than one-fourth (24.3%) of the teachers correctly answered this question.

Table 1. Teacher knowledge of itemized wildlife concepts (ranked by percentage of correct responses).

Wildlife-related Concept	Percentage of Teachers Correctly Answering Question	N
Beneficial value of predators	92.9	324
Relationship between wildlife birth and death rates and population dynamics	79.8	322
Relationship between habitat and species endangerment	76.0	325
Effect of overcrowding on wildlife population and habitat	74.6	323
Factors influencing the effect of predators on wildlife populations	71.8	323
Importance of habitat in increasing wildlife populations	68.0	316
Wildlife as public property	66.0	324
Habitat as main factor limiting wildlife	65.8	322
Relationship between animal size and birth rate	61.3	328
Stocking wildlife	56.7	321
Main source of wildlife funding	53.3	321
Exotic species introductions	44.2	321
Relationship between wildlife abundance and soil fertility	41.7	326
Calif. environmental education mandate	24.3	317
Relationship between edge effect and wildlife abundance	9.7	321

One way to combat low levels of teacher adoption is through in-service training. Teacher participation in training programs, however, was very low since only 13.3% of teachers had participated. The low level was apparently due to limited offerings of workshops, rather than teacher apathy, since 84.4% of teachers who hadn't attended a training session were interested in receiving training. While 60.9% of the teachers were interested in training even if credit wasn't offered, 23.5% required that credit be offered.

Another approach to increasing teacher knowledge is to disseminate information through communication channels that are commonly used by teachers as sources of environmental information. The channels most commonly used were television and newspapers (mass media channels).

The most popular type of wildlife recreation teachers participate in was observing wildlife in the zoo (Table 2). Feeding, attracting, or observing wildlife around the home rated second. Sport hunting and trapping had the lowest participation percentages. Therefore, non-consumptive activities (those that don't kill wildlife including observing, feeding, attracting, photographing, or painting wildlife) were more popular with teachers than consumptive activities (sport fishing, hunting, trapping, and collecting seashore animals). Even though consumptive activities were less popular than non-consumptive activities, the greatest proportion of teachers (76.8%) participated in both types of wildlife recreation (Table 3). Teachers showed negative attitudes toward the consumptive activities of hunting and trapping, yet approved of sport fishing (Table 4).

Table 2. Teacher participation in wildlife-oriented activities (rank order by mean rate).

	Participation Level (percent responding by category)							
Activity	Never, don't want to (1)	Never, would like to (2)	Very little (3)	Occa-sionally (4)	Fre-quently (5)	Mean	Standard Deviation	N
Observing wildlife in a zoo	1.2	2.8	21.2	60.1	14.7	3.8	0.7	326
Feeding, attracting, or observing wildlife around the home	6.4	7.6	25.1	34.3	26.6	3.7	1.1	327
Observing wildlife in the field	4.3	9.2	22.5	46.5	17.5	3.6	1.0	325
Photographing wildlife	11.6	34.5	23.5	24.8	5.6	2.8	1.1	319
Collecting seashore animals	23.5	14.6	26.9	28.5	6.5	2.8	1.3	323
Sport fishing	35.0	12.4	27.6	19.5	5.6	2.5	1.3	323
Painting or sketching wildlife	38.4	40.6	11.0	8.5	1.6	1.9	1.0	318
Sport hunting	77.9	4.4	8.7	7.2	1.9	1.5	1.1	321
Trapping	89.1	6.4	2.2	1.9	.3	1.2	.6	312

Teachers were not strongly oriented toward wildlife organizations, since most teachers (62.2%) were not members of any organization. In the sample, 20.4% of the teachers were members of one organization while 17.4% belonged to two or more organizations. The most popular organization was the National Wildlife Federation followed by the Sierra Club, Audubon Society, and National Rifle Association.

MULTIVARIATE ANALYSIS

Multiple regression analysis was performed on the data in order to estimate the effects of selected variables on the dependent variable (adoption of environmental education). Adoption was entered in the form of a six stage scale (Table 5). The stages were scored as follows:

Stage 0 (Not aware): Teacher was not aware that environmental themes could be used in teaching many subjects.

Stage 1 (Awareness): Teacher was aware that environmental themes could be used in teaching many subjects.

Stage 2 (Interest): Teacher has tried to find out more about using enivronmental themes in curriculum.

Stage 3 (Evaluation): Teacher has considered incorporating environmental themes in curriculum.

Stage 4 (Trial): Teacher has actually tried incorporating environmental themes in curriculum.

Stage 5 (Adoption): Teacher is currently incorporating or at one time incorporated environmental atemes into curriculum.

Table 3. Percentage of Teachers participating in consumptive and non-consumptive wildlife activities.

Activity classification	Percentage	N
Non-consumptive participant[1]	21.4	70
Mixed participant[2]	76.8	251
Consumptive participant[3]	.6	2
Non-participant[4]	1.2	4
	100.0	327

[1]Teacher participates only in observing, feeding, attracting, photographing, or painting wildlife.
[2]Teacher participates in both consumptive and non-consumptive activities
[3]Teacher participates only in hunting, fishing, trapping, or collecting wildlife
[4]Teacher does not participate in any wildlife activities

Table 4. Teacher attitudes toward consumptive wildlife activities.

	Attitude Toward Activity (percent responding by category)							
Activity	Strongly disapprove (1)	Disapprove (2)	Un-decided (3)	Approve (4)	Strongly approve (5)	Mean	Standard deviation	N
Sport hunting	34.6	21.6	10.5	28.1	5.2	2.5	1.4	324
Sport fishing	9.3	9.6	17.3	52.8	11.1	3.5	1.1	324
Trapping	51.5	24.1	13.3	9.3	1.9	1.9	1.1	324
						Index Mean[1] = 2.6		

[1]The index mean was calculated in two stages. First, each individual teacher's mean attitude toward consumptive wildlife activities was determined by adding the individual's attitude scores for each of the three activities and dividing by three. Then, these mean attitude scores were summed and divided by N to obtain the index mean.

Table 5. Partial regression coefficients for the regression of adoption of environmental education (measured as a six-stage scale) on selected variables.

Variable		b	BETA	F
x_1	System innovativeness	-.004	-.043	.499
x_2	Participation in wildlife activities	.641	.216	12.082**
x_3	Sex	.640	.196	8.765**
x_4	Age	.020	.129	4.555*
x_5	Individual innovativeness	.212	.077	1.511
x_6	Teach humanities	.746	.227	9.017**
x_7	Teach science	.962	.145	4.821*
x_8	Teach social science	1.471	.294	17.652**
x_9	Exposure to in-service training	.350	.074	1.459
x_{10}	Wildlife knowledge	.085	.134	4.737*
R^2		.220	----	6.211*

N = 231

Constant = -1.038

* Significant at .05 level
** Significant at .01 level

This format follows the adoption model outlined by the North Central Rural Sociology Committee (1955) and was used in order to test the applicability of their model. Adoption was also specified in dichotomous form (Stage 0 = Non-adoption; Stage 1 = Adoption) in an alternate model for comparative purposes.

Several steps were required to determine the nature of the final multiple regression model. First, it was very important to assure that all important variables were included. Five additional variables (school size, teacher major in college, teacher education level, grade level taught, and organizational membership) found to have significant bivariate relationships with adoption of environmental education were added to the model to determine their effects. These variables were not included in the final model because their effects did not remain significant when other relevant variables were controlled. A second reason that wildlife organizational membership was not included in the model was that the investigator felt that activity participation, which was already in the model, closely measured the same dimension as organizational membership.

Once the final model was created, tests were performed for interactions for selected variables. Variables included in the interaction tests were age, sex, and individual innovativeness. None of the tests for interactions, however, significantly improved the original model. Therefore, the additive model was sufficient to describe the data. Tests for linearity were not performed due to the small sample size. In addition, results of the bivariate analysis did not suggest any non-linear associations.

Although multiple regression analysis assumes use of interval level data, this requirement was relaxed in this analysis and the ordinal level dependent variable (adoption of environmental education) was treated as if it were interval in nature. Such relaxation should not introduce gross distortions except in extreme cases.

Twenty-two percent of the variation in adoption was explained by the causal model (Table 5). Variables having significant effects on adoption of environmental education (measured as a six-stage scale) included participation in wildlife activities, sex, age, wildlife knowledge, and subject taught. Teacher participation in wildlife activities was positively associated with adoption. The more active a teacher was in activities, the more likely he or she was to be an adopter. Sex showed a positive relationship with adoption, indicating that females are more likely to adopt than males. Older teachers were more likely to adopt than younger teachers. Teacher knowledge of wildlife was positively associated with adoption, with higher knowledge increasing the teacher's propensity to adopt. Teacher's main subject taught was scored in dummy form. All of the dummy variables differed significantly from the left-out category (teach health/vocational education) with respect to adoption of environmental education. Teaching social science showed the highest positive association with adoption, followed by teaching science and teaching humanities.

The regression of the dichotomized adoption of environmental education scale on selected variables showed similar results as the six-stage scale with the exception of in-service training and wildlife knowledge. Exposure to in-service training showed a positive, significant effect on adoption while wildlife knowledge was not significantly associated, although the nature of the association remained positive.

DISCUSSION

In this study, 60.1% of teachers had adopted environmental education. Considering that California has a legislative mandate to incorporate environmental themes into school curricula, the level of adoption revealed in this study seems low. However, this 60% adoption level may not be that low from a time perspective. Although it is impossible to pinpoint a starting date, environmental education did not receive widespread media attention until the first Earth Day in 1970. Considering that some educational innovations have taken up to 50 years to reach widespread adoption, the 60% adoption level may not be that low since the innovation has only had around 10 years to diffuse.

Although the percentage of teachers currently incorporating environmental education was disappointingly low (45.8% of teachers), it was encouraging to discover that the decision to adopt was overwhelmingly an individual teacher decision. Thus, school system constraints such as fellow teachers or the school administration that may impede adoption of some educational innovations do not appear to have a major influence on adoption of environmental education.

The low rate of adoption reported in this study may be understood by considering factors that limit adoption. Study results strongly point to the need for promoters of environmental education to develop curriculum materials and guides for teachers and train teachers how to incorporate the materials, since teachers lack the time and training to do so on their own. It was also apparent that adoption cannot be forced on teachers via a legal mandate (the Miller Bill of 1968), since teachers with knowledge of the California mandate did not adopt environmental education at a level significantly higher than teachers unaware of this legislation in bivariate crosstabular analysis.

The strong relationship of activity participation to adoption in multiple regression analysis implies that promoters of environmental education may be able to influence adoption by providing opportunities for teachers to be more involved in wildlife-associated activities. Wildlife organizations, for example, might provide special memberships for teachers, special publications aimed at teachers, or even specific sections of their monthly magazines aimed specifically at teachers. With respect to this third option, the Oregon Department of Wildlife already devotes a section of their "Oregon Wildlife" magazine to environmental education issues. In such publications, organizations could also suggest projects that would get teachers involved in wildlife activities. Such projects should stress activities that have been shown to be popular with teachers (Table 2) such as observing wildlife in a zoo or attracting wildlife around the school or home.

Wildlife knowledge was significantly associated in a positive direction with adoption of environmental education when adoption was measured as a six-stage-scale. When adoption was entered in dichotomous form, the same positive association was indicated but the relationship was no longer significant. In a larger sample, the effect may have been significant. The positive association is important to policy makers. Knowledge is a teacher characteristic that can be manipulated through mass media and personal appearance programs. Training sesssions are a commonly used method of increasing teacher knowledge in educational settings. This study has shown that teacher knowledge levels are generally low. Given the positive relationship between knowledge and adoption, efforts by wildlife educators to improve teacher wildlife knowledge by dispelling commonly held misconceptions may have a spinoff benefit of increasing teacher adoption of environmental education.

Pathways connecting teacher exposure to in-service training with adoption of environmental education indicate that such training is beneficial in increasing levels of adoption if adoption is measured as a dichotomy. When adoption was measured as a six-stage scale, the association was not significant. However, the sign was in the right direction and the effect may be real, but so small that it did not significantly increase the F value.

The inconsistent results between the two regression models with respect to wildlife knowledge and in-service training may be due to the existence of non-linear relationships. For example, the association between adoption and in-service training may be non-linear, and therefore, using different criteria for operationalizing adoption should produce similar regression equations. Tests for linearity were not performed in this study due to the small sample size. Future investigators using larger samples should explore curvilinear regression analysis.

The association between teacher exposure to in-service training and adoption has substantial implications for policy makers. This finding points out the critical need for promoters of environmental education to establish both preservice and in-service training sessions, especially considering the teacher willingness to attend training sessions. A note of caution should be added, however, since expressed willingness to attend workshops may not result in actual attendance when the opportunity arises.

Multivariate analysis indicated that the main subject taught by a teacher influences adoption of environmental education, especially if the subject is science or social science. Bivariate crosstabular analysis showed that at least 75% of the teachers in the sciences and social sciences had adopted environmental education. Apparently, science and social science teachers see the relevance and importance of environmental education to their curricula, while other teachers may not consider it as appropriate to their subject. However, the lower rates of adoption in the humanities and health/vocational education areas may also be a result of a lack of instructional materials that help teachers incorporate environmental themes into their subject matter.

Age exhibited a positive effect on adoption. Several factors might explain higher levels of adoption by older teachers. First, older teachers may have had more time over their career to develop their curriculum and thereby incorporating environmental themes is easier. Younger teachers may find it difficult enough just preparing a basic curriculum much less developing a curriculum which incorporates environmental themes. Older teachers may also be able to work around limiting factors which act as constraints to younger teachers. School administrators may also give experienced teachers more freedom to teach as they wish, thereby making it easier for them to adopt environmental education.

Explaining the significantly higher levels of adoption for females over males in the multiple regression model is difficult. Previous research has indicated that either males have higher levels of adoption than females or that no significant difference exists. The enivronmental education literature does not identify any theoretical reasons for females having a greater propensity to adopt environmental education. Further research is needed to clarify this association.

Some diffusion theorists believe that an educational innovation's institutional setting is the most important factor influencing adoption. However, results of multiple regression analysis did not indicate that system innovativeness plays a crucial role. The lack of a significant relationship is not that surprising, however considering the nature of environmental education adoption decisions. Over 90% of adopting teachers reported that they made

their own decision to adopt, independent of their principal or other teaching staff. This implies that system effects do not exert a major influence on adoption.

Individual innovativeness of teachers was not a significant predictor of adoption in multivariate analysis. This result is not consistent with diffusion research which has generally indicated that innovative people are more likely to adopt innovative practices. The sign of the multivariate association was in the right direction (positive), however, and the relationship might have been significant if the sample size was larger. The non-significant result may also be due to measurement error. The investigator has no theoretical explanation for this non-significant association.

RECOMMENDATIONS

Based on findings in this study, the investigator recommends that the following actions be taken to increase the level of adoption of environmental education in California K-12 school:

1) Teacher's concepts of what environmental education encompasses need to be broadened so that teachers of all grade levels and appropriate subject matters will better understand the relevance of environmental themes to their teaching.

2) Environmental education curriculum materials and guides need to be developed.

3) The availability of in-service training in environmental education needs to be greatly expanded.

4) Teacher participation in wildlife-related activities needs to be promoted since participation increases the teacher's propensity to adopt environmental education.

5) Wildlife-oriented organizations need to gear their programs more toward teachers in order to increase teacher interest and involvement in such organizations.

6) Wildlife educators need to stress mass media channels in their information campaigns since teachers use these channels of communication as primary sources of environmental information.

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