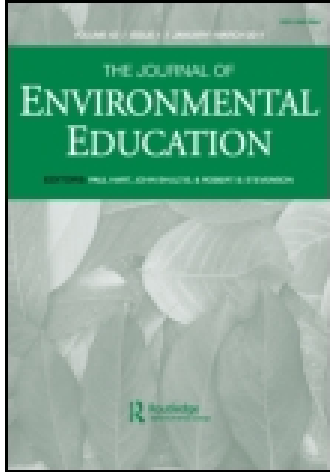


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Exploratory and Confirmatory Factor Analyses of an Environmental Attitude Scale (EAS) for Turkish University Students

GIRAY BERBEROGLU and CANAN TOSUNOGLU

ABSTRACT: The authors developed a 4-dimensional Environmental Attitude Scale (EAS) on a sample of 639 university students in Turkey. Forty-seven attitude statements from the pool of 172 items were given to 192 students. Items from the four different dimensions resulted from a principal component analysis with a varimax rotation. Both exploratory and confirmatory factor analyses indicated that the scale measures 4-dimensional traits, such as attitudes toward population growth, environmental problems, nuclear energy, and energy conservation. Differences in the factor structures between the present study and studies conducted in Western countries may reflect cultural differences.

The nature and severity of environmental deterioration is a well-known and widely discussed phenomenon. It has long been recognized that the resolution of our ecological dilemma requires not only technological changes but also changes in the attitudes and behavior of people (Stapp & Polunin, 1991). Maloney and Ward (1973) proposed that "the ecological crisis is a crisis of maladaptive behavior" (p. 583).

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Given that one's behavior toward any object or event is in part dependent upon the constellation of attitudes and values that bear upon that situation (Newhouse, 1990), we believe that it is more appropriate to make an assessment of people's attitudes concerning these issues. Such an assessment should provide clues about adjusting the school curricula to help citizens deal with the issues as they interact with their culture and biophysical environment.

Measurement of environmental attitudes has been the concern of many research studies. Steiner and Barnhart (1972) attempted to identify the dimensions of a 100-item Likert-type scale. They extracted seven dimensions in the scale reflecting the attitudes related to the regard for human life, disillusionment and pessimism regarding the implications and outcomes of man's scientific and technological involvement with nature, the need to cooperate with nature

rather than subjugate it, concern for the problem of increased population and the implications or consequences of this increase and its control, the need to take personal responsibility for current societal problems, optimistic belief in the ability and desirability of science and technology to solve societal problems and to deal with environmental deficiencies, and the desire for individual freedom. Recently Kuhn and Jackson (1989) indicated more simplified dimensions of environmental attitudes comprising the dimensions of the negative consequences of growth and technology, relationships between humankind and nature, quality of life, and limits to biosphere. These studies mainly emphasized that the trait of environmental attitudes was multidimensional in nature, although there have been similar and dissimilar groupings of the items as a result of factor analytic studies.

Worldwide environmental problems suggest that the development of scales dealing with attitudes in different cultural settings is increasingly important.

Our purpose in this study was to develop a short multidimensional environmental attitude scale, using a sample of Turkish university students. Exploratory and confirmatory factor analyses were conducted to find supportive evidence for the dimensions of the scale. Feedback about the dimensions of such a scale can help educators deal with environmental attitudes in the school curricula that may help direct behavior toward conservation of the environment. The scale may also prove useful for comparing structures of environmental attitudes across different cultures.

Method

Item Pool

Using earlier work in this field (Kuhn & Jackson, 1989; Steiner & Barnhart, 1972), we developed an item pool of 172 attitudinal statements. We carefully examined the wording of the items against Edwards' criteria for writing attitudinal statements (Anderson, 1988).

The items in the initial pool were written so as to capture ideas related to population growth, responsibility toward the environment, the importance of environmental problems, the use of nuclear energy, energy conservation, negative consequences of growth and technology, relationships between humankind and nature, and the importance of recycling.

Of the 172 items, 47 items representing the dimensions of the item pool were selected and rated using a 5-point Likert-type scale (*strongly agree*, *agree*, *undecided*, *disagree*, and *strongly disagree*) for the pilot study.

Procedure

The 47-item scale (26 indicative, 21 contraindicative items) was given to a pilot group of 192 university students in the Faculty of Education and Faculty of Arts and Sciences at Middle East Technical University in Ankara. Students in the sample were chemistry, biology, or mathematics majors.

The data were analyzed by exploratory factor analysis. Principal component factor analysis with a varimax rotation revealed four meaningful factors for statements grouped into the dimensions of attitude toward population growth, importance of environmental problems, the use of nuclear energy, and energy conservation. The rest of the items were distributed among the other factors without any meaningful cluster. The first four factors accounted for 54.1% of the variance in item responses. Eigenvalues of the first four factors were all greater than 1.50. This finding suggested developing the scale by considering these four dimensions only. As a result, we selected 5 items in the dimension of attitudes toward population growth, 5 items in the dimension of attitudes toward the importance of environmental problems, 4 items in the dimension of attitudes toward the use of nuclear energy, and 4 items in the dimension of attitudes toward energy conservation with respect to their content and factor loadings, for the final scale.

Sample

The 18-item Environmental Attitude Scale (EAS) was administered to 639 university students (348 women; 291 men) from different faculties of four universities in the Ankara district.

Data Analysis

We used both exploratory and confirmatory factor analyses to establish supportive evidence for the dimensions of the 18-item EAS. We used SPSS/PC+ (Norusis, 1986) to conduct the principal component analysis with a varimax rotation of the four factor axes. Confirmatory factor analysis was completed within the framework of LISREL VII (Joreskog & Sorbom, 1988). Items grouped into four different factors by exploratory solution in the pilot study were defined in their respective dimensions in the confirmatory analysis, and maximum likelihood estimates were evaluated with the adjusted goodness-of-fit index for the four-factor model.

Results

Principal component analysis with a varimax rotation for the four factors revealed factor loadings between .78 and .46 (Table 1). The rotated factor pattern obtained in this analysis indicated that the four factors accounted for 51% of the variance in item responses. Eigenvalues were between 3.76 and 1.47. Confirmatory factor analysis within the framework of LISREL VII (Joreskog & Sorbom, 1988) was conducted on the same data (see Table 2).

The confirmatory solution with the four factor model gave an adjusted goodness-of-fit index of 0.93 ($df = 129$), which was interpreted as a good fit by the researchers. Maximum likelihood estimations were between .402 and .739 for EAS items. The t values obtained by LISREL VII indicated that all the factor loadings were statistically significant at $p < .01$. The scale generally indicated a .75 Cronbach's alpha reliability estimate. The reliability of each

TABLE 1. Factor Loadings of the Items of the Environmental Attitude Scale Obtained via Principal Component Analysis With Varimax Rotation

Item	Statement	Dimension			
		1	2	3	4
15	I am not interested in the population growth of the world.	.779	.084	.062	.120
17	I don't intend to have more than two children.	.761	.178	.047	-.064
2	Population growth rate of Turkey should be decreased.	.743	.052	.082	-.115
7	There are more people on Earth than it can feed.	.594	.049	.119	.038
8	Families with too many children should pay more taxes.	.403	.011	.112	.004
12	It is annoying to see people do nothing for the environment.	.009	.762	.109	.137
11	To see gray clouds above the city makes me feel down.	.062	.633	.011	.048
10	Environmental problems should be given top priority.	.118	.612	.188	-.006
14	I would like to volunteer to help people work towards the water pollution.	.319	.608	.131	.033
5	The real reason for environmental pollution is people.	-.033	.458	-.019	.135
9	Nuclear power is a reliable and clean source of energy.	-.026	.033	.762	.033
3	Turkey is in need of nuclear power plants.	.090	.046	.761	-.023
13	I don't mind living near a nuclear power plant.	.166	.067	.652	.075
18	I would not work in a nuclear power plant even if I don't have any other jobs.	.088	.303	.597	-.074
4	I don't think turning the light off when leaving a room makes any real saving.	.022	.105	.085	.71
1	Cutting down the amount of water used will not help to solve the problem of water shortage.	.027	.012	.006	.668
6	I don't like trying to save some water.	-.045	.077	-.065	.650
16	I don't like cutting down my use of electricity.	-.033	.020	-.016	.639

Note. The scale was administered in Turkish.

TABLE 2. Maximum Likelihood Estimates of LISREL VII for the Items of the Environmental Attitude Scale

Item	LISREL maximum likelihood estimates			
	1	2	3	4
2	.739 (18.425)	.000	.000	.000
17	.734 (18.255)	.000	.000	.000
15	.681 (16.639)	.000	.000	.000
7	.583 (13.767)	.000	.000	.000
8	.451 (10.257)	.000	.000	.000
12	.000	.676 (14.978)	.000	.000
11	.000	.515 (11.763)	.000	.000
14	.000	.574 (12.550)	.000	.000
10	.000	.542 (11.756)	.000	.000
5	.000	.402 (8.501)	.000	.000
9	.000	.000	.654 (15.133)	.000
3	.000	.000	.714 (16.522)	.000
13	.000	.000	.616 (14.030)	.000
18	.000	.000	.574 (12.947)	.000
4	.000	.000	.000	.674 (13.083)
16	.000	.000	.000	.519 (10.911)
6	.000	.000	.000	.539 (10.794)
1	.000	.000	.000	.479 (9.611)

Note. The *t* values are provided in parentheses next to the associated factor loadings.

TABLE 3. Means, Standard Deviations, Reliabilities, and Intercorrelations of the Four-Factor Scale of the Environmental Attitude Scale

Factor	1	2	3	4	<i>X</i>	<i>SD</i>	<i>r</i>
Population growth	1.00				3.43	.95	.77
Environmental problems	.36	1.00			4.30	.60	.66
Nuclear energy	.24	.30	1.00		3.50	.92	.74
Energy conservation	-.01	.15	-.01	1.00	4.22	.75	.64

subscale and interscale correlations with the scale means and standard deviations are presented in Table 3.

The highest reliability was found for the subscale of population growth, and the lowest reliability was found for the subscale of energy conservation.

Energy conservation had the lowest interscale correlations with both population growth and nuclear energy. Environmental problems gave the highest correlations with population growth and nuclear energy dimensions.

Conclusion

The existence of four dimensions in the EAS received substantial support from configurations obtained in both exploratory and confirmatory factor analyses. The scale items loaded on separate factors in the four-factor solution in both the exploratory and confirmatory analyses. Students who responded to the scale perceived the environmental issues with respect to population growth, importance of environmental problems, nuclear energy, and energy conservation.

Intercorrelations among the subtests of EAS also demonstrate the different traits measured by the scale. For example, although the correlations of energy conservation with the dimensions of both population growth and nuclear energy were obtained as $-.01$, both nuclear energy and population growth gave correlations of $.30$ and $.36$ with the environmental problems dimension. Both of these dimensions were perceived as environmental problems by the students, but interscale correlations were generally far away from being moderate among the subscales supporting the results of factor analyses.

The dimensions we obtained in EAS are generally compatible with the dimensions of the scales developed by other researchers in different cultural settings (Steiner & Barnhart, 1972; Kuhn & Jackson, 1989). In the pilot study, however, we did not observe a consistent structure for the items of negative consequences of growth and technology, relationships between humankind and nature, and recycling. This may have been due to the cultural differences between Turkey and the western countries. In fact, items concerning

the dimensions cited above are more or less related to the awareness of technological development and its negative consequences on environmental issues. Given that Turkey is a developing country and on the way to industrialization, the importance of recycling and the effects of technological development on the environment are not as serious as in the developed countries: Consequently, they are not emphasized in school curricula or in the general mass media. Yet the rate of population growth, the use of nuclear energy in producing electricity, and the importance of energy conservation have been the main issues of environmental concern for many years both publicly and in the schools. In our study, these factors produced a scale with only four dimensions.

We expect that this first study of the dimensions of environmental attitudes in Turkey will initiate other research studies. Our findings seem to indicate that further research is needed to deal with the development of more awareness about environmental problems in Turkey. Based upon the psychometric properties of the EAS, we hope that further studies will explore the characteristics of the construct in depth.

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