AN EVALUATION OF A MODEL ENERGY AWARENESS AND CONSERVATION INSERVICE PROGRAM FOR OKLAHOMA DRIVER EDUCATION TEACHERS

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PREFACE

In this research project a model driver education energy awareness program was designed and evaluated for its effectiveness in causing a change in the attitude of subjects toward energy awareness and knowledge of conservation practices pertaining to the automobile. One of the major tasks of this study was designing an energy awareness instrument to measure a change in attitude and knowledge.

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CHAPTER I

STATEMENT OF THE PROBLEM

Introduction

The United States is faced with an energy crisis. The demand for energy is increasing while the supplies of oil and gas are diminishing. Unless Americans make timely adjustments in energy consumption and production before world oil becomes scarce and more expensive in the 1980's, the nation's economic security and the American standard of living will be gravely endangered (23).

How did we reach crisis stage? Americans have developed a habit of using large amounts of energy due to an abundant, cheap supply. Ever since the industrial revolution, America's appetite for energy has been growing, mainly because fossil energy has increasingly replaced human labor. An increasing population in the United States has had a major effect on increasing energy consumption. The U.S. has had a steady population growth of about two percent annually for the past 100 years. However, the per capita energy consumption grew 46 percent from 1950 to 1970, while population increased only 34 percent (12), showing that each individual is becoming more dependent on more energy.

America's primary source of energy is oil, which provides nearly one-half of the energy consumed. Oil was developed originally as a source of artificial light and lubricant in the 1870's and 1880's. It gradually became the principle heating fuel for industry and homes by the early 1900's. The early years of the nineteenth century began the "age of oil" with the increased use of the automobile. The number of registered automobiles increased from 8,000 in 1900 to over one million in 1913, 10 million in 1922, and 27.5 million in 1940 (23). Today, there are nearly 100 million registered automobiles in America (6). American oil production went from 64 million barrels per year in 1900 to 1.4 billion barrels per year in 1940 (23) and 9.5 million barrels per day in 1976 (23). The automobile has become a major factor in the energy crisis. The U.S. has 5.7 percent of the world's population but 46.1 percent of the world's automobiles which consume 75.3 billion gallons of gasoline each year. The average automobile will be driven 10,000 miles, consume 772 gallons of gasoline each year, and get 13.3 miles per gallon. The gasoline necessary to fuel all these cars and trucks takes 29.3 percent of the U.S. total petroleum consumption or (12.9 percent of the total U.S. energy consumption). It requires about 150 million BTU of energy to manufacture a car (equivalent to 1200 gallons of gasoline) (13). Automobiles indirectly require energy to operate; 21,000 square miles of paved roads, petroleum refining process, maintenance, and car manufacturing. All together it is equivalent to 147.2 billion gallons of gasoline, or 25.2 percent of the total U.S. energy consumption (13).

Definitions of Terms

ERDA - Energy Research and Development Administration.

CETA - Comprehensive Employment Training Act.

OPEC - Organization of Petroleum Exporting Countries.

M - Mean or average.

SD - Standard Deviation.

SE - Standard error of the mean.

N - Number of subjects.

Need of the Study

There is a drastic need for conservation of our precious petroleum products in America today. Transportation is one area where energy conservation practices should pay substantial dividends. If the fuel consumption of the average car were reduced just 15 percent through better driving practices and better maintenance, the nation's consumption of petroleum would fall by over 28,000,000 gallons per day (6). But many people do not understand why conservation of gasoline is necessary. Many people are also not knowledgeable about energy conservation techniques that are applicable to the automobile. One way this situation might be rectified is through the development and implementation of educational energy awareness and conservation programs. These programs could be a part of the regular curriculum for students taking driver education classes in high school. In Oklahoma this would mean that every year 48,900 students or 92 percent of those eligible to take driver education classes (24), would receive energy awareness and conservation information. If incorporated in all driver education classes across the nation this could develop a more conservative attitude in the future drivers of this nation. But first, such programs need to be developed and evaluated on their effectiveness in causing a change in attitude toward energy awareness and knowledge of conservation techniques.

Purpose of the Study

The purpose of this study was to develop and evaluate an energy awareness and conservation inservice program for a select group of driver education teachers in Oklahoma. The energy program was evaluated to see if it was effective in causing a change in attitude and knowledge toward energy awareness and conservation.

Research Questions

1. Did the information presented in the inservice program bring about a statistically positive significant change in attitude toward energy awareness at the .05 level?

2. Did the information presented in the inservice program bring about a statistically positive significant change in knowledge of conservation practices pertaining to the automobile tested at the .05 level?

Assumptions

The following conditions are assumed for this study:

1. The difference between the experimental group means and control group means are due to the treatment.

2. The non-equivalent control group design will control for certain factors of internal invalidity.

3. The data gathered were interval data.

4. The data collection instrument was valid.

Limitations

The results of this study could be generalized to a greater population with more confidence if the subjects could have been randomly assigned and selected. However, the inservice programs of this study were on a volunteer basis so it was not possible to randomly assign or select the subjects.

CHAPTER II

REVIEW OF LITERATURE

This chapter covers selected literature relation to: (1) a literature review of the energy crisis, (2) public beliefs, attitudes, and behaviors toward the energy problems, (3) conservation of energy through education, and (4) developing and evaluating inservice programs.

A Review of the Energy Crisis

> We often hear the term 'energy crisis' used these days. But what is the energy crisis? Is the world actually in danger of running out of useful energy? Are we faced with the prospect of darkened cities, curtailed transportation, and no heat for our homes? In reality, the world's energy resources are plentiful. The reserves of coal are sufficient for several hundred years; we receive vast amounts of energy from the sun; there is a huge and almost untapped reservoir of heat within the earth; and the supply of nuclear fuels is almost unlimited. Why, then, is there a 'crisis' at all? (14, p. 1).

The reason for the energy crisis is very complex and involved. Social attitudes, world politics, population dynamics, and a plethora of other entities must be considered in a review of the energy crisis.

Energy Research and Development Administration lists the four main reasons for the energy crisis: (1) our total energy consumption has been rising rapidly as population and the rate of per capita demand and living standards have grown; (2) our domestic supplies of natural gas and oil are running out, and dependence on overseas sources could create international political and financial risks; (3) the production of energy is now affected by standards of environmental quality concerning our air, water, land, recreational, and esthetic resources; and (4) we are not developing new sources of energy and new energy production systems fast enough to keep up with the increasing demand (28).

The world's population is growing at about two percent per year, which suggests a doubling rate of 35 years. The United States population growth is a little less than two percent. In 1920, the U.S. had 106 million people, but in 1970 there were 203 million people, which constitutes a 91 percent increase (10). The energy per capita jumped 76 percent during the same period of time (7). Not only has the number of people using energy increased, but the amount per person has increased considerably. The nation's energy demands grew by 3.5 percent per year between 1950 and 1970, and today every American has the energy equivalent of 178 full-time servants (28).

The increase in the number of automobiles has also contributed significantly to the demand for petroleum as an energy source. The number of registered automobiles increased from 8,000 in 1900 to 100 million in 1978 (18).

In 1960, the U.S. imported 1.8 M bbl/d (millions of barrels per day) of crude oil, or 19.8 percent of the domestic demand. The payment for this oil was 1,543 million dollars. In 1976, the U.S. imported 7.3 M bbl/d or 42 percent of the domestic demand. The payment to foreign countries was a staggering 34,643 million dollars (26). The U.S. domestic production does not meet the domestic demand and the difference must be purchased from foreign countries. The price for foreign crude oil per barrel in 1960 was $2.88. In 1974 the price had jumped to $12.52 and in 1976 it had jumped to $13.21 (26).

Why did the demand increase? Raymond Vernon (29) states:

> . . . the reasons for especially rapid growth in the demand for Middle East oil were various, but one overwhelming fact dominated: the cost of producing oil was lower--much lower--than the cost of producing practically any other source of energy (p. 2).

During the years following World War II, energy sources in the world market became more plentiful and less expensive, competing favorably with our own domestic sources. The discovery of vast and readily accessible oil reserves in the Middle East, plus a low per capita consumption in many parts of the world made oil available and cheap. Domestic oil companies invested heavily in foreign oil exploration and production. Gradually, our domestic production of energy began to slip. Our coal production peaked in 1917. Domestic exploration for oil and gas fell off in 1956. Domestic oil production peaked out in 1970 with 9.6 M bbl/d and has since decreased. Oil and gas exploration peaked out in 1955 with 55,896 wells drilled. To protect domestic oil producers, the U.S. had tariffs and import restrictions imposed on foreign crude oil. This lasted from the middle fifties to the early seventies. The U.S. was gradually becoming dependent on cheap Middle East oil. Raymond Vernon (29) goes on to say:

> . . . By the late sixties, however, the shift to reliance on Middle East oil was very far advanced. It was at about this time that a series of other trends greatly heightened the monopolistic potential of the Middle East countries. There was a stiffening in the demand for energy in general, and for oil in particular. The increase in energy demand was a consequence of a remarkable surge in industrial growth that hit Europe, Japan, and the United States simultaneously in 1972 and 1973, a very rare convergence of cyclical timing. The sharp increase in the demand for oil in particular came about partly because of delays in bringing nuclear power plants into operation, and because of various anti-pollution controls (p. 3).

Why did the price increase? On October 6, 1973, Egyptian forces attacked the west bank of the Suez Canal. The Syrian Army attacked and captured much of the Golan Heights. By October 18, 1973, the Arabs were on the defensive. An aggregate of five Middle East nations decided to use politics in place of bullets to win the war. Saudi Arabia, Iraq, Qatar, Abu Dhabi, and Kuwait agreed to decrease oil production by five percent per month until

Israel withdrew from occupied territories (8). The U.S., like other countries that import Middle East oil, had a significant shortage of oil from October, 1973 to March, 1974 when the embargo was lifted. Due to the tremendous world demand for oil during and after the embargo, the price went up considerably. Who was primarily responsible for this hike? The OPEC (Organization of Petroleum Exporting Countries) Ministers, particularly the Shah of Iran, who demanded in this meeting in Teheran on December 22-23, 1973, that the price be in the neighborhood of $20.00 per barrel. A compromise was reached at $11.65 with a government take of $7.00 per barrel (21). This was the largest increase in crude oil price in history and sent shock waves through the world economy. The price of gasoline went from 38.8 cents per gallon in 1973 to 52.8 cents per gallon in 1974 (26).

Public Beliefs, Attitudes, and Behaviors Toward Energy Problems

A Gallup poll asked the general public the following question on December 7, 1973: "Who or what do you think is responsible for the energy crisis?" The following answers were offered.

Multiple answers included:

	%
The oil companies	25
The Federal Government	23
The Nixon administration	19
U.S. consumers	16
Arab Nations	7

	%
Big business	6
Leaders playing politics	4
U.S. exporting	3
There is no shortage	6
Miscellaneous/no opinion	19 (15, p. 85).

It is clear from the results of this poll that the American people were not knowledgeable about the cause of the energy crisis. They believed, at least 67 percent, that the oil companies or the Federal Government or President Nixon were responsible for the energy crisis. The Louis Harris Poll (4) revealed that the resentment against all oil-producing countries had risen remarkably by 1974.

It appears that the U.S. public was uninformed about the cause of the crisis. Congressman Mike McCormack (11) sums up the beliefs of many Americans about the crisis in saying:

> . . . One of the most dangerous aspects of the energy crisis is that a large portion of our fellow citizens do not understand it. Indeed, a surprising portion of Americans deny that an energy crisis exists, and many who do, believe that it has been contrived by evil powers which could easily and quickly undo their nefarious deeds; that is, solve the energy crisis by magic (p. 1).

Energy consumption has not declined, but has gone up since the 1973 embargo, thus one could conclude that not too many people believe there is any need to conserve. President Carter (2, p. 55) stated in his national energy plan that "with the exception of preventing war (the energy crisis) is the greatest challenge that our country will face during our life time."

A more recent Gallup poll (2) showed that only 52 percent of the American public knew that America must import oil, and of those, only 17 percent had an accurate idea of how much oil the U.S. imports. It seems that the American people need to be educated about the problem so they can meet "the greatest challenge next to war" (p. 55). If the problem is really not known to the people, how can they meet it, much less solve it?

An attitude of unconcern and a lack of knowledge about conservation of gasoline can be verified by the selected results from energy questions used to measure science achievement in the National Assessment of Education Progress (NAEP) nationwide survey for 1973 (17). The question asked by NAEP was, "Do you know a way to test whether premium gasoline should be used in a second-hand automobile?" The results for 26-35 year old adults is described by the NAEP (17):

> . . . With the price of gasoline soaring and little hope for relief in the future, the question of whether people know when to use regular or premium gas takes on economic significance. Surprisingly few (40%) adults could describe a simple test to determine the type of gasoline to use. Only 12% of the blacks and 23% of adults in low metropolitan areas could describe one test (p. 17).

Approximately one out of three 17 year olds knew of one way to test a used car in order to determine the type of gasoline to buy (17).

The need for education of conservation techniques for the general public is further verified by an article in

Nation's Business (22, p. 28). The article featured an interview with Dr. Wernher Von Braun, one of the nation's foremost scientists and one time deputy associate administrator of the National Aeronautics and Space Administration, which recapitulates the attitude of the American people toward the use of energy. In the interview, Dr. Von Braun says: "We have been very, very wasteful of energy simply because it was cheap. The sooner we get used to the fact that it is not cheap, the better it will be for all of us" (p. 28). The American public has had and probably still has an attitude of wastefulness concerning the use of depletable energy supplies.

Conservation of Energy Through Education

Is there any effort being made to change the general public's level of knowledge and attitudes about the energy problem and conservation? Ernest L. Boyer (22), U.S. Commissioner on Education, in a speech before the sixth annual conference of Council for Educational Development and Research, proposed the establishment of an Energy/Education Action Center. The Center would have three educational goals: (1) providing information and technical assistance to schools and colleges as they move toward effective energy conservation, (2) giving support in the training of new energy and environment professionals,

(3) providing leadership and support in the development of new curricular materials focused on the three E's (Environment, Energy, and Engagement). It was suggested that the Center would be engaged in many projects related to educational programs in energy conservation and public awareness.

Energy awareness programs are being developed presently in the American education system to bring about public awareness. The author has had personal experience in several energy awareness programs. In the summer of 1976 Kansas State University, Manhattan, Kansas, held a summer energy awareness workshop sponsored by ERDA. It was an intensive study for ten days, aimed primarily at science educators. Every topic covered was directed by a person knowledgeable in that field. A great deal of energy education materials were distributed, but no data were taken to see if the participants changed in knowledge or attitude about energy. The next energy awareness program the author was engaged in was the Energy Awareness Demonstration Program at Oklahoma State University. A recent article in Research and Projects in Education explains what this program is about.

> Since January (1978), more than 50 schools have been visited, and a total of 20,000 students have been informed of the Oklahoma Energy Conservation Plan. The highlighted program, the Energy Awareness Demonstration Program, is sponsored by the Oklahoma Department of Energy in cooperation with the State Department of Education; the College of Education; the College of Agriculture; and the Cooperative Extensive

> Service of the Oklahoma State University. It is an integral part of the Oklahoma Energy Conservation Plan to meet the goal of a 5% energy savings by 1980 (20, p. 4).

This program aims at the long-range goal of a solution for energy conservation by informing youth. However, at present there has been no statistical data taken as to the effect of the program on the attitude and knowledge of the participants.

In the summer of 1977, the College of Education of Oklahoma State University held an Energy Awareness Work Conference. The 20 participants were actively involved in it for three weeks. The objectives (Appendix A) of the workshop were met by class activities, discussions with a variety of energy specialists, and field trips. An evaluation of the conference was conducted to see if the participants had: (1) increased their energy vocabulary, (2) knowledge of conservation techniques, and (3) changed attitude toward energy awareness. The results of the analysis showed: (1) a significant difference in participant's energy vocabulary at the .01 level, (2) a significant change in knowledge of conservation at the .20 level, (3) no significant difference in attitude toward energy awareness, and (4) a significant change in knowledge about specific energy concepts at the .05 level (1).

Conservation programs are being developed and implemented to create a better understanding of the energy crisis. The general public needs to be educated about energy conservation. Education is the foundation of the American society and can be utilized as a tool to bring about not only awareness but solutions to the energy crisis. Materials (Appendix B) are now being published for educators in nearly every field to help with the development of energy conservation programs.

Developing and Evaluating Inservice Programs

Since this study deals with evaluation of an energy awareness program, it is appropriate to mention briefly the components of a model inservice program. The inservice model has five basic steps: (1) identification of the aims and objectives of the program (the dependent variable), (2) restatement of the aims and objectives in behavioral terms (an operational definition), (3) construction of a content valid test to measure the behaviorally-stated aims and objectives (measurement of the dependent variable), (4) identification and selection of a control, comparison, or criterion group against which to contrast the test group (establishing the independent variable), and (5) data collection and analysis (25).

The aims and objectives of a study are very general and broad statements that the designer is interested in achieving in the program. These objectives are the dependent variables in the study. The broad aims in Step 1 are stated more specifically in the next step. These statements of behavior are measurable and will allow the researcher to use the instrument of evaluation to gain data that will be analyzed later.

Most generally, a researcher wants to know to what extent the participants have changed after the treatment of the program has been applied. But to be really useful, it is best to compare this information to a standard which is most often a control group. The control group receives the measuring instrument, but not the treatment. Threats to internal reliability are minimized by using a random selection procedure to obtain the participants. This is not always possible, so one could use a nonequivalent control group design. The last step in the evaluation procedure would be to collect the data by administering the measuring instrument and analyze it using the appropriate analysis procedure.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

Introduction

This study was done to evaluate a model driver education energy awareness inservice program. Energy awareness concepts were incorporated into a six hour program. The programs were conducted at five universities in Oklahoma. The subjects were driver education teachers or driver education majors taking advanced driver education classes. The control group received the instrument but not the treatment. Data were collected by using an instrument which measured energy awareness concepts on the affective and cognitive level. Statistical procedures were applied to the data to test for a significant difference between the control group means and experimental group means on the affective and cognitive level.

Driver Education Energy Awareness Inservice Program

While there exists an abundant amount of information on energy awareness, the energy crisis, and energy conservation, there is little or no information on driver education energy awareness inservice programs. Thus, the task was to organize the right material from the voluminous amount of energy related material in print. The material was selected that would cover what was thought to be the most important energy awareness concepts that driver education teachers needed to know (Appendix C).

The energy awareness programs were to cover six areas with each area taking about one hour. The first hour of the program explained why we are facing an energy crisis. This section was used to give an informative background on the world and national energy situation. Graphs and charts were used to formulate an overall picture of the growing problems and needs. The material on engines and alternate fuels was used because it explains what experimental progress is being made with new engine types and new fuels. The section on "selection and maintenance of your automobile" was developed from the "Don't be Fuelish" pamphlet (6) printed by the Federal Energy Administration. It was part of the program because it explained how to save fuel by keeping an automobile in tune. The information in the "1978 Gas Mileage Guide" (27) was useful for those people considering buying a new car because it gives the mileage of all 1978 cars. The "power train and tires" section was included in the program because of the energy savings that could result from using radial tires and keeping them properly inflated.

Some time was also spent on tire safety and the different types of tires on the market today. The fifth hour of the program dealt with safe driving techniques. The "Don't be Fuelish" pamphlet (6) was used for this section also. The last section allowed time for the use of "Energy Conservation Education for Oklahoma Driver Education Teachers" (19) which was a booklet of energy related activities for high school students put together especially for this energy awareness program.

A free packet of materials and pamphlets (Appendix D) was given to each participant to be used as a study guide during the program and later for future reference and teaching.

Selection of the Subjects

The population for this research project was driver education teachers and students majoring in driver education in the state of Oklahoma. The Driver Education Energy Awareness Programs were conducted at five universities (Table I) in the state of Oklahoma. The participants in the programs were involved in taking advanced driver education classes in the summer of 1978 at one of the universities. It was not possible to randomly assign or select participants, so a non-equivalent control group design described by Campbell and Stanley (3) was used in this research. It controls for the following factors of internal invalidity: history, maturation, testing, instruments, selection, mortality, and interaction of selection.

TABLE I

THE LOCATION OF THE INSERVICE PROGRAMS AND THE NUMBER OF PARTICIPANTS

Experimental Group	n	Control Group	n	Other	n
Northeastern	26	OSU	31	CETA	46
Southeastern	19				
Southwestern	14				
Central	11				
Northwestern	6				

The control group used in this study consisted of 31 students taking a driver education class at Oklahoma State University in the fall semester of the 1978 school year.

A special workshop was conducted with a group of high school students who were participating in a CETA program in a metropolitan city in the summer of 1978. The original workshop material was revised somewhat to better meet the needs of the subjects in this program.

Development of the Instrument

The instrument (Appendix E) used in this research project was developed by the author after nothing was found in the literature that could test the specific concepts taught in the inservice program. The instrument was a multiple choice test of 40 questions on energy awareness. The first 20 questions of the test measured the participant's attitude about energy awareness. The participants answered each question as strongly agree, agree, no opinion, disagree, or strongly disagree. This section resembled the Likert scale. The second 20 questions tested for specific knowledge about energy conservation techniques having to do with the automobile.

Some statistical analyses were applied to the instrument to calculate internal reliability and test-retest reliability coefficients. The control group posttest scores on the cognitive section of the test resulted in a .76 internal reliability coefficient. This was determined by finding Cronbach's alpha (5). The test-retest reliability for the posttest cognitive scores on the control group was .46. A similar computation for the posttest affective scores was .51. Probably the reason the test-retest scores were low has to do with the small variance in the cognitive posttest scores and affective posttest scores. The small variance could be a result of individuals with similar backgrounds. Validity of the instrument was checked by inspection.

Collection of the Data

The treatment in this study was the six hour energy awareness inservice program. The treatment was administered to the experimental group and CETA group, but not to the control group. The instrument was given at the beginning and end of each program. Each participant was issued a packet of energy materials with an identification number which was recorded on the test answer sheets to assist the analysis of the data. The instrument was given to the control group; then, one week later the instrument was given again.

Statistical Treatment

The data were analyzed to answer the following research questions:

1. Did the information in the inservice program bring about a statistically positive significant change in attitude toward energy awareness at the.05 level?

2. Did the information in the inservice program bring about a statistically positive significant change in knowledge of conservation practices pertaining to the automobile tested at the .05 level?

The instrument used to collect data had 40 questions, the first 20 of which measured the participants' attitude and will be referred to as the affective part of the test. The second 20 questions on the instrument measured the participants' knowledge about energy awareness and will be referred to as the cognitive section. The affective pretest means from the control group and the experimental group were tested for a significant difference at the .05 level. The cognitive pretest means from the control group and the experimental group were tested for a significant difference at the .05 level. In a similar manner, the affective posttest means from the control group and the experimental group were tested at the .05 level. The cognitive posttest means from both groups were also tested at the .05 level. Since there existed a significant difference between cognitive pretest means from the control group and the experimental group, an analysis of covariance was used to adjust the posttest means and test for a significant difference between these adjusted means (9).

Since the control group had a different number of subjects than the experimental group, it was necessary to test the assumption of homogeneity of variance. This test would determine whether the regular form of *t*-test or a special form of *t*-test would be used (16).

The participants in the CETA program were 14 to 18 year old high school students which were quite different from the rest of the subjects in this research. Thus, the CETA mean scores were not included in the experimental group and were not compared to the control group. The CETA program was done to see if the same information used in the driver education programs would bring about a significant difference in attitude and knowledge in students of this age. A *t*-test was also used for the CETA group to test for a significant difference at the .05 level between the affective pretest mean and the affective posttest mean. A *t*-test was used to test for a significant difference between the cognitive pretest mean and cognitive posttest mean.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

For this study, driver education teachers taking summer driver education classes were engaged in a six hour program on energy awareness. An instrument, developed by the author, was used to measure energy awareness concepts on the affective and cognitive level. The control group was given the instrument but not the treatment. A special program was conducted with a group of young people involved in a CETA program to see how effective the program was in changing their level of energy awareness.

Upon comparing the control group cognitive pretest mean of 9.13 (Table II) to the experimental group cognitive pretest mean of 7.61 (Table III), one can see that there was a difference. This difference was found to be significant at the .002 level (Table IV). Thus, the groups were not equivalent on the cognitive level. An analysis of covariance (Tables V and VI) was utilized to adjust the posttest means using the pretest means as the covariate variable. The cognitive posttest means were significantly different at the .0001 level. This indicates the experimental group had a greater knowledge of

TABLE II

M, SD, AND SE FOR CONTROL GROUP COGNITIVE AND AFFECTIVE PRE AND POSTTEST SCORES

Test	N	M	SD	SE
Cognitive Pre	31	9.13	2.57	.46
Cognitive Post	31	8.87	1.88	.34
Affective Pre	31	75.55	7.44	1.34
Affective Post	31	74.58	8.13	1.46

TABLE III

M, SD, AND SE FOR EXPERIMENTAL GROUP COGNITIVE AND AFFECTIVE PRE AND POSTTEST SCORES

Test	N	M	SD	SE
Cognitive Pre	75	7.61	2.16	.25
Cognitive Post	75	12.15	2.72	.31
Affective Pre	75	73.97	9.70	1.12
Affective Post	75	78.86	11.88	1.36

TABLE IV

M, SD, SE, AND T-VALUE FOR CONTROL AND EXPERIMENTAL GROUP ON COGNITIVE PRETEST

Group	N	M	SD	SE	T-Value	F**
Control	31	9.13	2.57	.46	3.11*	.23
Experimental	75	7.61	2.16	.25		

*P<.002
**F-test: tests homogeneity of variance

TABLE V

SUMMARY OF ANALYSIS OF COVARIANCE

	SS	DF	MS	F
Between Groups	358.11	2	179.06	38.90*
Within Groups	474.11	103	4.60	
Total	832.22	105		

*P<.001

TABLE VI

POST COGNITIVE UNADJUSTED AND ADJUSTED MEANS FOR CONTROL AND EXPERIMENTAL GROUP

	Unadjusted M	Adjusted M
Control	8.87	8.36
Experimental	12.04	12.36

conservation concepts after the program than the control group.

When the affective pretest means were compared (Table VII), a significant difference was not found. Thus, the groups were equivalent on the affective level before the treatment. The affective posttest means (Table VIII) were not found significant at the.05 level but they were significant at the .065 level. It depends on the level of significance a researcher wants to accept whether the affective posttest scores are significant or not. The author established the .05 level in the initial stage of this research, so the means would not be significantly different at this level.

The analysis of the data from the CETA program (Table IX) demonstrated that the cognitive pretest and cognitive posttest scores were significantly different at the .0002 level. The subjects had evidently gained some knowledge

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TABLE VII

M, SD, SE, AND T-VALUE FOR CONTROL AND EXPERIMENTAL GROUP ON AFFECTIVE PRETEST

Group	N	M	SD	SE	T-Value	F*
Control	31	75.55	7.44	1.34	.81	.11
Experimental	75	73.98	9.70	1.12		

*F-test: tests homogeneity of variance

TABLE VIII

M, SD, SE, AND T-VALUE FOR CONTROL AND EXPERIMENTAL GROUP ON AFFECTIVE POSTTEST

Group	N	M	SD	SE	T-Value	F**
Control	31	74.58	8.13	1.46	1.87*	.02***
Experimental	75	78.32	11.86	1.36		

*P<.065
**F-test: tests homogeneity of variance
***P<.02

of conservation due to the energy awareness program. The affective pretest means and posttest means (Table X) were found to be not significantly different at the .05 level. The attitudes and opinions of the subjects about energy awareness were not changed significantly.

TABLE IX

M, SD, SE, AND T-VALUE FOR COGNITIVE PRE AND POSTTEST SCORES FOR CETA GROUP

Test	N	M	SD	SE	T-Value
Cognitive Pre	45	5.56	2.31	.34	3.89*
Cognitive Post	45	7.69	2.75	.41	

*P<.0002

TABLE X

M, SD, SE, AND T-VALUE FOR AFFECTIVE PRE AND POSTTEST SCORES FOR CETA GROUP

Test	N	M	SD	SE	T-Value
Affective Pre	45	69.93		1.37	.56
Affective Post	45	66.87		1.34	

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

In this research project a model driver education energy awareness program was designed and evaluated for its effectiveness in causing a change in the attitude of the subjects toward energy awareness and knowledge of conservation practices pertaining to the automobile. It was assumed that if driver education teachers were exposed to the treatment that their attitudes toward energy awareness and their knowledge of conservation would be changed significantly. It was also assumed that the data gathered was interval data which would satisfy the assumptions underlying the t-test and the analysis of covariance.

Inservice programs were conducted at five universities in Oklahoma. The 75 subjects in the experimental group were driver education teachers or students majoring in driver education that were involved in taking advanced driver education classes. The control group consisted of 31 driver education majors at Oklahoma State University.

The results of analysis show that the experimental group mean on the cognitive level was significantly different from the control group mean tested by the analysis of covariance at the .0001 level. The experimental group mean and control group mean on the affective section showed a significant difference at the .065 level but not at the .05 level. The CETA group pretest mean and posttest mean on the affective area of the test was not significantly different at the .05 level. The CETA group pretest mean and posttest mean on the cognitive level was significantly different at the .0002 level.

Conclusions

The driver education energy awareness inservice program demonstrated that it was effective in causing the participants to have a gain in knowledge of energy conservation. One could conclude that it is easier to change a participants knowledge about energy and conservation than it is to change a participant's prejudices, opinions, and attitudes about energy awareness.

Recommendations

The author suggests that more time in the inservice program be contributed to explaining the causes of the energy crisis. More time could also be spent doing the energy activities. If the program could be scheduled for two to three days with four to six hours per day, a greater change in attitude could probably be expected. Some revision could probably be done with the material taught in the program. The material on safety might be left out, possibly allowing the subjects time to develop and explain about their own energy conservation tips. Having a longer question and answer period could help clear up any confusion that might have resulted from the topics covered in the program.

Recommendations for Further Study

The data indicated that the program did cause a change in knowledge of conservation but not as much change in attitude toward energy awareness. The author suggests that further research be done with the affective level of the study. One possibility would be to use the Mathew Miles program design. There is evidence in the literature that the Mathew Miles model is more effective in causing a change in the affective level than other designs.

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APPENDIXES

APPENDIX A

OBJECTIVES FOR OSU ENERGY AWARENESS WORK CONFERENCE

Energy Awareness Work Conference

The second Energy Awareness Work Conference was held on the campus of Oklahoma State University July 11-29, 1977.

The objectives of the work conference were:

1. To develop an awareness of the energy problem.
2. To stimulate a widespread awareness of energy education at all levels of the curriculum.
3. To encourage closer affiliation between educational institutions, energy producing industries, and governmental agencies.
4. To stimulate educator's and administrator's interest in energy education.
5. To train teachers and administrators in the application of energy education in the schools of Oklahoma.
6. To promote an understanding of the scientific, social, economic, and political implications of energy exploration, production, consumption, and conservation.
7. To make energy education materials available to students in all grade levels.
8. To stimulate an awareness of career opportunities in the energy industry.
9. To create a knowledge of the impact of energy consumption on international relationships.
10. To develop new inservice energy awareness workshop materials and activities.

APPENDIX B

ENERGY EDUCATION MATERIALS FOR DRIVER EDUCATION TEACHERS

1. Energy, Engines, and the Industrial Revolution: ERDA-Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee, 37830.

2. Agriculture, Energy, and Society; ERDA-Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee, 37830.

3. Transportation and The City; ERDA-Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee, 37830.

4. How a Bill Becomes a Law to Conserve Energy; ERDA-Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee, 37830.

5. The Energy We Use; ERDA-Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee, 37830.

6. Community Workers and the Energy They Use; ERDA-Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee, 37830.

7. Energy Conservation in the Home; ERDA-Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee, 37830.

8. Energy and Education; National Science Teachers Association, 1742 Connecticut Ave., N. W., Washington, D.C.; 20009.

9. Energy Reporter; Federal Energy Administration, Washington, D.C., 20461.

10. Oklahoma Energy Awareness Education; Oklahoma State Department of Education.

11. Catalog of Publications; Federal Energy Administration, Washington, D.C., 20461.

APPENDIX C

OUTLINE FOR ENERGY AWARENESS PROGRAM
FOR DRIVER EDUCATION TEACHERS

1st hour — Why do we have an Energy Crisis?
- A. What has caused demand to exceed supply
- B. "When the Circuit Breaks"

2nd hour — Engines and Alternate Fuels
- A. Internal Combustion Principles
- B. Major Pollutants - NOX, CO, HC
- C. Rotary, Gyro, Stratified Charge, Diesels
- D. Alternate Fuels
  1. Gasoline-Octane Ratings
  2. Steam, Electric (External Combustion)
  3. Hydrogen (4-minute film)
  4. Alcohol (Methanol)

3rd hour — Selection and Maintenance of Your Automobile
- A. Size (compromise between comfort and efficiency)
  1. Needs (size of family, type of driving)
  2. E.P.A. Ratings
- B. Accessories
- C. Engine Maintenance
  1. Tune-Ups
  2. Air Cleaners
  3. Oil Changes
  4. Octane Ratings

4th hour — Power Train and Tires
- A. Gear Selection and Use
- B. Standard vs. Automatic Transmission
- C. Front Wheel Drive
- D. Types of Tires (Bias, Bias Belted, Radial, Eliptical)
  1. Tire Maintenance
  2. Tire Pressure
  3. Road Surfaces
  4. "Tire Hydroplaning" film

5th hour — Driving Habits
- A. Review 30 points in "Don't be Fuelish"
- B. Cruise Controls
- C. Relate Energy Saving Driving to Safe Driving
  1. Smooth Steering
  2. Smooth Starting and Stopping
  3. City Driving Tips
  4. Right Turn on Red
  5. 55 M.P.H.
  6. Vacuum Gauge - Acceleration

6th hour — Methods of Incorporating Energy Information into Driver Education Classes

A. "Energy Conservation Education for Oklahoma Driver Education Teachers"
B. Student Activities on Energy
C. Participant Input-Sharing Ideas on Contributing to Energy Awareness Program
D. Summary and Recognition

APPENDIX D

FREE PACKET MATERIALS

The following materials may be obtained free of charge from: Energy Awareness Program, Poultry Science Building, Room 212A, Oklahoma State University, Stillwater, Oklahoma, 74074.

Activity Sheets

1. Energy Conservation Education for Oklahoma Drivers, Oklahoma State University, Energy Program (Appendix B).
2. Why We Have an Energy Crisis, Oklahoma State University, Energy Program.

Bumper Stickers

1. Don't be Fuelish
2. 55 MPH We Can Live With It
3. Slow Down and Save Energy
4. Drive 55 Today, or Tomorrow You Won't
5. Fast is Fuelish
6. Be a Gas Watcher

Film Strip

Energy Conservation Education for Oklahoma Drivers; Energy Awareness Program, Poultry Science Building, Room 212A, Oklahoma State University, Stillwater, Oklahoma, 74074.

Pamphlets

1. A Modern Day Parable of the 20 Measures of Oil; Oklahoma Department of Energy.
2. Consumer Tire Guide; National Highway Traffic Safety Administration, U.S. Department of Transportation.

3. Don't be Fuelish; Energy Conservation and Environment, Federal Energy Administration, Washington, D.C., 20461.

4. 1978 Gas Mileage Guide; U.S. Department of Energy, Fuel Economy Distribution, Office of Administration Services, Washington, D.C., 20585.

5. Gas Savers When Driving; American Automobile Association, 811 Gatehouse Road, Falls Church, Virginia, 22042.

6. Gas Watchers' Guide; American Automobile Association, 811 Gatehouse Road, Falls Church, Virginia, 22042.

7. Maintenance Gas Savers; American Automobile Association, 811 Gatehouse Road, Falls Church, Virginia, 22042.

8. OIL Fossil Energy; Energy Research and Development Administration, Office of Public Affairs, Washington, D.C., 20545.

9. Tips for Energy Savers; Federal Energy Administration, Conservation and Environment, Washington, D.C., 20461.

10. Tips on Tune-Ups; American Automobile Association, 811 Gatehouse Road, Falls Church, Virginia, 22042.

11. The Petroleum Industry in Oklahoma; Oklahoma Petroleum Council, 1615 Fourth National Bank Building, Tulsa, Oklahoma, 74119.

12. Why an Energy Crisis?; Federal Energy Administration, Washington, D.C., 20461.

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APPENDIX E

DRIVER EDUCATION ENERGY AWARENESS SURVEY

This survey is to gain information about the level of energy awareness of Driver Education teachers in Oklahoma and how the workshop affects this level of awareness. We appreciate your cooperation in this project.

Please record the following information on your answer sheet.

In the boxes marked, STUDENT NUMBER, blacken in the number you were given.

In the boxes marked, SECT., blacken in "1" for the first time you take this test and "2" for the second time you take this test.

In the boxes marked, STUDENT NAME, blacken in the name of the college where you are taking the workshop.

In the boxes marked, COURSE NUMBER, black n in the number of years teaching experience.

Use the following scale to answer the first 20 questions.

1 = Strongly Disagree

2 = Disagree

3 = No Opinion

4 = Agree

5 = Strongly Agree

PLEASE DO NOT WRITE ON THE QUESTIONNAIRE

1. The major oil companies contrived the energy crisis so large profits could be made.

2. The national speed limit results in energy conservation.

3. There is no great need to improve the national average M.P.G. for automobiles.

4. The energy crisis is a problem but technology will deal with it in a short time and no real sacrifice by the public will be necessary.

5. Using safe driving techniques will help save lives and fuel.

6. Teaching energy saving techniques in driver education classes is one of the best ways to help reduce consumption of fuel in the future.

7. The demand for petroleum products in the U.S. exceeds domestic supply.

8. The automobile is not really a major factor in the energy crisis.

9. The U.S. is a big country and has plenty of fossil fuel reserves waiting to be discovered.

10. The energy crisis of today is making itself felt less in shortages but more in exorbitant prices for energy related products.

11. The main reason we have wasted so much energy in the past has been because of low prices.

12. A national energy awareness education program is needed in America today to inform future consumers about conservation.

13. In late 1973, the Arab oil producers imposed an oil embargo which reduced our imports considerably, resulting in a drastic fuel shortage in America.

14. The use of fossil fuels for world energy will be a rather brief period in human history with other sources of energy replacing it.

15. The use of pricing and taxes should be used to control Americans' energy wasteful habits.

16. Americans are well informed on energy facts.

17. High energy use in America is traditionally equated with success and even high prices for energy will not change this idea.

18. Americans are unwilling to make sacrifices because they do not feel the need is genuine.

19. A dramatic change in the American life style is necessary to counteract the energy crisis.

20. America has a higher energy per capita than any other country in the world.

The next 20 questions are multiple choice and one response should be chosen.

21. Using radial tires on a car can increase the gas mileage by

A. 1-3 mpg C. not at all

B. 5-10 mpg D. 15 mpg

22. Running the air conditioner can cut gas mileage by about

A. 2 mpg C. 6 mpg

B. 4 mpg D. 8 mpg

23. How can you test for correct octane gas in your car?

A. If the motor pings while coasting down a hill the octane is too low.
B. If the motor pings while accelerating the octane is too low.
C. If the motor pings while accelerating the octane is too high.
C. There is no way to tell.

24. Driving 70 mph instead of 55 mph can increase gas consumption by

A. 1% C. 31%

B. 21% D. 41%

25. If the fuel economy of the 100 million registered cars in the U.S. was improved by 15%, how many gallons of gas a day would be saved?

A. 28 million C. 100 million

B. 1 million D. 100,000

26. The gas necessary to fuel the cars and trucks in the U.S. is about what percentage of the total U.S. petroleum consumption?

A. 5% C. 30%

B. 20% D. 40%

27. What is the national average mpg for automobiles in the U.S.?

A. 10.5 C. 16.3

B. 13.7 D. 18.5

28. Cars directly require fuel but indirectly require energy through paved roads, maintenance, car manufacturing, and petroleum refining, which altogether is about 147 billion gallons of gasoline or equivalent to about what percentage of the total U.S. energy consumption?

A. 5% C. 35%

B. 15% D. 25%

29. By what factor did the price of foreign crude oil increase during the period from 1970 to 1974?

A. 3 C. 8

B. 5 D. 10

30. In 1900 about two percent of the total energy needs were met by using oil. What percentage of the total energy needs were met by using oil in 1973?

A. 22% C. 46%

B. 35% D. 51%

31. The U.S. obtains about what percentage of its energy needs from fossil fuels?

A. 94% C. 32%

B. 75% D. 10%

32. The U.S. is currently about what percent dependent on foreign crude oil?

A. 0% B. 50%

B. 40% C. 60%

33. By what percentage did America's population grow from 1920 to 1970?

A. 62% C. 84%

B. 71% D. 91%

34. About what percentage of the potential energy in gasoline do automobiles waste?

A. 60% C. 80%

B. 70% D. 90%

35. A good engine tune-up including plugs, points, condenser, air filter, and timing adjustment can result in about what percent improvement in fuel economy?

A. 5% C. 25%

B. 15% D. 35%

36. Which gauge on an automobile would be helpful in improving fuel economy?

    A. vacuum
    B. oil
    C. temperature
    D. amperes

37. How many miles should an automobile be driven before changing oil and filter?

    A. 5,000 miles
    B. 8,000 miles
    C. 10,000 miles
    D. 12,000 miles

38. A major tune-up on an automobile should be done every

    A. 10,000 miles
    B. 12,000 miles
    C. 14,000 miles
    D. 16,000 miles

39. Keeping the tire pressure one or two pounds less than maximum recommended pressure will

    A. wear the tire in the middle
    B. be unsafe
    C. save fuel and prolong the life of the tire
    D. not be much different than having it over inflated one or two pounds

40. The average weight of a car in Europe is 1900 pounds. What is the average weight of an American car?

    A. 2600 pounds
    B. 2950 pounds
    C. 3300 pounds
    D. 4120 pounds

VITA 2

Johnnie Lee Smith

Candidate for the Degree of

Doctor of Education

Thesis: AN EVALUATION OF A MODEL ENERGY AWARENESS AND CONSERVATION INSERVICE PROGRAM FOR OKLAHOMA DRIVER EDUCATION TEACHERS

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