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ABSTRACT

This paper discusses the results of a research effort in Michigan examining alternative means of encouraging energy conservation in high school youth. The study itself was conducted in Michigan during the 1978-79 school year, and involved a total of 95 high schools. This report describes the methods and procedures used in that study and presents a variety of findings. First, the project demonstrates that it is feasible to carry out this type of large scale research, including the reliable measurement of student attitudes about energy conservation. Second, the results show that both workshops and individual consultations were successful in influencing teachers to include energy conservation instruction in their classes. Finally, the findings concerning impact on student attitudes and self-reported behaviors are mixed but encouraging. These results are presented; preliminary conclusions are drawn; and the necessity for further research is discussed. (Author/RE)

An Experimental Examination of Alternative Strategies To Promote Energy Conservation in High School Youth

by

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An Experimental Examination of Alternative Strategies to promote Energy Conservation in High School Youth

The intent of this paper is to introduce and present the preliminary findings of an on-going research project examining alternative means of encouraging energy conservation in high school students. The questions addressed in this project were: 1) is it possible to reliably measure energy conservation attitudes in high school youth, 2) is it possible to influence teachers to teach about energy and energy conservation, 3) what types of strategies would be most effective in influencing teachers to teach and 4) what impact would this teaching have on attitudes and self-reported behaviors of high school students. The answers to each of these questions seem fundamental in planning the future of energy conservation efforts in America.

The Problem

In the six years since the 1973 oil embargo, the awareness of the need for energy conservation has become painfully obvious to policy-makers in the United States. Unfortunately, the prime motivating force among citizens for the conservation of energy has been to "save money" (D.O.E., 1977). Indeed, too little attention has been focused on the economic, social and environmental implications of energy resources and usage. Furthermore, governmental policies addressing the "energy problem" have tended to favor technical, production-oriented solutions emanating from the physical sciences (Ferber, 1977; Shippee, 1978) while giving little emphasis to behavioral approaches to energy conservation (Winett, 1976; Ferber, 1977).

With respect to the school-age population in particular, a recent national survey of energy awareness among young adults (conducted for the National Center for Education Statistics) concluded that, while general awareness of an energy problem is increasing America's students are lacking in knowledge of basic energy facts; show little evidence of being prepared to select practical energy options for the future; and expect to be able to continue to depend on high energy use (National Assessment of Educational Progress, 1978). Further, this study found that most students appear to be obtaining what information they do have about energy from the media rather than through schooling. In conclusion, the consultants recommended a broad-based effort toward the infusion of energy facts and information into current school curricula.

Additional evidence of the lack of activity by the nation's schools in this area is provided by a recent nationwide survey of state energy education policies (Education Commission of the states, 1978). This study concluded that

> while some exemplary materials on energy are available for incorporation in the usual school curricula for grades K--12, there appears to be little widespread communication and cooperation within or between states to further energy education. Few state legislatures and/or offices have provided input, financial or otherwise, into the K--12 energy education effort. (pp. 46-47)

One notable exception to this pattern, however, is a current research project in Michigan which is examining alternative means of encouraging energy conservation in high school youth.

Background: The Michigan Energy Extension Service Project .

In mid-1977, the Michigan Department of Commerce, through the Michigan Energy Administration, received a $1.1 million grant from the U.S. Energy Research and Development Administration. This award was one of ten similar grants awarded to ten pilot states around the country (Michigan, Wisconsin, Washington, Wyoming, New Mexico, Texas, Alabama, Tennessee, Pennsylvania, and Connecticut). The Michigan Energy Extension Service (MEES) pilot program was designed to educate Michigan residents about the need for and methods of energy conservation and utilization of renewable energy sources.

The Youth component of this grant made Michigan's proposal unique among the ten states selected. One of the major objectives of the Youth Project was to create an "energy conservation ethic" in 50,000 high school age students. More specifically, the EES Youth Project has also attempted to examine the relative effectiveness of various strategies in terms of influencing attitude change and energy consumption.

The early months of this project focused on laying the ground work for the upcoming intervention. In particular, much effort was spent on developing the evaluation instrument to be utilized by the Project. Following extensive pilot testing and careful analysis, using a combination of rational and empirical processes (eg. Jackson, 1971), a final highly reliable 45 item attitude measure was constructed. The attitude measure was combined with a series of demographic related questions and a set of self report of behavior questions and placed on a single convenient, machine readible survey form. Subsequent use of this instrument with over 100,000 high school students in nine states has demonstrated consistent reliability and very encouraging validity results. (Please see Stevens & Kushler, 1979, for a more complete discussion of this instrument.)

Following this initial developmental phase, plans were constructed for a pilot testing of some actual intervention strategies. The overall plan of the Youth Project pilot was to try out several strategies during the first school year of the project and, upon identifying the most successful strategies, restructure a more effective program to test during the second school year. In this pilot phase, the general strategies examined included two types of assembly presentations, a teacher training workshop, and a type of youth group participation model.

Briefly summarized, the results indicated that the two assembly strategies were not at all useful in fostering energy conservation, while the youth groups and teacher training strategies were moderately effective (though the youth groups were found to be procedurally difficult to implement). Most encouraging was a correlational finding that students who had taken an energy conservation-related class, regardless of what other intervention their school had received, were significantly more positive in terms of attitudes and self-report behaviors. (See Stevens, Kushler, Jeppesen & Leedom, 1979 for a detailed report of these results).

In addition, in a small substudy by MEES (Leedom, 1978), the particular strategy of having youths participate in a "task-oriented" activity (whereby they actually engaged in some energy conserving behavior) was found to be strikingly effective in producing positive attitudes. This finding, in addition to being empirically encouraging, is congruent with various other theoretical positions concerning attitude change (e.g. Breer & Locke, 1965; Festinger, 1957; Bem, 1965, 1972; etc.). Hence, a re-examination of this strategy was built into the current research design.

The Current Research Project

Drawing on the results of the first phase, MEES began a second research effort in the fall of 1978 which more specifically focused upon strategies to encourage teaching of energy conservation. The procedures that were followed are briefly outlined below:

Subjects

A population of 124 high schools in 15 counties throughout Michigan was identified with the assistance of the Michigan State Department of Education. The 15 counties were selected to contain a good mix of rural, suburban, and urban areas. The high schools themselves include a mix of approximatley 80% public and 20% private (religious) schools.

The schools range in size from 150 to 2200 students and include a variety of racial and socioeconomic mixes as well. Hence this study should provide for good generalizability to high schools in almost any setting. In addition, in order to provide for the soundest methodological procedures, these schools were randomly assigned to treatment and control conditions.

Design

The experimental design was a one-way analysis of variance with five levels of treatment condition (control, teacher consultation, teacher training workshop, teacher workshop including "task-oriented" training, and energy committee consultation). To use the terminology of Campbell and Stanley (1966) the experiment was a "post-test only" design. There were three major categories of dependent variables, including: teacher response (in terms of teaching about energy); student attitudes; and student self-report of energy conservation behavior.

Procedure

All schools in the experimental conditions first received a general introductory letter from the Michigan Energy Extension Service (MEES). The purpose of this letter was to acquaint the principal with MEES and to introduce the regional MEES coordinator. The regional coordinator then contacted the principal by phone to arrange a meeting with him/her, at which time the coordinator briefly explained the program which had been selected for that school and asked the principal to set up a meeting with teachers he/she felt would be interested in such a program. As is often the case in such large scale field research, a number of schools did not wish to participate in this program. Fortunately, the percent of refusals was virtually the same for all five conditions (approximately 20%).

Thus, a final sample of 95 schools actually completed the procedures described below.

For all experimental conditions, the teacher meeting began with the MEES coordinator explaining the MEES program in general, the importance of energy conservation, and how teachers can play a role in promoting wise energy use by teaching about energy in their classes. Following the introductory segment, the coordinator then outlined the particular services being offered to that school. Briefly summarized, the four treatment conditions consisted of the following:

1) Teacher consultation--The coordinator would present him/herself as a resource person for the teachers and attempt to persuade and assist teachers to teach energy conservation topics in their classes. As a

part of this effort, the coordinator would hand out to the teachers some standard energy education curriculum packages (eg. National Science Teachers Association curriculum packages) and provide them with a list of additional energy related materials (eg. filmstrips, curricula, visual aids, etc.) available through regional or state MEES offices. The coordinator would emphasize his/her availability as a consultant, at their initiative, in the future. In response to any subsequent requests by teachers, the coordinator would meet with them (individually or in small groups) to provide information or materials.

2) Energy Committee Consultation--The role of the coordinator was virtually the same as in the teacher consultation condition, except that a major area of effort was devoted to getting the teachers to form an "energy committee" within the school. Membership on the committee was recommended to include representatives from diverse groups such as teachers, principal, custodial staff, students, cafeteria staff, etc. The purpose of the committee would be to discuss energy saving topics relevent to the school including teaching; energy project; and saving energy in the school buildings. In addition, teachers were provided with curriculum materials and encouraged to teach just as in the consultation condition.

3) Teacher Workshop--The coordinator's role here was to recruit the teachers to attend a 5 hour workshop (including one hour for a complimentary dinner) presented free of charge by MEES. The workshop itself included presentations by MEES consultants including lecture, media (films and slides), small group discussions and demonstrations of curriculum materials. In addition, the same materials provided in the consulation strategies were also provided to the teachers at the workshop.

4) Teacher workshop including "Task-Oriented" Training--This condition was essentially identical to condition #3 above except that this workshop included the presentation and demonstration of "Task-oriented" curriculum materials (eg. involving the actual saving of energy, as discussed previously). Once again, the same set of curriculum materials (with the addition of two task-oriented project booklets) was provided to these teachers as was provided in the other three conditions. (Note: each type of workshop was standardized in format such that workshops provided at different locations were essentially the same in content. Also, the workshops were all provided by the same team of MEES consultants.)

All treatment interventions took place in late October and early November. To avoid any "history" effects or bias due to time of year, the intervention schedules were staggered such that the different treatment conditions were all implemented over the same time span.

Data Gathering

At the conclusion of the first semester of the school year (approximately late January to early February) teachers were contacted by the coordinators and given packets of Youth Energy Surveys to distribute to their students in each class, as well as short questionnaires for themselves to fill out (concerning their own attitudes perceptions and teaching activity for that semester). In addition, as a validity check, approximately one-third of the teachers received telephone interviews soliciting essentially the same information as requested in the written questionnaires.

During this same time period, the coordinators entered the control schools with the same approach discussed earlier, identified groups of interested teachers in those schools, and had them fill out and distribute the same questionnaires (control teachers also received telephone interviews.) As is ethically required in such a situation, following this data gathering the control teachers were provided with the same materials and services earlier available to the experimental teachers.

Findings

Although the results of this study are still undergoing further and more detailed analysis, it does appear possible to respond to each of the four questions raised in the introduction.

With respect to the first question, it does indeed seem feasible to reliably measure energy conservation attitudes in high school youth. The MEES Youth Energy Survey has demonstrated strong internal consistency in repeated small and large scale applications totaling over 100,000 youths. In addition, a variety of small scale studies examining the validity of this measure have found that it is significantly positively correlated with such factors as: youths' self report of energy conservation behavior: teacher's independent rating of energy conservation attitudes of their students; youth performance of various optional energy conservation related behaviors suggested by teachers; size of car youth owns; and, most encouragingly, with actual energy consumption records (home electricity use) of the youths' families. Although these results are but a tangential product of the experiment discussed here, the findings should be of interest to those involved in energy conservation efforts. (Again, the reader is referred to Stevens & Kushler, 1979.)

With respect to the second question, the results clearly suggest that it is possible to influence teachers to teach about energy and energy conservation. Table 1 provides the data concerning the number of participating teachers in each condition who did and did not include energy education in their classes.

Table 1

Teacher Response by Condition

	(1) Consultation	(2) Committee	(3) Workshop	(4) Task-Workshop	(5) Control
Taught Energy	41 (70%)	32 (78%)	51 (74%)	44 (67%)	25 (40%)
Did not	18 (30%)	9 (22%)	18 (26%)	22 (33%)	38 (60%)
	59	41	69	66	63

N=298

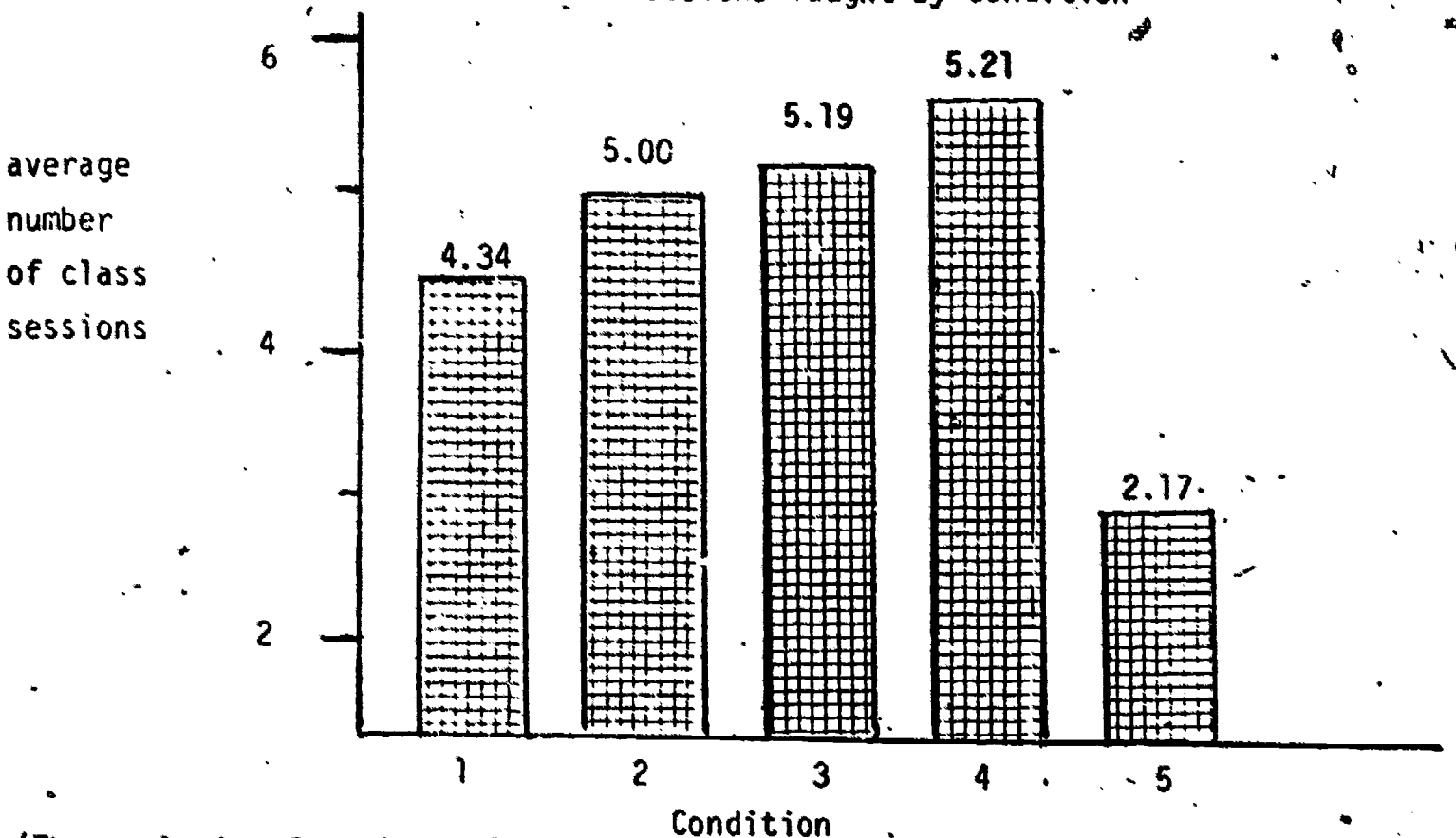
(Chi-square analysis for this data is significant at $p < .001$)

As one can see from the table, each of the four treatment conditions were clearly superior to the control condition. (It is interesting to note that these effects cannot be explained by such extraneous factors as sex of teacher or subject taught by the teacher. The observed results were found to be consistent across these variables.)

Another way of examining this question is to consider the average number of class sessions that the teachers in each condition spent on energy education. Graph #1 illustrates the findings of this variable.

Graph #1

Number of Class Sessions Taught by Condition



(The analysis of variance for this data is significant at the P<.005 level. Scheffe tests reveal that all four treatment groups are significantly higher than the control group, and that groups 3 and 4 are significantly higher than groups 1 and 2.)

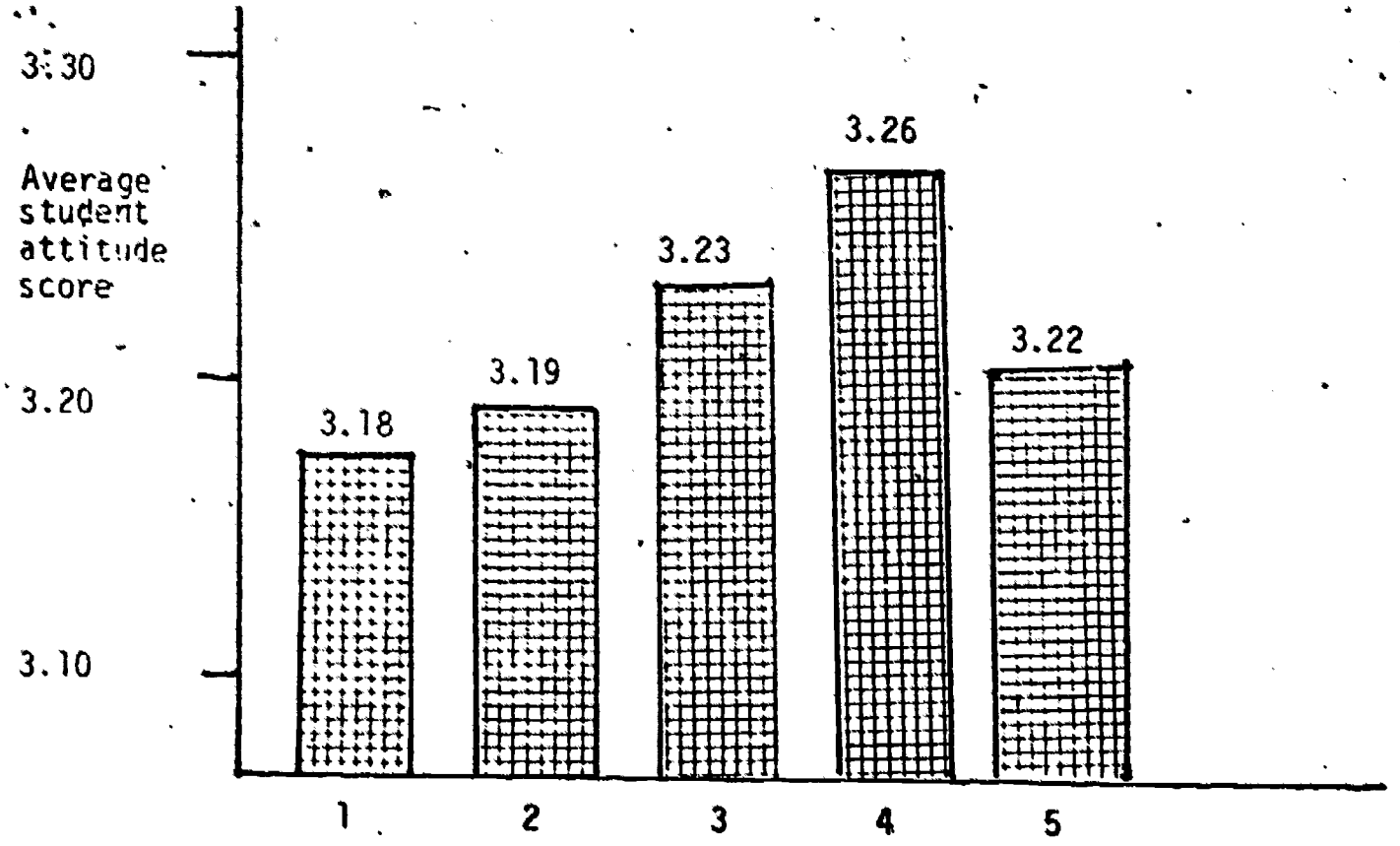
Once again, the data indicate that it is indeed possible to influence teachers to provide more energy education to their students. This also is a very encouraging finding.

With respect to question number three, there do appear to be some distinctions between the four treatment conditions in terms of results. For the variable of whether or not a teacher taught energy, Table 1 reveals that groups 2 and 3 tended to be superior. For the variable of average number of class sessions taught, Graph #1 shows that groups 3 and 4 tend to be slightly superior to groups 1 and 2. For an additional variable of whether or not the teacher utilized the materials provided to them, groups 3 and 4 reported using at least some of the materials nearly twice as often (50%) as the teachers in groups 1 and 2. (Unfortunately space does not permit the presentation of all relevant tables in this paper.) Finally, with respect to student responses (which will be discussed in a moment) groups 3 and 4 tend to produce higher scores on both attitude and self report behavior data. In summary, it appears that groups 2,3, and 4 (and particularly groups 3 and 4 which are the two workshop conditions) are somewhat superior on most outcome variables.

Finally, with respect to question number four, the results are somewhat mixed. Graph #2 presents the overall average student attitude score for each condition. (Note: This data is computed as an average student score for each teacher, then summed and averaged across all participating teachers in each condition. The grand mean thus computed was 3.22 with a standard deviation of .15. High scores represent positive attitudes toward conservation.)

Graph #2

Average student Attitude Score by Condition

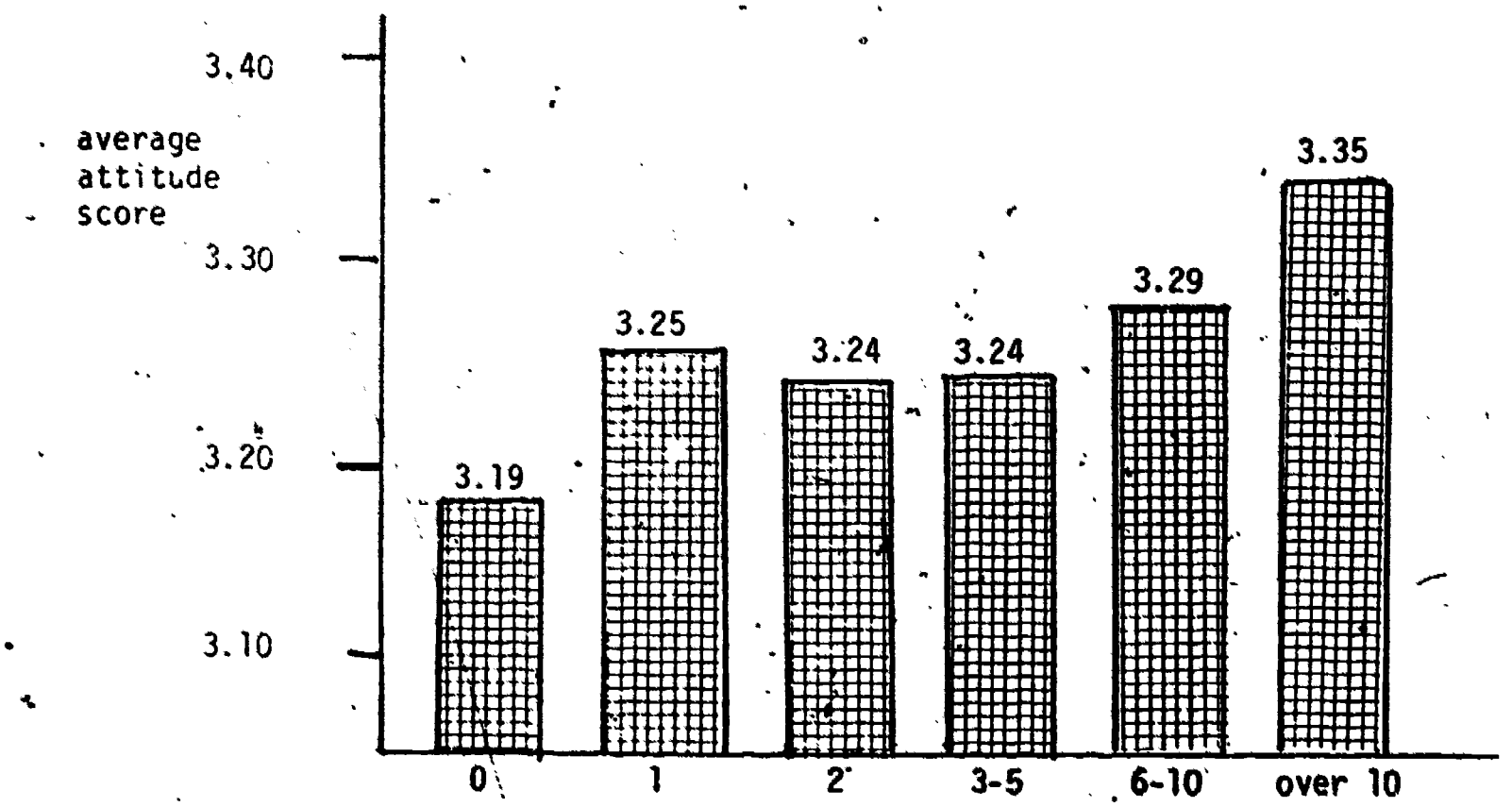


(The analysis of variance for this data is only significant at the P=.05 level. SCHEFFE tests found no significant differences among the individual groups. A more liberal STUDENT-NEWMAN-KEULS procedure revealed that group 4 was significantly higher than the other four groups at the .05 level.)

As one can see from this data, the effects of the intervention per se were not strong enough to produce major differences between the treatment groups and the control group in terms of student attitudes. One possible explanation for this finding is that the treatments applied to teachers were not powerful enough to produce ultimate student responses. Another possible explanation is that treatment teachers who only taught a little or not at all helped water down the overall results. Whatever the actual reasons, it was decided to further examine the available data in an effort to understand the findings.

In particular, since the treatments did produce more teaching behavior it was decided to directly examine the relationship between teaching and student scores. To do so, the data was broken down to the level of individual classes. Graph #3 provides a breakdown of the average student attitude score per class, for classes that received various amounts of energy conservation instruction.

Graph #3



As one can see from this graph, there is a fairly consistent positive relationship between amount of instruction and student attitudes. These results are statistically significant and the magnitude of differences observed are quite comparable to those obtained in earlier research by MEES. This finding is encouraging because it suggests that attempting to promote the teaching of energy conservation topics is a worthwhile activity even though no striking overall differences between conditions were visible in student attitudes.

Finally, the outcomes in terms of student self reported behavior were also examined. Using a total scale score of the nine youth tasks the questionnaires, analysis of variance and Scheffe tests revealed that groups 2,3, and 4 were significantly better than groups 1 and 5, and further, than group 4 (task workshop) scored significantly higher than all other groups. In addition, it was observed that there was a strong positive relationship between the score on this measure of energy conservation behavior and the number of courses in which a youth reported having had energy conservation instruction. These results are important because they suggest that the experiment may indeed have had a positive impact on energy conservation behaviors and, in particular, that the task workshop strategy fostered the most actual energy conservation behavior.

Conclusions

In summary, it appears that this study has provided a number of interesting findings. First, it has helped demonstrate that a reliable and valid measure of high school student energy conservation attitudes can be developed and conveniently utilized in a large scale research effort. Second, it has demonstrated that a variety of techniques involving direct consultation or workshop presentations can be successful in getting high school teachers to teach energy topics in their classes. Third, although the direct experimental evidence is not strong, it suggests (and indirect correlational evidence strengthens this conclusion) that classroon instruction and activities can have a positive impact on energy conservation attitudes and behaviors. It is encouraging to note that each of these conclusions reaffirms findings generated in earlier M.E.E.S. reserach efforts (see Stevens, Kushler, Jeppesen & Leedom, 1979).

However, as mentioned at the outset of this report, much analysis remains to be done. In particular, M.E.E.S. is interested in more closely examining what specific classroom instruction techniques appear to have the greatest success. For example, MEES is now considering a set of detailed follow-up interviews to be conducted with teachers whose students scored highest on the attitude and self-report behavior measures, in an effort to gather information about their classroom activities. Indeed, the findings reported in study should be regarded as just a preliminary indication that educational interventions in the area of energy conservation are feasible and show hope for success. Much work remains to be done in exploring what types of interventions, delivered in what manner, with what materials and by whom are most successful. Given the current and projected energy situation, it is certainly time that such research receive the increased emphasis that it deserves.

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