

A Comparison of Four Methods of Disseminating Information on Earth Sheltered Housing.

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This research tested the effectiveness of four methods of dissemination of information on earth sheltered housing. The purpose was to determine which method would be most effective to accompany a slide series developed for use in group situations. Using a test, retest design, all four methods were found to be effective, and no significant differences among the methods were found. Implications in terms of cost and information delivery are discussed.

About 25 percent of the energy used in the United States is used in homes (Federal Energy Administration, 1977). Although there are many ways to conserve energy in existing homes, to conserve most efficiently, energy conservation should be planned before construction actually begins. At that stage, the proper amount of insulation can be planned, solar energy can be most effectively employed, siting of the structure for greatest energy efficiency can be considered, and sheltering the house with earth can be planned.

Earth sheltered houses have many advantages, not the least of which is energy efficiency. Bligh (1975) maintained that the best mode of energy

conservation in buildings is to construct them beneath the surface of the earth, as earth sheltered homes have lower transmission heat loss rates than even the best above grade structures. Bligh indicated that heat loss through an above grade wall with eight inches of insulation was six and one-half times greater than through an uninsulated underground concrete wall. He also estimated energy savings for space heating and cooling of completely underground buildings to be 75 percent or more. A major reason for this energy savings in earth sheltered buildings is that temperature differentials between outside and inside air can be minimized. In fact, just a few feet below the surface, seasonal temperature changes are slight, generally less than ten degrees Fahrenheit as compared with surface temperature changes of onehundred degrees Fahrenheit or more.

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There are other advantages to earth sheltered buildings. Architect Malcolm Wells (1971) asserted that the greatest long term advantage is the conservation of land and the natural environment. Earth sheltered residences provide protection from wind, storms, and tornadoes. They also have unique acoustical qualities which result in freedom from surrounding sounds such as traffic, industry, and aircraft.

There are several types of earth sheltered houses, offering a balance between energy efficiency, natural light, and a view. Exposure to the outside may be provided on one or more sides by building into the side of a hill, by berming earth around portions of the building, by use of an atrium, or by covering only the roof with soil.

One of the problems encountered with earth sheltered housing appears to be public attitude. Research pertaining to psychological effects of earth sheltered homes is sparse (Johnson, 1978), but experts generally believe that there are some psychological objections (Wells, 1975; Fairhurst, 1976; LaNier, 1970). These objections can be divided into two basic categories: an unpleasant feeling stemming from the darkness associated with windowless environments, and the dampness associated with underground structures with which the majority of persons are familiar.

Attitude Change and Cognitive Gain Through Education

Educational methods have been found to be effective in facilitating attitude change (Caplan, 1973; Harbin, 1971; Botkin, 1976). Attitude change can be facilitated by the use of audiovisual materials (Kinder, 1965). At the same time, instructional materials have value in the teaching/learning process because they increase retention of factual material, increase objectivity toward a subject, and reinforce verbal messages (Kinder, 1965).

By using pictures to reinforce verbal messages, cognitive gains can be significantly increased (McTeer, 1977; Clark, 1978). The use of pictures

which illustrate concepts and printed material combined with verbal information leads to significant increases in cognitive gains as well as retention of material (Peng and Levin, 1979; Guttman, Levin, and Pressley, 1977; Lesgold, Levin, Shimron, and Guttman, 1975; Paivio, 1971). A methodology less frequently studied was the use of sound tape recordings. When comparing taped lectures with personally presented material, Pickrel, Neidt, and Gibson (1958) and Popham (1962) found no significant differences in cognitive gains.

The Research

Two purposes were identified for this study: (1) to design a program which could eventually be "checked out" and used by adult groups, and (2) to test the impact of the program on knowledge of and attitudes toward earth sheltered housing. Four methods of information dissemination were selected for use with one series of slides. Criteria for selection included: (1) the availability and portability of equipment needed, (2) ease of use of equipment, and (3) ease of reproducing the program so multiple copies could be made available.

The sample consisted of 165 members of twelve intact groups listed by the Chamber of Commerce as civic organizations, including Kiwanis, Optimist, Mensa, and American Business Women's organizations. Because intact groups were used, no effort was made to include an even distribution according to the demographic variables identified in the study. The method of information dissemination used with each group was randomly selected.

A slide presentation lasting approximately fifteen minutes was developed. An audio tape of the script was recorded for use with two of the four methods of information dissemination. A brochure was developed which included an outline of the major concepts covered in the program as well as four photographs of earth sheltered houses and a list of sources for further information.

A four-part instrument was developed for collection of data. The first part contained ten five-point Likert-type statements designed to determine attitudes toward earth sheltered housing. Validity of this portion of the instrument was determined by a panel of experts and a table of specifications based on the program outline (Table 1). Because values of earth sheltered housing and personal feelings toward earth sheltered housing were broad concepts for which more than one type of attitude was likely to be formed, more items were included which covered these two concepts. The second section of the instrument consisted of six photographs of earth sheltered houses to determine knowledge of participants of the various forms of earth sheltered houses. The photographs were submitted to two architects studying earth sheltered housing to

help determine validity. A table of specifications for the cognitive portion of the instrument was used to determine the number of photographs to be used (Table 2). The third section of the instrument consisted of fourteen multiple-choice questions relating to earth sheltered housing which further determined knowledge. These were selected from an original list of fifty-four questions which had been pilot tested and an item analysis performed. Questions used were selected on the basis of discriminatory power of each item and the table of specifications for the cognitive portion (Table 2). The final section of the instrument included the demographic variables of sex, age range, educational achievement, income range, and occupation.

To determine reliability of the instrument, a test/retest method with a seven day interval was

TABLE 1. — Specifications for Affective Portion of the Instrument

Topic from program outline	Attitude statement
Public policy issues	There should be NO restrictions on where and how to build earth sheltered houses.
Values of earth sheltered houses	The slight benefits of earth sheltered housing hardly justify it.
	Earth sheltered housing is a fad.
	If an earth sheltered house were built in my neighborhood, it would increase property values.
Education	Information about earth sheltered housing should be included in every person's education.
Social acceptance	Living in an earth sheltered house has NOTHING to do with social acceptance.
Dampness	Damp walls and floors represent a serious disadvantage in most earth sheltered houses.
Light	An earth sheltered house would be too dark for me to live in.
Personal feelings	Living in an earth sheltered house would make me feel like a cave man/woman.
	I could function just as well in an earth sheltered house as in a house above the ground.

TABLE 2. — Specifications for Cognitive Portion of the Instrument

Objective	Time in Seconds	Percent Time	Cognitive item
Identify examples of troglodyte communities.	40	5.4	In American cultures, early earth sheltered structures included (A) New England salt box houses (B) settler's log cabins with mud chinking (C) Indian cliff dwellings (D) none of the above
Identify reasons for higher energy efficiency of earth sheltered residences.	66	8.9	<p>Maximum energy savings in earth sheltered houses can be realized when the house is located (A) 30 feet below the surface (B) 15 feet below the surface (C) 6 feet below the surface (D) 1 foot below the surface</p> <p>To protect an earth sheltered house from summer sun, (A) the house should not face toward the south (B) large overhangs and shade trees may be used (C) the house should be entirely under the ground (D) none of the above</p>
Identify siting characteristics of an earth sheltered house which provide for maximum energy efficiency.	141	19.1	<p>For maximum energy efficiency in earth sheltered houses, proper landscaping is (A) not necessary (B) important (C) necessary on the north (D) not useful</p> <p>In earth sheltered houses, loud noises from the environment (A) are a major problem (B) are not a problem (C) cause vibrations with the sound (D) make it impossible to live near airports</p> <p>Initial costs of earth sheltered houses are (A) distributed differently than in houses above the ground (B) too high to ever gain them back in energy savings (C) much lower than for houses above the ground (D) much higher than for houses above the ground</p> <p>When compared with houses above the ground of the same size, maintenance costs of earth sheltered houses (A) are higher (B) are lower (C) are the same (D) first are lower, but later are much higher</p>
Identify solutions to psychological issues involved in earth sheltered housing.	72	9.7	<p>To best fill people's needs, earth sheltered houses (A) must be completely under the ground (B) should have a balance between energy efficiency and view (C) should have 10 feet ceiling heights (D) should not have a view</p> <p>In an earth sheltered house natural light (A) can be provided by windows and skylights (B) is not possible to get (C) cut down on energy efficiency too much (D) makes waterproofing more difficult</p>

(continued)

Table 2 (continued)

			In order to make the best use of the sun's energy, the best way to face an earth sheltered house is (A) west (B) east (C) north (D) south
			In areas with high ground water levels, earth sheltered houses (A) cannot be built (B) require double concrete walls (C) may be more expensive to build (D) are "floated" on beds of gravel
			When selecting a location for an earth sheltered house, you should consider (A) neighboring buildings (B) type of soil (C) groundwater levels (D) all of the above
Identify advantages of earth sheltered houses.	180	24.4	When compared with houses above the ground, controlling dust and pollen counts in earth sheltered houses is (A) easier (B) more difficult (C) impossible (D) unnecessary
			The use of earth sheltered houses can (A) cut down on the number of dust storms (B) preserve land and the natural environment (C) cause flooding in low areas (D) none of the above
Select examples of earth sheltered houses from a group of reproductions.	239	32.4	Six photographs

employed. Using the Pearson product moment correlation technique, reliability coefficients of .82 for the attitude statements, .83 for the visual portion, .77 for the multiple-choice questions, and .98 for the entire instrument were obtained. These values were significant at the .001 level.

The researcher presented the program to all groups using one of the four methods of information dissemination. Participants responded to the items in the instrument both immediately before and immediately after the slide presentation on earth sheltered housing. The ten Likert-type statements had a total range of zero to fifty points. Each photograph and multiple-choice question in the cognitive portion were worth one point, for a total of twenty.

Findings

The Sample

The cross-tabulation technique was used to determine frequency counts and percentages for the demographic items. Using the Pearson product moment correlation technique, preassessment attitude and cognitive scores were correlated with demographic items. Age, sex, income, and occupation were not significantly related to either preassessment attitude or cognitive scores. However, there was a statistically significant negative relationship between education and preassessment attitude, and a statistically significant relationship between education and preassessment cognitive scores (Table 3).

TABLE 3. — Pearson Product Moment Correlations Between Demographic Variables and Preassessment Attitude and Cognitive Scores

Demographic variable	Pearson r with attitude	Level of significance	Pearson r with cognitive	Level of significance
Age	0.08369	N.S.	0.12881	N.S.
Sex	0.14095	N.S.	-0.07364	N.S.
Income	0.03073	N.S.	-0.04329	N.S.
Occupation	0.04887	N.S.	0.02963	N.S.
Education	-0.15302	.05	0.22597	.001

The mean preassessment attitude score for all groups was 33.170, therefore, the average participant had a slightly positive attitude toward earth sheltered housing prior to participation in the program. Using an analysis of variance technique, no significant differences in mean preassessment attitude scores among groups were found.

Knowledge of earth sheltered housing was measured using responses to the fourteen multiple-choice questions and the six photographs. The mean cognitive score for all participants on the preassessment instrument was 11.552. Using an analysis of variance technique, no statistically significant differences among individuals participating in the four groups were found.

Attitudes

Pre- and postassessment attitude scores were subjected to a t-test to determine differences. A significant gain in participants' attitudes toward earth sheltered housing occurred as a result of participation in a program, as a difference significant at the .001 level was found for the combined groups. The mean score for all participants on preassessment attitude was 33.170, and the mean postassessment attitude score was 37.273.

An analysis of covariance technique was employed to determine whether significant differences occurred among the postassessment attitude scores of the four groups. Analysis of

covariance adjusts for preassessment scores, equating groups according to the variable involved. In this case, the covariate was preassessment attitude toward earth sheltered housing. The analysis of covariance indicated that the method of information dissemination did not significantly affect the postassessment attitude scores when adjusted for preassessment attitude scores.

Knowledge

A significant difference was found between mean preassessment cognitive scores and mean postassessment cognitive scores. Of a total possible score of twenty, the mean preassessment score was 11.552 and mean postassessment score was 17.594 with the difference significant at the .001 level.

An analysis of covariance technique was used to determine whether significant differences existed among the postassessment scores of the four groups when adjusted for preassessment cognitive scores. No significant differences among methods were found, and it is concluded that method of information dissemination did not significantly affect the postassessment cognitive scores.

Implications

All four of the methods of information dissemination were found to be effective, but none significantly more effective than others for increas-

ing participants' knowledge of and attitudes toward earth sheltered housing. The author concludes, then, that if the slides and taped script (with or without the brochure) were reproduced, the program, (when checked out and used by groups), would be an effective medium for dissemination of information about earth sheltered housing.

The program was well-received by all groups and two questions recurred. These were: (1) By what method is sewage delivered to a main sewer line? and (2) Wouldn't an earth sheltered house leak when it rained? Prior to making the program available, the script should be revised to answer these two questions. The question of water leakage was mentioned in the original script, but no specific examples of waterproofing methods were given. In a script revision, this question should receive more attention.

Because the brochure would not be returned with the slides and tape and because printing costs are high, it may be more feasible to reproduce the program without it. Additional sources of information were listed in the brochure, but in a script revision, this information could be included. This would not only eliminate the cost of the brochure, but provide people with sources where questions could be answered if necessary.

Actual use of the program would depend on people knowing it was available. Possible methods of creating that awareness include: (1) letters to civic organizations, (2) inclusion with programs offered by agricultural extension services, (3) listing with a public relations office at universities, (4) news item in local newspapers, (5) listing with local chambers of commerce.

As emphasis on energy conservation continues to increase, there will be a corresponding increase in demand for energy efficient housing. Programs of the type used in this study may help to increase public awareness of earth sheltered housing and promote the use of these structures as energy efficient residences. Although participation in the slide presentation significantly increased both attitude and cognitive scores, preassessment scores

obtained do not support the presupposition that public attitude toward earth sheltered housing is negative. Earth sheltered houses, then, may become more popular as dwellings. Because exposure to reproductions of earth sheltered houses and information pertaining to them increased knowledge and attitude scores, it may be assumed that actually experiencing a well-designed earth sheltered house would lead to similar results. To obtain this result, monies should be provided for construction of earth sheltered buildings located in public places such as parks and recreation areas.

Problems associated with building earth sheltered houses include: (1) finding a builder with the special knowledge required to construct earth sheltered houses, (2) lack of information on resale values and subsequent difficulty of obtaining home mortgage loans, and (3) home insurance agents do not have sufficient experience with earth sheltered houses to grant reductions on home owner policies on a consistent basis. Educational programs designed specifically for these groups need to be developed and tested.

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