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ABSTRACT

Reported is a study designed to determine (1) if there was any significant relationship between elementary teachers' realistic and idealistic attitudes toward selected science-related concepts, (2) if the degree of open- or closed-mindedness of the teachers had any relationship to these realistic or idealistic attitudes, and (3) if instruction had any effect upon the changing of these attitudes. In-service teachers enrolled in six sections of an elementary science methods course during the summer session at a large midwestern university served as the population. Two sections served as the experimental group and the remainder as the control. The Semantic Differential Attitude Inventory and Rokeach Dogmatism Scale (Form E) were administered as pre- and post-tests in a non-equivalent control group design. Participants in the experimental group received instruction in basic and integrated process skills; content for the control group was not specified. Open-minded teachers in both groups made consistent gains in a decrease of difference between idealistic and realistic attitude scores. The experimental group exhibited positive realistic attitudinal changes. Findings caused the authors to conclude that the stereotyped concept of what constitutes "good" science teaching is too firmly established to be altered without intensive effort. (PEB)

THE EFFECTS OF INSTRUCTION ON ELEMENTARY TEACHER'S REALISTIC AND IDEALISTIC ATTITUDES TOWARD SELECTED SCIENCE RELATED CONCEPTS

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Background:

The attitudes of elementary teachers towards the teaching of science is a most important factor in the learning process. Research has suggested that these teacher attitudes are a critical factor and greatly influences the effectiveness of their teaching of elementary science. (1,2,3,4)

The possibility exists that many elementary teachers hold an unrealistic view of what constitutes "good" science teaching. This viewpoint holds that to be a successful and effective science teacher, a strong background in science is needed. It is possible that this unrealistic view may produce feelings of insecurity which in turn may contribute toward less effective teaching. (5,6,7,8)

It appears reasonable to assume that effectiveness in teaching elementary science is, at least to some extent, a function of the teacher's attitude toward science. Therefore, it becomes necessary for teacher educators to develop and test, techniques and approaches designed to improve these attitudes.

Problem:

The general purpose of this study was to determine:

(1) if there is any significant relationship between elementary teachers realistic and idealistic attitudes toward selected science related concepts;

(2) if the degree of open- or closed-mindedness of the teachers has any relationship to these realistic or idealistic attitudes;

(3) if instruction has any effect upon the changing of these attitudes.

Population:

The population for this study consisted of 6 sections of in-service elementary teachers enrolled in a summer session at a large midwestern university.*

Two of the 6 sections were advanced elementary science methods courses and were designated as the experimental group; the remaining four sections were designated as the control population.

Criterion Instruments:

Two basic instruments, the Semantic Differential Attitude Inventory and the Rokeach Dogmatism Scale (Form E) were used to evaluate the attitudes and degree of open-mindedness of the participants.

Semantic Differential: This instrument can be described as a five point interval, unidimensional, semantic differential that uses seven polarized adjectives. Three major science related concepts were investigated from both the realistic and idealistic viewpoints. They were:

(1) a. The way that I feel about myself as an elementary science teacher. (Realistic)
b. The way that I would like to feel about myself as an elementary science teacher. (Idealistic)

*Certain categories of students such as principals, doctoral students and secondary teachers were excluded from both the sample and control populations.

(2) a. The way that I feel about science. (Realistic)
b. The way that I would like to feel about science. (Idealistic)

(3) a. The way that I feel about noise during science class. (Realistic)
b. The way that I would like to feel about noise during science class. (Idealistic)

Reliability:

To determine the reliability of the Semantic Differential instrument, a principle components, varimax rotation, factor analysis was conducted to determine the factor loadings of the various responses. The factor loadings were then used to assign the items to their respective sub-scales and then the Cronbach Alpha was calculated to determine the internal consistency of the instrument. Only the scales that maintained their cluster throughout the rotation were used in the final instrument. Table 1 presents the item reliability scores along with the Total Test R.

Table 1

ITEM AND TOTAL TEST RELIABILITY

Item	R (Scale)
Friendly-Aloof	.7441
Strong-Weak	.7740
Valuable-Worthless	.6322
Nice-Mean	.6704
Pleasant-Unpleasant	.7868
Interesting-Boring	.7442
Good-Bad	.7526
TOTAL TEST R	.8523

Rokeach Dogmatism Scale (Form E):

This instrument can be described as a forced choice, Likert-type scaling device that was developed by Milton Rokeach. (1960) A score on this instrument is an indication of an individual's open- or closed-mindedness. The higher the score, the more likely an individual is closed-minded.

Reliability:

Rokeach, in his research with seven groups of Mid-western college students, obtained reliability coefficients ranging from 0.68 to 0.85. (Rokeach, 1960, p. 90). Jaus, (9) using 90 subjects, obtained a reliability coefficient of 0.83 using the Spearman-Brown formula.

Procedures:

The design of this study is described by Campbell and Stanley, (10) as the Non-Equivalent Control Group design. The two sections of graduate elementary science methods classes and the four additional sections of graduate elementary methods classes mentioned earlier, were pre-tested on the first day of the summer session, using the criterion instruments described previously. Using the scores obtained from the Rokeach Dogmatism Scale, the subjects in both groups were classified as being either open- or closed-minded. The table of random numbers was then used to select 15 closed-minded and 15 open-minded individuals from each population to form both samples groups. These sub-groups were designated as Experimental-Open, Experimental-Closed, Control-Open, and Control-Closed. On the last day of the session, all groups were admin-

istered the post-test using the same criterion instruments.

T scores were calculated to determine if both the experimental and control groups were equivalent in terms of realistic attitudes expressed on the pre-test. Table 2 presents the results of these calculations.

Table 2

COMPARISONS FOR REALISTIC ATTITUDE CONCEPTS ON PRE-TESTS FOR EXPERIMENTAL AND CONTROL GROUPS.

Concept	Experimental Mean(N=30)	Control Mean(N=30)	t score	Probability
S.D.#1	27.50	26.40	1.02	0.310
S.D.#2	27.36	25.90	1.02	0.310
S.D.#3	26.96	25.03	1.44	0.155

An examination of Table 2 reveals that the differences in means between the two groups are not significant.

Treatment Description:

All participants in the experimental group received instruction in both basic and integrated process skills. (11) These skills were presented as individually programmed, auto-tutorial instructional products which contained practice exercises and self-tests. The complete set of these products are on file at the Science Education Center, Indiana University, Bloomington, Indiana.

The participants were also exposed to in-depth explorations of various ESS units such as Clay Boats, Mystery Powders, Batteries and Bulbs, Attribute Games, etc. Selected units from the SCIS program such as

Whirlybirds, Grandma's Buttons and Interaction were also investigated by the students.

The students also investigated and explored independently, various science topics and activities of their own choosing. Suggestions for these investigations and explorations were presented by the instructor in the form of a mimeographed exploration guide. (12) The activities in this guide ranged from collecting materials to building and launching model rockets.

The instructor and his assistants paid considerable attention to the affective area by continually making supportive and encouraging statements to the students. These statements appeared to be warmly received by the teachers. The treatment period lasted for a period of 8 weeks.

Results:

Table 3 presents the data for the realistic and idealistic attitude raw score means for all groups, all concepts, on both the pre- and post-test Semantic Differential.

Table 3

REALISTIC AND IDEALISTIC ATTITUDE MEANS FOR ALL GROUPS, ALL CONCEPTS, PRE AND POST TEST

		CONCEPT I				CONCEPT II				CONCEPT III			
		PRE		POST		PRE		POST		PRE		POST	
GROUP		R	I	R	I	R	I	R	I	R	I	R	I
EXP.	Open (N=15)	26.80	33.13	29.20	33.13	27.40	33.47	30.13	34.07	27.87	32.00	29.87	32.27
	Closed (N=15)	28.20	33.93	29.07	33.93	27.33	33.40	29.07	34.20	26.07	29.13	28.53	30.40
	Total	27.50	33.53	29.13	33.53	27.37	33.44	29.60	34.13	26.97	30.57	29.20	31.33
CONT.	Open (N=15)	26.20	32.73	25.87	32.67	26.00	33.27	27.07	32.67	24.20	30.33	27.27	29.87
	Closed (N=15)	26.60	32.93	25.60	33.20	25.80	33.60	26.27	32.40	25.87	31.33	25.93	30.07
	Total	26.40	32.83	25.73	32.93	25.90	33.43	26.67	32.53	25.03	30.83	26.60	29.97

The reader will notice that the open-minded teachers in both the experimental and control groups made consistent gains in terms of decreasing the difference between idealistic and realistic attitude scores. It appears that, the idealistic attitudes of open-minded teachers remained basically unchanged, but the realistic attitudes improved, thus narrowing the differences between the two attitudinal means. This reduction is reflected in all three of the concepts investigated. Again referring to the specific tables mentioned previously, it is readily apparent that the attitudinal scores of the closed-minded teachers do not reflect the same changes. Tables 4, 5, and 6 present the correlation coefficients between the realistic and idealistic attitudes of the teachers on all concepts investigated.

Table 4

CORRELATIONS BETWEEN REALISTIC AND IDEALISTIC ATTITUDES FOR CONCEPT #1. ALL GROUPS.

	GROUP	PRE-TEST	POST-TEST	CHANGE
EXP.	OPEN	-.2308	.0597	.2905
	CLOSED	-.1879	.3399	.5278
	TOTAL	-.1550	.2298	.3848
CONT.	OPEN	-.0095	.4271	.4366
	CLOSED	.3702	.1675	-.2027
	TOTAL	.1686	.3023	.1337

TABLE 5

CORRELATIONS BETWEEN REALISTIC AND IDEALISTIC ATTITUDES FOR CONCEPT #2. ALL GROUPS.

	GROUP	PRE-TEST	POST-TEST	CHANGE
EXP.	OPEN	.0761	.3869	.3108
	CLOSED	.4516	.4663	.0147
	TOTAL	.3237	.3663	.0428
CONT.	OPEN	.3520	.3635	.0115
	CLOSED	.4457	.1038	-.3419
	TOTAL	.3888	.2281	-.1607

TABLE 6

CORRELATIONS BETWEEN REALISTIC AND IDEALISTIC ATTITUDES FOR CONCEPT #3. ALL GROUPS.

	GROUP	PRE-TEST	POST-TEST	CHANGE
EXP.	OPEN	.5867	.7023	.1156
	CLOSED	.8529	.8502	-.0027
	TOTAL	.7837	.8186	.0349
CONT.	OPEN	.4308	.6159	.1851
	CLOSED	.6543	.7177	.0634
	TOTAL	.5767	.6611	.0844

Table 7, presents the post-test means for the realistic attitudes, all concepts, along with the t-scores and probabilities that were calculated. The reader will note that in all cases, the experimental groups had more positive attitudes than the control groups. It is also interesting to note that the open-minded teachers of the experimental group consistently scored somewhat higher than the closed-minded teachers in the same group, although not to a significant degree.

TABLE 7

POST-TEST t COMPARISONS FOR REALISTIC ATTITUDES, ALL CONCEPTS, EXPERIMENTAL vs CONTROL

CONCEPT	GROUP	EXP. MEAN	CONT. MEAN	t	PROB.
S.D. #1	OPEN	29.2000	25.8667	2.17	..039
	CLOSED	29.0667	25.6000	1.87	.072
	TOTAL	29.1333	25.7333	2.87	.006
S.D. #2	OPEN	30.1333	27.0667	1.74	.093
	CLOSED	29.0667	26.2667	1.22	.234
	TOTAL	29.6000	26.6667	2.05	.045
S.D. #3	OPEN	29.8667	27.2667	1.78	.085
	CLOSED	28.5333	25.9333	1.22	.233
	TOTAL	29.2000	26.6000	2.03	.047

Conclusions:

An interpretation of the data resulting from this study permits the following conclusions:

(1) Differences between the realistic and idealistic attitudes of the teachers towards science related concepts, can be reduced after appropriate instruction. This reduction is unidirectional in that the idealistic attitudes across all groups, conditions, and concepts investigated remained relatively constant, while the realistic attitudes of the experimental group increased across all conditions and concepts. This resulted in a reduction of the initial differences between the realistic and idealistic viewpoints of the experimental group.

The realistic attitudes of the control group for Concept #1 decreased slightly. However, this group did show a minimal increase on Concepts #2 and #3, with the exception of the open-minded sub-group on Concept #3.

(2) Open-minded individuals consistently scored higher on realistic attitudes than did the closed-minded individuals. With the exception of Concept #3, the open-minded individuals of both the experimental and control groups also produced greater positive realistic attitudinal changes than did the closed-minded individuals. Another consistent pattern noted, was that closed-minded individuals in the control group not only had the lowest raw scores but also made the least gains on the realistic attitudinal post-test.

(3) The treatment accorded the experimental group was effective in producing positive realistic attitudinal changes. The differences between the post-test means of the experimental and control groups were statistically significant at the .05 level of confidence across all con-

cepts investigated. It is interesting to note however, that the treatment was not able to produce any appreciable effect on the teachers' idealistic attitudes. Perhaps the stereotyped concept of what constitutes "good" science teaching is too firmly established in the teachers' minds to alter without intensive effort.

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