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ABSTRACT

The purpose of this study was to determine if elementary teachers' attitudes toward science and science education would become more positive if: (1) they participated in a four-week workshop on new science curricula; (2) the training they received was directed toward Elementary Science Study (ESS), Science Curriculum Improvement Study (SCIS), or Science - A Process Approach (SAPA); and (3) they served as model science teachers for preservice teachers who observed and taught in their classrooms. Thirty-six teachers who attended a four-week workshop on the new science curricula participated in the study. Twenty teachers were selected as model teachers on the basis of proximity of their schools to the university. Pre-service teachers were placed in 11 teachers' classrooms. Statistical analyses showed: (1) a significant positive change in attitude toward teaching science but not toward science as a result of the workshop; (2) no significant differences for the type of training received nor for the type of model teacher the workshop participant would become; and (3) for the pre-service teachers, no significant changes in attitude toward science or science teaching after observing the model teachers. (Author/MH)

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ATTITUDE CHANGES OF ELEMENTARY TEACHERS
TRAINED AND SELECTED AS MODEL SCIENCE TEACHERS

A Paper Presented at the 50th
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Attitude Changes of Elementary Teachers
Trained and Selected as Model Science Teachers

Introduction

The development of positive attitudes toward science and science teaching by both inservice and preservice elementary teachers is a recognized goal of science education. It is thought that teachers who have positive attitudes toward science will convey these attitudes to students in their classrooms.

Much work has been done with preservice teachers to change their attitudes toward science and science teaching through the modification of college science courses and science methods courses (Arons, 1972; DeVito and Nordland, 1974; Thomson and Thompson, 1975). Because elementary inservice teachers frequently do not take a science methods or science courses beyond those required for an undergraduate degree, attempts have been made to change teachers attitudes through participation in science workshops (Hasan and Billek, 1975; Moore, 1975; Stronck, 1976). Hasan and Billek found no differences in secondary science teachers attitudes toward science and science teaching. Moore discovered the opposite, noting that both a change in attitude toward science and science teaching resulted from a four week workshop on the new elementary curriculum projects. However, the change in attitude toward science did not persist beyond one year.

Stronck examined teachers attitudes toward ESS and SCIS as a result of ESS and SCIS workshops. He found no change of attitude toward SCIS among teachers attending the SCIS workshop. For teachers studying ESS, though, there were changes in attitude toward the curriculum as a result of the workshop. The research reported on here examined the effect of teachers studying ESS, SCIS and SAPA at one workshop on attitudes toward science

and science teaching rather than philosophies of a particular program.

Many times teachers do not have the opportunity or the desire to attend a summer workshop on science teaching. An alternative way of modifying teachers attitudes was found by Piper (1976). She found that teachers who observed science activities being taught in their classroom by preservice teachers developed positive attitudes toward teaching science. In this research, the attitude changes of teachers who were designated as model teachers for preservice teachers were examined. The preservice teachers both observed and taught science lessons in the teachers' classrooms.

Purposes of the Study

The purpose of this study was to determine if elementary teachers' attitudes toward science and science teaching would change in a positive direction if:

- a. they participated in a four week workshop on the new science curricula.
- b. the training they received was directed toward ESS, SCIS and SAPA.
- c. they served as model science teachers for preservice teachers who observed and taught in their classrooms.

Procedure

Sample

The subjects of this study were 36 elementary classroom teachers from a midwest city of 50,000 who attended an NSF sponsored four week workshop on the new science curriculum projects. These teachers were to act as resource persons and model science teachers in the schools in which they taught.

Instruments

Moore's "Science Teaching Attitude Scales" were used to assess the teachers' attitudes toward science and science teaching. This instrument contains 140 likert type items which are keyed to seven position statements about science (4 statements) and science teaching (3 statements). The reliability coefficient of Part I on attitudes toward science reported by Moore and Sutman (1970) using the test-retest method was 0.93. The reliability coefficient for Part II on science teaching was 0.89 (Moore, 1973).

The instrument was administered three times to workshop participants: at the beginning (pretest) and at the end of the workshops, (posttest) and in mid-November after preservice students had visited their classrooms.

Treatment

Elementary teachers attended a four week science workshop designed to familiarize and enable them to teach the NSF supported science curriculum projects (ESS, SAPA, SCIS). During the introductory week of the workshop, teachers were given an overview of the three programs. They returned to their school on Friday to inventory science materials available to them. (All three programs were currently being used in the school system, although many teachers were not aware of materials available in their schools and did not use the programs). Based on materials available in their schools and their interest, teachers selected one of the three programs (ESS, SAPA, SCIS) on which they would concentrate during the remaining three weeks of the workshop. Eight teachers selected ESS, 15 selected SAPA and 13 selected SCIS.

Workshop instruction was given by local teachers who had been trained by science educators earlier in the summer. The instruction consisted of a study of the curriculum's instructional philosophy, performing some of the activities in the curriculum project, teaching small groups of children science lessons, and making lesson plans for the fall semester.

Twenty of the teachers who attended the workshops were available for the second phase of this study which examined the effect of their acting as model teachers for preservice elementary teachers. (Some teachers who attended the workshop were in a special reading program; others were located too far from the university to all easy access). Eleven of these teachers were randomly selected to have preservice teachers observe and teach in their classrooms. Groups of three to six preservice teachers observed each model teacher teach science three times and then taught one science lesson in the teacher's classroom.

Findings

The change in attitude due to the participation in the workshop was determined by analyzing the pretest and posttest mean scores using a correlated two tailed t-test. Results of this test as shown in Table 1 indicate that there was no significant change in teachers' attitudes toward science as a result of the workshop but that teachers' attitudes toward science teaching became more positive.

Insert Table 1 about here

In order to determine whether the type of training (ESS, SAPA or SCIS) had different effects on changing the teachers' attitudes toward science and science teaching, 2 x 3 analyses of variance of pre- and postworkshop data were made. There are two levels of future model teachers (observers, non-observers) and three levels of curriculum projects (ESS, SAPA, SCIS). Data and results are summarized in Table 2.

Insert Table 2 about here

Examination of Table 2 indicates that there was no difference in attitude scores for teachers studying the three science curriculum projects during the workshop. Although there were significant differences in pretest scores for teachers who were to have observers at the beginning of the workshop, these differences diminished by the end of the workshop and were not significant.

The attitude scales which were administered in mid-November were analyzed to determine whether teachers who were acting as model teachers by having pre-service teachers observe and teach in their classrooms had more positive attitudes than teachers who do not have observers. This data and analysis are given in Table 3. For this analysis data for 20 teachers who acted as model teacher were analyzed.

Insert Table 3 about here

In addition to giving the mid-November total scores for both attitude scales, Table 3 gives scores on the subscales that comprise the attitude toward science and toward science teaching scales. From the table it can be seen that

there were no significant differences between teachers who had observers and those who did not on the total attitude scales. This is also true for teachers who studied different curriculum projects at the workshop. It is interesting to note, however, that there were some differences among the teachers in two of the subscales. Teachers who studied SAPA at the workshop had more positive attitudes on subscale 4 and teachers who had observers had more positive attitudes on subscale 5. (As a check to determine whether their differences were real, a 2 x 3 analysis of variance on the 20 teachers postworkshop attitudes was performed. There were no significant differences on subscales 4 and 5 at that time.)

Subscale 4 measures the attitude that understanding science is important for the general public and that the public benefits from scientific work. Why teachers who taught SAPA rather than ESS or SCIS in the interval from the end of the workshop to mid-November had higher attitudes on this subscale is unknown. Perhaps the structured SAPA approach to teaching conveys the feeling that it is important for the public to understand science.

Of more significance is the finding that teachers who had preservice teachers in their classrooms achieved higher scores on subscale 5. The attitude measure by this subscale was that the idea of teaching science was attractive and that the teacher understood science and could teach it.

DISCUSSION

The results of this study confirm Moore's finding that one method of changing elementary teachers attitudes toward science teaching is through participation in workshops on the new science curriculum. This research also indicates that science curriculum emphasized during the workshop has no differential effect on teachers' attitudes. All the program effected

a positive attitude change. It is, of course, impossible to tell whether this lack of difference according to the curriculum project is merely due to lack of distinct treatment for each curriculum studied, or whether the curriculum studied in a workshop is unimportant. In this workshop teachers socialized with one another and compared philosophies, materials, and methods of the three programs. In order to determine more precisely the effect of one curriculum project as compared to another, data should be collected from separate but equivalent ESS, SCIS, and SAPA workshops.

More important than the above findings, however, is the fact the teachers who acted as model teachers had more positive attitudes toward their own ability to teach science and found teaching science attractive to them. This positive attitude toward teaching science may have positive effects on the quality and quantity of science instruction in their classrooms and thus change the attitude of their students toward science. In addition, these model teachers expressed a willingness to continue to have students observe them and teach in their classrooms. This is not only beneficial to the teachers themselves, but also contributes greatly to quality training of preservice teachers.

Teachers in this study who acted as model teachers also attended a science workshop. There may have been an interaction effect between attendance at the workshop and acting as a model teacher that caused the positive change in attitudes. Considering the findings of Piper (1976), however, who placed preservice students in teachers' classroom who had not attended a workshop, there is reason to believe that the effect is due to the placement of the preservice teachers in the teachers' classrooms.

Additional research is now needed to determine the optimal length of

time the preservice teacher should spend in the classroom to effect these changes in attitudes and to determine if the effects are long lasting. If the effects are permanent, science educators may have a powerful vehicle for improving science instruction in the elementary schools.

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Table 2

Comparison of Scores on Attitude Scales for Model Teachers According to Curriculum Project Studied for Pretest and Posttest Data

Test	Pretest Scores						ANOVA-F		
	O/ESS ^a (3) ^b	O/SAPA (7)	O/SCIS (1)	N/ESS (5)	N/SAPA (8)	N/SCIS (12)	M ^f	p ^g	MP ^h
Part I	79.50 ^c	78.13	82.00	69.30	75.43	73.00			
	2.65 ^d	4.34	0.00	6.74	7.46	7.26	6.14 [*]	0.43	1.00
Part II	53.67 ^e	53.69	64.50	48.70	52.00	54.00			
	3.21	4.48	0.00	10.54	4.65	7.55	3.44	1.84	0.67
Total	133.17	131.81	146.50	118.00	127.43	127.00			
	3.06	7.88	0.00	14.92	10.79	11.67	6.86 [*]	1.31	1.06
Posttest Scores									
Part I	80.83	79.31	82.00	75.00	80.93	72.75			
	1.53	6.05	0.00	9.35	10.24	5.67	1.81	0.35	1.18
Part II	63.50	60.63	66.50	59.20	57.20	59.88			
	3.12	8.03	0.00	6.47	7.23	5.67	2.41	0.71	0.11
Total	144.33	139.94	148.50	134.20	138.13	132.63			
	4.19	8.01	0.00	14.36	16.91	9.49	3.00	0.02	0.74

^aThe first symbol given stands for whether the model teacher had observers (O) or did not have observers (N).

The second symbol stands for the curriculum project studied.

^bThe number in parenthesis is the number in the sample.

^cAttitude toward science score (maximum score = 120).

^dStandard deviation

^eAttitude toward science teaching (maximum score = 90).

^fM = the model teacher treatment (with and without observers).

^gp = curriculum project studied (ESS, SAPA, SCIS).

^hMP = interaction between model teacher and curriculum project studied.

* p < 0.05

Table 3
Comparison of Scores on Attitude Scales for Model Teachers
According to Curriculum Project Studied and Observers

Scale on Test	O/ESS ^a (3) ^b	O/SAPA (3)	O/SCIS (3)	N/ESS (3)	N/SAPA (3)	N/SCIS (3)	M ^e	p ^f	MP ^g
1	24.17 ^c	20.30	20.00	18.00	16.67	20.50			
	0.29 ^d	4.19	4.00	3.61	3.40	3.91	1.65	0.89	1.43
2	22.33	23.86	22.50	18.50	21.50	20.50			
	4.48	2.44	0	2.65	1.80	1.80	3.68	1.23	0.17
3	11.83	15.57	16.50	14.67	17.17	13.17			
	3.01	2.24	0	3.40	3.55	3.88	0.05	1.89	1.09
4	18.67	21.93	20.00	17.17	22.83	16.83			
	3.33	2.16	0	5.39	1.26	1.26	0.70	4.92 ^h	0.67
Part I (1-4)	77.00	81.71	77.00	68.33	78.17	71.00			
	5.41	6.15	0	7.29	8.52	9.18	2.66	2.05	0.23
5	18.50	20.50	22.50	16.67	17.50	15.33			
	4.33	2.55	0	5.84	1.00	2.93	4.97 ^h	0.33	0.63
6	15.17	17.71	17.00	17.00	18.83	20.00			
	5.13	5.48	0	1.50	2.93	4.58	0.68	0.47	0.05
7	20.17	19.36	19.50	18.33	20.67	20.17			
	3.25	6.81	0	2.02	5.51	2.08	0.00	0.04	0.17
Part II (5-7)	53.83	57.57	59.00	52.00	57.00	55.50			
	4.65	10.20	0	8.67	7.37	8.76	0.18	0.48	0.03
Total (1-7)	130.83	139.29	136.00	120.33	135.17	126.50			
	9.67	10.00	0	15.70	15.89	13.23	1.54	1.57	0.13

^aThe first symbol given stands for whether the model teacher had observers (O) or did not have observers (N).

The second symbol stands for the curriculum project studied.

^bThe number in parenthesis is the number in the sample.

^cScales 1-4 measure attitude toward science and scales 5-7 measure attitude toward science teaching.

(Maximum score for each scale is 30.)

^dStandard deviation.

^eM = the model teacher treatment (with and without observers).

^fp = curriculum project studied (ESS, SAPA, SCIS).

^gMP = interaction between model teacher and curriculum project studied.

^hp < 0.05