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ABSTRACT

This paper contains the report of an investigation to determine what relationships existed between teacher competencies in science mastered via a televised inservice program (LIFT OFF!) and teachers' science-related attitudes, past experiences, and use of a science program (Science - A Process Approach). Evidence was obtained from the number of science activities a teacher used in the classroom. Subjects were 76 elementary teachers, grades K-6. Fifty teachers participated via color/cable television at their schools; 26, through the use of a videotape recorder. Participants varied in teaching experience, science content, and sex (two males). Data were collected via a pre- and post-semantic differential instrument, biographical information, and a post-science competency measure. Sixty-six teachers scored 29 or better for the 33 tasks on the science competency post-measure. The 26 who used videotape recorders which they could start and stop at will scored higher as a group on this measure than did the 50 teachers who used color/cable television. Teacher attitudes changed in a positive direction. A weekly tally of science activities taught showed a general increase over the 15 weeks. (Author/PEB)

THE DEVELOPMENT AND EVALUATION OF A TELEVISED SCIENCE INSERVICE PROGRAM

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Despite the renewed vigor in curriculum development and implementation over the past ten years, a prevailing problem persists in the teaching of science in the elementary school. Looking back over the years, Craig (1957) stated that science was little more than a fad and an extracurriculum matter to be taught more or less incidentally and accidentally, if at all. Since Craig made that observation in 1957, the picture seems to have changed very little.

Why is science not generally taught by elementary teachers? Soy (1964) reported a survey of full-time students majoring in elementary education. Less than eight percent of the 529 sophomores, juniors and seniors indicated they had chosen science as a subject field. Lack of interest in the area, difficulty of college courses in science, and lack of high school background were reasons which the students indicated were most important in their decisions not to elect science as a subject field. Science was also one of the subjects in which they had received the least amount of experience in their student teaching experience. Ritz (1968) inferred fellings about science may go back

as far as a teacher's own elementary school experiences. In his investigation, he asked a group of thirty elementary teachers to recall some of the science content they had been taught as children. Five teachers listed one to three items each, twelve managed to list from four to six, and seven teachers reached the seven to nine range. Two teachers listed ten items each, but two others left their papers blank. Thus, three areas seem to stand out as significant influences on the teaching of science in the elementary school: a teacher's past experience, their personal competency, and attitude.

An increased number of curricula are being developed more quickly than in the past. This puts a demand on school systems to provide adequate teacher inservice to implement these programs. At the same time school districts are hard pressed to find funds to pay teachers for time spent outside of school time for inservice training. Inservice instruction via television is one method for those school systems with accessibility to television to wisely make use of resources, time, place, and personnel. Television can provide for the most efficient and widespread use of an inservice program with a minimum of personnel. Television can be utilized without teachers leaving their schools and traveling to a specialist. The inservice opportunity comes to them. Qualified personnel and specialists are relieved of time spent in formal workshop programs and can devote their time to individual teacher problems at the building level where they are needed.

Lack of motivation to teach science was assumed to be a function of past experiences and lack of competency which result

in predisposed negative attitudes toward science and science teaching. Can a televised inservice program provide the means to adequately prepare teachers to teach science? Following televised instruction, will attitudes toward science and science teaching be changed in a positive direction? If science teaching competencies are acquired and attitudes move in a positive direction, will there be a corresponding increase in science activities being taught in the classrooms?

The Problem

What relationships exist between teacher science competencies mastered via a televised inservice program (L I F T O F F !) and teacher's science related attitudes, their past experiences, and their use of a science program as indicated by the number of science activities a teacher uses in a classroom?

The Study

The subjects for this study were seventy-six elementary teachers who elected to commit themselves to implementing a new science program, Science - A Process Approach, in their classrooms. These subjects were part of the Shawnee Mission School District in Shawnee Mission, Kansas. None of the subjects had previously taught Science - A Process Approach or any of the other new elementary science programs. They also stated there was no coordinated science program in their respective buildings.

Fifty teachers participated in the televised inservice program via color/cable television at their own schools. Twenty-six teachers participated in the program through the use of a video tape recorder (VTR) in their own schools. The schools and grade level distribution of these teachers are found in Table 1.

TABLE 1
DISTRIBUTION OF TEACHERS ACCORDING TO CABLE OR VTR AND GRADE LEVEL

	Number of Teachers from Each Grade Level						
Color/ Cable	Kinder-garten	First	Second	Third	Fourth	Fifth	Sixth
	2	3	5	3	3	1	2
	2	3	6	4		4	
	2	3	4				
					2		1
VTR							
	1	3	4	3	4	5	2
	1	1		1			1

In each school the principal and the staff made the decision as to whether to involve the entire staff, kindergarten through sixth grades, or to involve part of the staff. The participating teachers had prior teaching experience from zero to thirty-six years with a median of six years. The total number of semester science hours taken ranged from three hours to thirty

hours with a median of eleven hours. All but two of the seventy-six teachers were female. A pre and post Semantic Differential (Osgood, 1957) was given to the subjects. Biographical data was collected from each participant. A post-science competency measure was given to the subjects.

Description of L I F T O F F !

L I F T O F F ! was developed by the investigator for the purpose of this study. The philosophy and procedure of the inservice program is consistent with that of the authors of Science - A Process Approach (1963) in that it provides the means for teachers to participate in science activities using manipulative materials.

The guide book used in conjunction with L I F T O F F ! states the performance objectives of each lesson, procedure, and follow-up activity to test achievement of the performance objectives. The guide book followed the same format found in the teacher's Science - A Process Approach guide book of lesson pamphlets as an additional way of familiarizing teachers with procedural methods in teaching activities in their classrooms.

Following is a brief description of each telelesson in the televised series, L I F T O F F !

Countdown 10.....Introduction to Philosophy and Materials (12 min.)

This lesson introduced the desired outcomes of Science - A Process Approach with children as well as teachers. It showed teachers the materials they would be using with their students as well as the teacher's guide and resource book.

Countdown 9.....Observing, Measuring (19 min.)
Observing and Measuring are processes introduced early in the program with children. The inservice program followed the general framework of introducing the simple skills and building upon those before introducing the more complex ones.

Teachers participated in observing and measuring activities using materials they would be using with their own students.

Skylab I.....Teaching Part B: Measuring 2 (10 min.)
Three Skylab lessons interspersed throughout the inservice program simulated a classroom being taught a lesson from Science - A Process Approach.

Measuring 2 is a lesson generally taught in second grade. The television teacher simulated a classroom situation with a group of second grade children.

Countdown 8.....Inferring (17 min.)
The teachers made inferences from visuals shown on the telelesson.

Countdown 7.....Using Space/Time Relationships (13 min.)
The teachers learned the names of two and three dimensional shapes. They also investigated the shapes of shadows caused by three dimensional shapes.

Skylab II.....Teaching Part D: Inferring 5 (13 min.)
Third grade children were used in a simulated lesson to investigate the problem of air replacing water in a container.

Countdown 6.....Classifying (15 min.)
Teachers classified shapes and then outlines of leaves in their guide book to develop the skills in building a multi-stage classification system.

Countdown 5.....Controlling Variables (12 min.)
Teachers investigated their responses to sight, sound, and touch and controlled variables while they investigated.

Skylab III.....Teaching Part E: Controlling Variables 2 (28 min.)
Sixth grade children simulated which emphasizes controlling variables when investigating upward movement of liquids in materials.

Countdown 4.....Interpreting Data, Predicting (5 min.)
This lesson, as most of the others for teachers, was based on a lesson from Science - A Process Approach lesson booklets for children. The teachers interpreted data from a quantitative analysis investigation.

Two other activities called for graphing and on the basis of their interpretation of the data collected and graphed, the teachers made predictions.

Countdown 3.....Defining Operationally (11 min.)
Defining Operationally was practiced by the teachers using visuals first from the telelesson and then materials provided for them. After discovering how to make a closed circuit, they constructed an operational definition of a closed circuit.

Countdown 2.....Formulating Hypotheses (5 min.)
Teachers collected data about themselves in groups and formulated a hypothesis. They then tested their hypothesis with other groups.

Countdown 1.....Experimenting (8 min.)
This was the culminating experience to test if they had acquired enough skills to carry out an experiment on their own. They investigated the resolving power of the eye.

Countdown.....Lift Off! (7 min.)
This lesson was to induce teachers to discuss among themselves the key to successful teaching and also ideas to handle problems encountered.

Treatment

A total of fifteen meetings were scheduled for viewing at each of the six schools involved. The meetings were scheduled to last thirty to forty minutes once a week at the end of the school day. A tally was kept each week of the number of activities a teacher had taught. Each teacher was given a guide book to use in conjunction with the telelessons. The guide book listed the performance objectives of each telelesson, the rationale, materials needed, instructions for participating in and responding to the telelesson activities. Materials for each lesson were coded and packed in a cardboard box easily accessible for each teacher or each group of teachers depending on what the

lesson specified. One teacher in each building volunteered to see that the materials were passed out before the telelesson began and checked the television set for proper tuning.

Results

1. Competency Attainment

Sixty-six teachers scored twenty-nine or better out of thirty-three tasks on the science competency post-measure which indicates the televised inservice program was a success in its goal to assist teachers in acquiring those skills identified as important in teaching Science - A Process Approach in the classroom. One reason television may have achieved its objectives is through the careful selection of visuals that compliment the lessons. Close-up viewing of visuals or objects can lessen the possibility of misinterpreting the point of the activity. Lessons are also carefully prepared and rehearsed for accuracy. Television tapes can be used over and over after the initial expense and free specialists for other jobs. Those teachers who participated in the inservice telelessons via VTR achieved a slightly higher level of competency than those who participated via color/cable. It should be noted, however, that science competency scores were generally high for the entire group. The twenty-six teachers who participated in the lessons via VTR had more flexibility in controlling their inservice time which may have accounted for the slightly higher level of competency. This suggests a need for more flexibility in control of inservice

scheduling that would allow times for repeating programs, ways for teachers to select programs, and even schedules for home viewing.

2. Competence Attainment and Attendance

Teachers who attended all of the inservice sessions achieved a higher competency on the post-measure. The competency posttest was a criterion-referenced test and it measured the performance objectives practiced at each session. Each session was designed to help teachers reach the identified objectives for that session. Those teachers who did not attend one or more sessions did miss the opportunity to achieve specific objectives and probably did not achieve those on the post-measure.

3. Competency Attainment and Past Experience

In this study, past experience was defined as prior science hours taken, years taught, and grade level taught. None of these were related to achievement in science competency and change in attitudes. Two reasons might be proposed for these observations in this study. The inservice program was designed to assist teachers to implement Science - A Process Approach. Both the inservice program and the science curricula were new programs to all seventy-six teachers. Even those few who had taken as many as thirty science hours or who had taught thirty-six years had not participated in inservice instruction via television nor had they taught Science - A Process Approach.

Therefore, they all shared a stimulus--a new experience. Another reason could be the readiness of this group of teachers. In general, whether teaching kindergarten or sixth grade, the teachers expressed a common dissatisfaction with their science program or lack of science program prior to beginning the televised science inservice program and wanted a change. An implication of this study may be that desire for change is a necessary ingredient to change. Further study is needed to investigate whether or not readiness for change must already exist for change to occur of if readiness or desire for change can be induced?

4. Change in Teacher Attitude

The analysis of the pre and post-measure of all seventy-six teachers' attitudes indicated many positive attitude changes did occur. (See Table 2.) The lower the mean score the more positive is the teacher's attitude. For example, a change from a pretest mean of 12.36 to a posttest mean of 11.66 is a change in the positive direction and significant at the .05 level. Some of the success of the positive attitude changes can be attributed to the fact that science inservice training via cable or VTR was a totally different medium by which the teachers had not experienced science activities. Prior feelings were less likely to surface in a new medium unrelated to unpleasant past experiences in science. There was an attempt to supply pleasant music, attractive visuals and participating activities that aroused curiosity. It was observed that teachers relaxed in their own

TABLE 2

PRE- AND POST-ATTITUDE CHANGE

Protocol		Pre-Mean	Post-Mean	Change	Probability Level
1. TV as an Inservice Tool	E	12.36	10.66	1.70	*.01
	P	15.91	13.99	1.92	*.00
	A	15.42	14.32	1.10	*.01
2. Exercise Booklets	E	13.49	11.34	2.15	*.01
	P	16.08	14.80	1.28	*.01
	A	14.61	13.84	.77	*.09
3. Teaching	E	8.53	8.86	-.33	.41
	P	13.08	12.82	.26	.55
	A	10.64	11.03	-.39	.35
4. Children	E	8.63	8.57	.06	.85
	P	13.86	14.49	-.63	.08
	A	11.07	9.97	1.10	*.02
5. Teaching Science	E	12.86	10.58	2.28	*.00
	P	15.25	13.64	1.61	*.00
	A	13.41	11.86	1.55	*.00
6. Behavioral Objectives	E	12.76	12.19	.57	.24
	P	14.73	14.49	.24	.47
	A	14.76	14.65	.11	.79
7. Science	E	11.92	10.97	.95	.41
	P	15.27	13.27	2.00	*.00
	A	13.32	11.68	1.64	*.00
8. Your Closest Associate's View	E	13.76	11.92	1.84	*.00
	P	15.71	14.52	1.19	*.00
	A	14.83	13.29	1.54	*.00
9. TV Lift Off Program	E	14.01	11.05	2.96	*.00
	P	15.79	14.09	1.70	*.00
	A	14.75	13.85	.90	*.03
10. Television	E	11.96	11.05	.91	*.03
	P	15.23	14.66	.57	.11
	A	14.80	14.14	.66	.14
11. Guide Book to Lift Off	E	14.69	11.43	3.26	*.00
	P	15.51	14.47	1.04	*.00
	A	15.58	14.12	1.46	*.00

E Evaluation
P Potency
A Activity
* Significant at .05 Level

N = 76

familiar surroundings without having to rush to another place for inservice training. The relaxed atmosphere seemed to have reduced tension and at the same time put the responsibility for learning on the teachers as a group. There was no disconcerting presence of an "expert" to tell the teachers how to carry out their investigations, but they were encouraged to help each other. It was observed by the investigator through periodic classroom visits that this same atmosphere of self-learning seemed to carry into the teachers' classrooms with their students.

Inferences can be made from the pre and post-Semantic Differential scores regarding the teachers' perceptions of "Teaching" and "Children." During the intervening weeks in which inservice training took place attitudes toward "Teaching" and "Children" did not change in a positive direction but a slight change in the opposite direction. It should be noted that the pre-Semantic Differential was given during school orientation week before the teachers had actually begun to teach children. After a restful vacation, teachers usually express eager anticipation and perhaps attitudes toward teaching and children tend to be more positive than usual. The post-Semantic Differential was given during the hectic days just prior to winter vacation. It was observed that nerves were frayed with the extra burden of holiday school programs and preparation for the coming festive season. Attitudes toward teaching and children are perhaps more pessimistic than usual. It might be inferred this is the reason the attitudes toward "Teaching" and "Children" were less enthusiastic and less positive. Perhaps this very fact gives more

credence to the positive attitudes that resulted toward science and television inservice instruction despite the season and conflicting interests. There is need for further study to investigate attitude changes during certain seasons of the year and the impact upon teaching practices.

As part of the analyses the attitude change of the cable group and VTR group were contrasted. No differences were observed between these two groups. This suggests that the usefulness of VTR presentations needs exploration. Although cable television has wide distributive powers and is particularly advantageous for large metropolitan schools where large groups of teachers must be involved with minimum travel, VTR presentations can serve a useful purpose for both large and small school districts.

Evidence based on pre and post-attitude scores indicate teachers' attitudes did change in a positive direction after being involved with the televised inservice program. Corresponding with this was a general increase of activities being taught in the classrooms over the weeks in which a tally was kept. (See Table 3.)

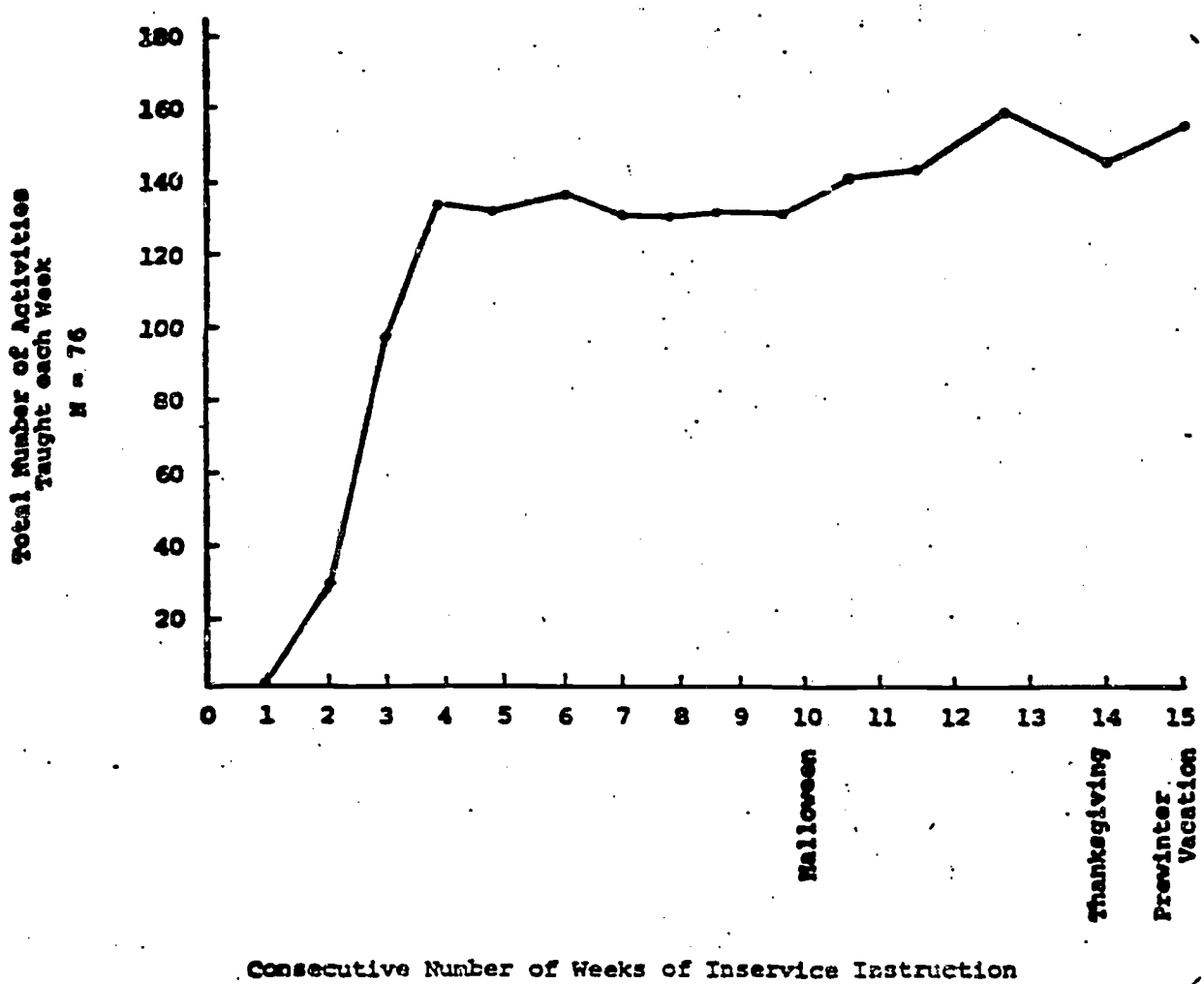
Conclusion

In this study, it has been demonstrated that through a televised inservice program teachers can acquire needed science competencies and demonstrate positive attitude changes toward science and science teaching while increasing the number of activities being taught in the classrooms. There is a related

TABLE 3

ACTIVITIES TAUGHT IN THE CLASSROOM

DURING TELEVISED INSERVICE INSTRUCTION



question of key importance. What kind of continuing education do teachers need who are not beginning a new science program but rather who have been teaching a new program for more than a school year? We have seen renewed interest in teaching science when teachers use programs that stress active involvement from students. However, unless teachers maintain an interest in doing science with their students we will see the crest of the new wave of enthusiasm wan and lose its momentum. Finding a key to successful inservice instruction for initial implementation is only the beginning. Insight into the variables that sustain a teacher's enthusiasm to continue teaching science is as vitally important as initiating a successful program.

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