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ABSTRACT

Reported is a study undertaken to examine an attitude paradigm that might be valid to use in initiating research on the modification of the attitudes of preservice elementary teachers toward science and the teaching of science. The subjects were 286 third year preservice elementary teachers enrolled in the fall term of 1972, at four teacher preparation institutions: a land grant university (N=152); an urban, commuter university (N=68); a teachers college (N=50); and a private, church-related college (N=16). The Instrument of Instructor Credibility, a Likert-type response instrument, was used to determine the preservice teachers' beliefs about the professional credibility of their science methods instructor. A frequency count and percentage on each of the 14 statements of the instrument were computed for each of the 5 response categories. Responses and their possible implications indicate that a credible science methods instructor should have (1) taught elementary science, (2) drawn from a store of practical experiences, (3) modeled many modes of teaching, (4) competence in science content, and (5) a close liaison with public school teachers. (Author/PEB)

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Credibility of the Communicator: A Paradigm for Attitude Change for Preservice Elementary Teachers Toward Science*

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Introduction

In the decade following Blackwood's (1964) study, where he reported the lack of teacher interest as one of the barriers to effective science teaching in the elementary schools throughout the nation, there have been a number of studies concerned with the attitude of teachers toward science. Among those reporting their research findings have been Stollberg (1969), Hone and Carswell (1969), Washton (1971) and Shrigley (1972, 1973). There seems to be general agreement that elementary teachers, as a group, have less than a positive attitude toward the teaching of science.

The need for more research on science attitudes is well summarized by Ramsey and Howe (1969, p. 68):

> A student's attitudes toward science may well be more important than his understanding of science since his attitudes determine how he will use his knowledge. For this reason the development of attitudes as a part of science instruction is an area requiring increasing research.

If it can be assumed that the science attitude of students is affected by the attitude of the teacher, and Washton's (1971) study supports this assumption, the need for a positive attitude of elementary teachers toward science seems obvious.

There are at least two attitude scales in the literature that have been developed to measure the attitude of preservice teachers

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toward science. Dutton and Stephens (1963) have published a scale utilizing the ~~Thorndike~~ Thurstone technique and Shrigley (1971) has developed a Likert-type attitude scale.

With a need established and instruments available the remaining prerequisite to attitude research is designing a valid attitude paradigm that can become a theoretical model for experimental study.

The Problem

The purpose of this study was to examine an attitude paradigm that might be valid to use in initiating research on the modification of the attitude of preservice elementary teachers toward science and the teaching of science.

Furthermore, the study proposed to: (1) examine research on attitude change in the field of social psychology, and specifically the model known as credibility of the communicator; (2) investigate the adaptability of this model to the field of science education and develop an instrument to survey the factors that preservice teachers perceive as representing the more credible science educator; and (4) survey the preservice teachers' perception of professional credibility of the science educator.

Definitions of Terms

Attitude paradigm was defined as a theoretical construct or model that could be used to initiate experimental studies concerning the modification of attitude of preservice teachers toward science.

The credibility of the communicator was a theoretical model used in the field of social psychology whereby the attitude of respondents toward

a psychological object (i.e., science and the teaching of science) is modified by their perception of the expertness and trustworthiness of a communicator.

The instructor's professional credibility was the science educator's past or present, direct of indirect relationship with the teaching of science in the elementary school classroom.

A preservice elementary teacher was a third year education major preparing to be an elementary teacher.

Science attitude was defined as the interests, opinions and/or beliefs held by a preservice teacher toward science and the teaching of science.

The science educator was defined as a college instructor of science methods courses for elementary education majors.

The Credibility of the Communicator

Halloran (1967, p. 61) enumerates many factors that are involved in attitude change. The list includes:

1. the person who is presenting the knowledge
2. how this person is perceived
3. the form in which the knowledge is given
4. the circumstances of delivery
5. the manner of presentation
6. the conditions and affiliation of those receiving the knowledge
7. The function that knowledge might perform in serving the needs of the recipients

The first two factors listed by Halloran, the source of the communication and how the source is perceived, are the focal points of this investigation. Research indicates that the credibility, expertise and trustworthiness of the communicator have a principal effect on attitude change of the recipients of a communication.

After reviewing the findings in social psychology concerning the credibility of the communicator and its influence on attitude change, Cohen (1964, p. 29) writes:

> The data from these different experiments show with reasonably good agreement that variations in the credibility of the communicator do indeed determine variations in attitude change: the greater the trustworthiness or expertness, the greater the change toward the position advocated by the communicator.

In a more recent summary of findings on attitude change, Eysenck et al. (1972, p. 97) support Cohen with the following statement: "...the extent to which a communication is effective in changing attitudes depends upon the perceived credibility of the source..."

Assumptions of the Study

This study was based on several assumptions as follows: (1) many preservice elementary teachers, and later as in-service teachers, have less than a positive attitude toward science; (2) the teachers' attitude toward science affects their teaching, and therefore the pupils' learning, in science; (3) attitudes are learned, thus the attitude of the preservice teacher toward science can be changed; (4) the attitude theory common to social psychology, credibility of the communicator, is a valid theory on which to build an attitude paradigm in science education; and (5) the preservice teacher is a valid population to survey to establish the credibility factor of the science educator.

The Population

The sampling for this study was 286 third year preservice elementary teachers enrolled at four teacher preparation institutions: (1) a land grant university (n=152); (2) an urban, commuter university (n=68);

(3) a teachers college (n=50), and (4) a private, church-related college (n=16). All of the preservice teachers were enrolled in a professional course in the teaching of science. The survey of the population was made during the fall term of 1972.

Procedure

The instrument was administered by four science educators at the four teacher preparation institutions. The directions were given as stated in Table 1. As shown in the table, a frequency count and percentage were computed for each of the five response categories for each of the 14 statements. In interpreting the findings, 70 percent agreement (strongly agree plus agree) or higher was considered criterion. Therefore a statement having at least 70 percent agreement was considered a valid component of the credibility model.

Rationale for Statements on the Instrument of Instructor Credibility

Reference to Practical Teaching Ideas. The investigator has found preservice teachers to be in constant quest for what they call practical ideas in science teaching. Secondly, the investigator is assuming that the sharing of successful teaching activities assists the preservice teacher in perceiving the instructor as expert and trustworthy, an important facet to this model for attitude change, (Halloran 1967). Therefore, Statement 1 seemed to be valid for the instrument.

Teaching Experience. Two statements placed on the instrument were based on the assumption that first hand experience at teaching science in the elementary classroom was a factor in an instructor's professional credibility. Statements 2 and 12 in the table dealt with past and present teaching experience in the elementary school. Both statements were

supported by Ballou (1969).

The correlation of science with other subjects in the elementary school curriculum has long been advocated in the literature. One of the more recent writings advocating such correlation was published by Hogan and Schall (1973).

Assuming the correlation of science and other subjects to be viable concept in the preparation of elementary school teachers, the investigator assumed that whether a science educator had taught subjects other than science to children was a valid statement in testing instructor credibility. (See Statement 9 on Table 1)

Responsibility for Teaching Science Content. The subjects in this study were enrolled at four colleges and universities where science content and science methods were taught as separate courses with content courses preceding method in the students' schedule. However, it has been the investigator's experience that preservice teachers express a lack in science content even after they have completed all science content courses.

It seemed that one of the science educator's roles that could affect attitude change was the teaching of science content. Therefore, the inclusion of Statement 3 was a means of testing this component of the attitude paradigm.

Model a Variety of Teaching Modes. Not only does this study assume that science educators should refer verbally to practical teaching ideas, they should model in a science education course many modes of instruction that their students will be expected to practice when they become classroom teachers. Teacher exposition, guided discovery, demonstration, group learning and independent study would be a list of such modes. Ballou (1969) has concluded that the science educator should teach as he would expect his

Table 1: The Instrument of Instructor Credibility and a Summary of the Responses of 286 Third Year Elementary Education Majors Enrolled in Science Methods Courses at Four Midwestern Colleges and Universities

The purpose of this survey is to ask your opinion in regard to your instructor's teaching credibility, i.e., his present or past relationship with the teaching of science in the elementary school classroom. Will you respond to the following statements by placing on the answer sheet one of five reactions:
A - Strongly agree; B - Agree; C - Uncertain; D - Disagree; E - Strongly disagree

Do not place your name on the opinionaire or answer sheet.

If elementary education majors are expected to respect the teaching credibility of their instructor, those who teach science methods should:

	RESPONSES				
	A	B	C	D	E
	Percentage*				
1. refer, when appropriate, to practical teaching activities he has experienced in the elementary school classroom. (3)**	66	32	1	1	0
2. have taught science for several years in the elementary school classroom. (1)	67	25	2	5	1
3. assume some responsibility for teaching content to students in science methods. (9)	26	59	8	6	0
4. teach the methods course using similar teaching modes as he expects his students to use when they teach young children. (6)	44	37	9	8	2
5. assume some responsibility for assisting college science professors in developing appropriate science content courses for elementary education students. (10)	29	52	13	5	1
6. assume some responsibility for counseling with his students when they enroll in student teaching. (12)	24	55	15	6	0
7. be involved in assisting in-service teachers in the development of science curricula. (14)	18	55	21	5	0
8. assume the responsibility of dealing with topics that are not specifically science methods - e.g., discipline, reporting pupil progress, etc. (11)	22	47	17	12	2
9. have taught subjects in the elementary school other than science. (2)	22	43	21	12	2
10. be involved in research having to do with elementary science methods. (8)	8	48	28	13	2
11. assume some responsibility for counseling former students in their beginning years of teaching. (13)	14	42	29	15	1
12. teach a few science lessons to elementary age students each term. (4)	12	35	32	20	2
13. have been involved in writing elementary science textbooks. (5)	5	9	35	45	7
14. have written the textbook used in this course. (7)	1	3	15	55	27

*Percentages may not total 100 due to rounding.

**Number indicates sequence of statement on original instrument.

students to teach. Statement 4 was placed on the instrument for the purpose of testing the credibility of this facet of science education.

Interdepartmental Cooperation. Assuming that the preservice teacher needs science content courses developed on a rationale similar to that undergirding the innovative science programs (SAPA, SCIS, ESS) for elementary school students, college science courses for teachers should have a hands-on, inquiry-based emphasis. If it can be further assumed that many college science professors need the assistance of science educators in designing such courses, Statement 5, dealing with interdepartmental cooperation, seemed a valid component in the credibility factor of science educators.

Responsibility to Student After Course Completion. In Ballou's (1969, p. 9) model of the science educator, the author writes, "Good methods teachers should be willing to help college students after they have begun teaching." Statement 6 on the instrument deals with the science educator's role during student teaching. Statement 7 tests the preservice teachers attitude toward the educator's role in in-service education and Statement 11 is concerned with the counsel of former students after graduation.

General Topics in Specific (Science) Education Courses. As professors of education become more specialized and teach exclusively in science, math or reading education, there are general components of teacher education, such as classroom discipline, that tend to become "everybody's business and nobody's business." Assuming that such general topics as reporting pupil progress to parents or classroom discipline could be valid components to the credibility of all teacher educators, including science educators, Statement 8 was placed on the instrument.

Research and Writing. Many of the science textbooks for children, as well as the texts for science methods, are written by science educators. Much of the educational research is done by the same group. As a means of testing the credibility of writing and research as viewed by preservice teachers, Statements 10, 13 and 14 were included on the instrument.

Results of the Survey

Table 1 reports a summary of the subjects' five choices of responses to each of the 14 statements. For the purpose of examining the implications of the responses, the investigator collapsed the data in the "strongly agree" and "agree" categories and interpreted that data in one general agreement category.

What is the attitude of preservice elementary teachers toward the science educator who cite practical teaching ideas for class? Ninety-eight percent of the respondents were in agreement that the more credible science educator should cite in class practical teaching activities he had experienced in the elementary school classroom. (See Statement 1 on Table 1) The investigator considered this component valid for the attitude paradigm.

What is the attitude of preservice teachers toward the role of the science educator as a practicing school teacher? As shown by the data on Table 1, the attitude of preservice teachers was divided. Ninety-two percent of the sample in the study were in agreement that the more credible science educator should have taught for several years in the elementary school classroom. (See Statement 2) Assuming 70 percent agreement as criterion, it is obvious that preservice teachers consider past teaching experience in the elementary classroom an important component

in instructor credibility. Therefore, the investigator considered this component a valid one for the attitude paradigm.

On the other hand, preservice teachers were not nearly as concerned about the recency of the science educator's experience with children. As shown by the data on Statement 12, only 47 percent of the sample agreed that the science educator should teach a few science lessons to children each term. The investigator does not consider this component valid for the attitude paradigm.

Sixty-five percent of the respondents were in agreement and 21 percent were uncertain whether the science educator's role as a teacher of subjects other than science was as important as science. (See Statement 9)

If 70 percent agreement is considered absolute as criterion, the results rate this component as invalid for the attitude criterion. However, further examination of the data indicated that students enrolled in the teachers college and private college reached criterion with a 76 and 75 percent agreement. Students in the sample enrolled at the urban, commuter university and land grant university did not reach criterion with a 62 and 61 percent agreement. Twenty-one percent of the sample responded as uncertain. Until further study is made of Statement 9, the investigator considered it marginal and therefore, invalid for the attitude paradigm.

What is the attitude of preservice teachers toward the science educator's role in the teaching of science content? Eighty-five percent of the respondents were in agreement that the science educator should assume some responsibility for teaching science content. (See Statement 3) Therefore, the investigator considered this a valid component.

What is the attitude of preservice teachers toward the role of the science educator as one who models in the college classroom teaching modes similar to those he expects them to use when they teach young children? Eighty-one percent of the respondents were in agreement that a science educator should model in the classroom modes of teaching similar to those he expects students to use later as teachers. (See Statement 4) The investigator considered this compenent as valid for the attitude paradigm.

What is the attitude of preservice teachers toward the science educator's role as an advisor to the college science professor? Eighty-one percent of the respondents were in agreement that the science educator should assume some responsibility for assisting college science professors in developing appropriate science content courses for preservice teachers. (See Statement 5) Therefore, the investigator considered this to be a valid component.

What is the attitude of preservice teachers toward the responsibility of the science educator to the student after course completion? Seventy-nine percent of the respondents were in agreement that the science educator should assume some responsibility for counseling students during student teaching. (See Statement 6) Therefore, the investigator considered this component valid.

Seventy-three percent of the respondents were in agreement that the science educator should be involved in assisting in-service teachers in the development of science curricula. (See Statement 7) The investigator considered this component valid.

Fifty-six percent of the respondents were in agreement and 29 percent were uncertain whether the science educator should assume some responsibility for counseling former students in their beginning years of teaching. (See Statement 11) The investigator considered this component invalid.

What is the attitude of preservice teachers toward the role of general topics (e.g., classroom discipline) in science education courses? Sixty-nine percent of the respondents were in agreement and 17 percent were uncertain whether the science educator should assume some responsibility for dealing with such general topics as classroom discipline and reporting pupil progress to parents. (See Statement 8)

If 70 percent agreement is considered an absolute criterion, the results suggest this component to be invalid. However, further examination of the data indicated that students enrolled in the teachers college reached criterion with a 77 percent agreement. Students in the sample enrolled at the urban, commuter university, the land grant university and private college did not reach criterion with a 60, 68 and 69 percent agreement. Until further study is made of Statement 8, the investigator considered it marginal and therefore invalid for the attitude paradigm.

What is the attitude of preservice teachers toward the science educators role as an author and researcher? Fifty-six percent of the respondents were in agreement and 28 percent were uncertain whether the science educator should be involved in research having to do with elementary science methods. (See Statement 10) The investigator does not consider this component valid.

Fourteen percent of the respondents were in agreement that the science educator should be involved in writing elementary science textbooks. (See Statement 13) The investigator does not consider this component to be valid.

Four percent of the respondents were in agreement that the science educator should write the textbook for the course. (See Statement 14). The investigator does not consider this component to be valid.

Conclusions

The results of this study indicate that the more credible professional qualities of a science educator were that he:

(1) refer to practical teaching activities he had experienced in the elementary school classroom.

(2) has taught science for several years in the elementary school classroom.

(3) model in the college classroom modes of teaching similar to those he expects his students to use when they teach young children.

(4) assume some responsibility for teaching science content.

(5) assume some responsibility for assisting college science professors in developing appropriate science content courses for elementary education majors.

(6) assume some responsibility for counseling students during student teaching.

(7) be involved in assisting in-service teachers in the development of science curricula.

The results of this study indicate that the following experiences do not tend to make the science educator a more credible instructor to preservice elementary teachers:

(1) that he teach a few lessons to elementary age students each term.

(2) that he counsel former students in their beginning years of teaching.

(3) that he be involved in research having to do with elementary science methods.

(4) that he write elementary science textbooks.

(5) that he write the textbook for the science methods course.

The results of this study indicate that two qualities thought to be components of instructor credibility were marginal and therefore considered invalid until further research has been conducted. They were:

(1) that the science educator have had experience teaching subjects other than science to children.

(2) that the science educator assume some responsibility for dealing with topics that are not specifically science methods (e.g., classroom discipline).

Implications

If we could assume that instructor credibility is a valid paradigm for attitude change, and experimental studies should be designed to test the theory, the implications for preparation and selection of science educators are specific.

The instructor who would best affect attitude change would be the practitioner, perhaps the former elementary school teacher. He should be able to draw on a store of practical experiences and would have reason to model many modes of teaching with preservice teachers. If he is to be responsible for teaching science content, formal or informal training in the sciences is important. Perhaps team teaching of the science content and science method might affect the attitude of preservice teachers.

A close liasion between public schools and teacher preparation is implied. And many of the qualifications that make the science educator more respected by the university community, namely research and professional writing, seem not to enhance his credibility with preservice teachers.

Recommendations

The results of this study must be considered preliminary in nature. First of all, the instrument should be further examined. Statements 8 and 9 (See Table 1) are marginal and should be modified or possibly deleted.

Secondly, the universe of credibility statements could be further examined as a means of seeking a greater sampling of valid credibility statements. For example, students might be asked if a doctorate lends credence to the science educator.

Thirdly, experimental studies should be designed and hypotheses tested. This study seems to differentiate the credible from the non-credible science educator. Using the criteria developed in this study, instructors defined as credible and non-credible could be randomly assigned to instruct groups of preservice teachers, also randomized. After a period of treatment, the science attitude of the treatment groups could be tested and the results analyzed statistically.

The credibility paradigm has two principal components. One is the person and his qualifications. But, as Halloran (1967) has written, how the communicator (i.e., the science educator) is perceived by the recipients (i.e., the preservice teacher) is equally important.

It is possible that an instructor could have some credible qualifications without making them known to the preservice teachers. With this assumption in mind, experimental studies could be designed to test the behavior by which there is a greater probability that a credible science educator can be sure his credibility is accurately perceived by the students.

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