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AUTHOR Martin, Ralph E., Jr.
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ABSTRACT

Reported is a study designed to test Hovland's principle of attitude change as related to attitudes toward science and science teaching. Hovland's research provided information that communicators who were perceived as being highly credible and authoritative are more likely to produce greater attitude change than are communicators perceived as less credible and authoritative. A one-group pretest-posttest-posttest test time series research design was used with 25 preservice elementary education students enrolled in a science methods course. Treatment consisted of: (1) on-campus methods instruction and science unit planning during weeks 1-7 of one quarter; (2) in-field preservice elementary teacher science instruction of pupils in local elementary schools during weeks 8-10; and (3) an on-campus science fair and evaluative feedback sessions during the final week of the quarter. Preservice students' attitudes toward elementary science teaching and toward science were measured with Moore's Science Teaching Attitude Scales instrument while perceptions of communicator credibility were measured by the semantic differential technique in the form of the Perceptions of Communicator Attitudes instrument. The investigator concluded, after data analysis, that Hovland's principle is important to attitude change but that credibility is not the main cause for change. (PB)

THE INFLUENCE OF COMMUNICATOR CREDIBILITY ON PRESERVICE ELEMENTARY TEACHERS' ATTITUDES TOWARD SCIENCE AND SCIENCE TEACHING

Ralph E. Martin, Jr., Ph.D.

Assistant Professor
College of Education
Ohio University
Athens, OH 45701

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Introduction

Teacher attitude is one of the most important aspects of a school's effectiveness. Positive and negative teacher attitudes contribute to the nature of a school's educational environment, determine how instructional resources are utilized in the classroom, and influence student attitudes and achievement.

The literature supports the tenets that (1) teacher attitudes do make a difference in the teaching-learning process (Good et al., 1975); and (2) teacher attitudes can be changed (Stern & Keislar, 1971). The need for attitude research in science education has spawned numerous studies during the past two decades. Some studies have focused on the need for theoretical models on which to base attitude research. One model suggested is built upon reinforcement theory (Shrigley, 1980, 1976). Central to the model is the principle that the credibility of the communicator of attitude change affects the degree to which an individual's attitude will change.

Posited by Carl Hovland and his associates (1953) of the Yale University Communication Research Program, communicator credibility is reported to consist of the respondents' perceptions of a communicator's expertise and trustworthiness toward an attitude object. Contained within the communicator's verbal attitude change message is a "recommended position" toward which the respondent is encouraged

to move. Hence, according to Hovland et al., (1953, p. 11), "...a major effect of persuasive communication lies in stimulating an individual to think both of his initial (position) and of the new (position) recommended in the communication." Therefore, Hovland's model purports the importance of (1) the communicator, (2) the respondent, (3) the respondent's perception of the communicator's credibility and attitude change message, and (4) the respondent's change in attitude. Or as Smith (et al., 1946) has stated: "Who says what to whom with what effect?"

Hovland (1953) and his associates believed the credibility principle was of central importance to the attitude change process. In general, their research found that communicators who are perceived as being highly credible and authoritative are more likely to produce greater attitude change, whereas communicators who are perceived to be less credible and authoritative are less likely to produce change. These findings suggest that the respondent's attitudes will move toward what they perceive to be the attitude level of the most credible communicator.

Rationale for the Study

It has been assumed that the principle of communicator credibility and attitude change "... is as applicable to education as to government, industry, and business, where this model has been used for decades" (Shrigley, 1980, p. 161). Recent studies which have sought to identify the more credible characteristics of science educators have been based upon this assumption (Shrigley, 1980; 1976). But does this principle

apply to attitude changes in classrooms, particularly teacher education, where future elementary teachers who come to a program with varied predispositions toward science and its teaching are trained?

If one considers the classroom as a stimulus-response learning environment, the teacher as the communicator, and students as respondents to the teacher's message, then one may expect the more credible teacher to effect a greater change in attitudes than a teacher who is perceived as being less credible. Intuitively, the credibility principle applies to education. However, this investigator found no studies which tested this principle in a contemporary education context.

The Problem

Methods instructors, graduate assistants, university supervisors, field school cooperating teachers, and student peers are among the numerous communicators commonly at work in campus-based teacher education methods classes and the accompanying practice teaching experiences in field schools. Each communicator may offer an attitude change message to the preservice teacher (respondent). Yet, each communicator cannot provide a communication free from the possible contamination of other communicators. The nature and quality of the message delivered by each communicator and the amount received by the respondent are not likely to be equal. Moreover, failure to account for differing perceptions of communicator credibility would limit the identification of attitude change elements in the methods course.

The influence of the communicator has been identified as the

probable producer of most changes in attitudes. Hovland and his associates (1953) reported that the credibility principle worked well when the number of communicators was limited to three for short, intense periods of communication exposure. However, many different communicators exist in a teacher-education methods class with a related field experience component and the lengths and frequencies of their communications vary. Each communicator may influence, to some degree, the attitudes that preservice teachers have toward a given subject and its teaching. The purpose of this study was to test Hovland's principle of attitude change as related to attitudes toward science and science teaching. Therefore, the major question of concern to this study became one of:

> Does Hovland's principle of communicator credibility hold true in the context of a team taught preservice elementary teacher science methods course?

Given the context of this study, certain relationships must exist to confirm Hovland's principle. Therefore, to answer the major question, the following questions first had to be answered:

1. Did preservice elementary teachers' attitudes toward science and science teaching change during and following the science methods course?

2. Which communicator was perceived as being most credible during and following the methods course?

3. Did the preservice elementary teachers' attitudes change toward what they perceived to be the attitude level of the most credible communicator?

The following assumptions supported this study:

1. Attitudes are not innate, they are learned; therefore, positive attitudes can be taught (Shrigley, 1974).

2. Attitudes are influenced by a variety of variables which exist within the structure of a course (Haney, 1964).

3. Preservice elementary teachers are a valid population to determine the credibility of a communicator (Shrigley, 1976).

4. The preservice elementary teachers were honest and knowledgeable while responding to treatments and completing the instruments.

5. The instruments used to measure the dependent variables and methods of statistical analyses are valid.

6. An increase or decrease of at least three points on the attitude measures is a meaningful difference in science and science teaching attitudes.

Procedures

Population

A population of preservice elementary teachers enrolled in The University of Toledo's College of Education was available for study. The population consisted of 25 junior and senior elementary education majors enrolled during the Winter Quarter, 1981 in a team taught elementary science methods course.

The population was composed of 22 females and 3 males ranging in age from 19 to 40 with a mean age of 21.7 years.

Treatment

The treatment of this study consisted of three parts: (1) on-campus methods instruction and science unit planning during weeks 1-7 of the quarter; (2) in-field preservice elementary teacher science instruction of students in local elementary schools during weeks 8-10; and (3) an on-campus science fair and evaluative feedback sessions during the final week of the quarter.

The independent variables included six communicators (science instructor, graduate assistant, unit evaluator, university supervisor, cooperating teacher and peer team member) and their communications. Dependent variables included the preservice teachers' science and science teaching attitudes, perceptions of communicator credibility, and perceptions of communicator attitudes.

Instrumentation

The following are descriptions of instruments used to measure the dependent variables.

Science and science teaching attitudes. Moore's (1973) Science Teaching Attitude Scales (STAS) instrument was used to determine preservice elementary teacher attitudes. Also known as "What is Your Attitude Toward Science and Science Teaching?" the instrument contains 70 items which assess attitudes in two areas: (1) attitudes toward science; and (2) attitudes toward elementary science teaching.

The Likert-type, forced choice instrument provided scores on 14 individual scales. The range of each scale is 0-15. The eight positive and negative attitudes toward science scales have a range

of 0-120, whereas the six positive and negative attitudes toward science teaching scales have a range of 0-90.

Moore (1973) established the reliability of the Science Teaching Attitude Scales by using the test-retest method. A reliability coefficient of 0.816 was obtained on the attitudes toward science scales and 0.934 on the attitudes toward science teaching scales. In a separate study, Riley (1979) reported Hoyt Reliability coefficients of 0.71 and 0.84 respectively on Moore's instrument. Field testing demonstrated the instrument's construct validity (Moore, 1972).

Perceptions of communicator attitudes. Moore's (1973) STAS instrument was also used to obtain the preservice elementary teachers' perceptions of the communicators' attitudes (PCA) toward science and science teaching. The preservice teachers were directed to respond to each item on the STAS as they believed each communicator would respond if he or she were asked to complete the same instrument.

Perceptions of communicator credibility. Perservice elementary teacher perceptions of communicator credibility (PCC) were measured by the Semantic Differential (SD) technique. Osgood's (1971) semantic differential has been used in a number of attitude studies (Butzow & Davis, 1975; Butzow & Williams, 1973; Gallagher & Korth, 1969; Klopfer, 1966). Since expressed perceptions are considered to be opinions and opinions are verbalizations of attitudes (Hovland et al., 1953), an attitude instrument such as the SD was considered a reliable instrument for measuring directly the two concepts of credibility, i.e., expertness and trustworthiness.

The Semantic Differential has become a useful and powerful tool in quantifying the measurement of meaning. Osgood's SD is actually a scale in itself. The scale is reported to be of such a general sort that it can be applied to any concept at all (Oskamp, 1977) and can easily be modified to measure specific concepts (Triandis, 1971).

Bi-polar adjective pairs were selected from an atlas of semantic profiles for 360 words compiled by Jenkins et al. (1958). These words were rated on twenty scales by eighteen groups of thirty students. The reliability of the scale values was determined to be 0.97 for sophomore college students. Based upon extensive study, Osgood (1971) reported no reasons to question the validity of the SD on the basis of its correspondence with the results to be expected from common sense.

From the factor loadings reported in the atlas, the researcher selected thirteen pairs of bipolar adjectives believed to relate to the concepts to be measured. A panel of nine former elementary science methods students volunteered to participate in a field test of the instrument during early January 1981. The volunteers were asked to complete the instrument and during an interview responded to the clarity of the printed instructions and relationships between the bipolar adjective pairs and the concepts. As a result, the instrument was improved to the form used in the study -- a two concept, 10 bipolar adjective pair, seven space semantic differential which measured perceptions of credibility for each communicator.

Design and Data Collection

The study was based upon a one-group pretest-posttest-postpost-test time series research design (see Figure 1).

All preservice elementary teachers enrolled in the science methods course were pretested on their attitudes toward science and science teaching at the end of the Fall Quarter, 1980. Attitudes were measured by Moore's (1973) "What is Your Attitude Toward Science and Science Teaching ?" instrument (Science Teaching Attitudes Scales, STAS).

After applying the instructional treatment during the quarter's first seven weeks, all preservice teachers also provided perceptions of all communicators' credibilities by completing the Perception of Communicator Credibility (PCC) instrument. Perceptions of science methods instructor and graduate assistant attitudes were measured by the Perceptions of Communicator Attitudes (PCA) instrument.

Postposttest attitudes were measured after the preservice teachers taught self-constructed science units to students in local elementary schools. Again, the preservice teachers provided perceptions of all communicators' credibilities by completing the PCC. Perceptions of university supervisor, unit evaluator, cooperating teacher, and peer team member attitudes were measured by using the PCA.

Time line	Fall Quarter, 1980 Week 11	Winter Quarter, 1981 Week 1-7	Week 7	Week 8-10	Week 11
	Pretest	Treatment	Posttest	Treatment	Postposttest
	$STAS_1$	SMM	$STAS_2$	FE	SF,E $STAS_3$
			PCA_1		PCA_2
			PCC_1		PCC_2

$STAS_{1,2,3}$ - preservice teachers' attitudes toward science and science teaching.

SMM - Science Methods Module, generic methods and unit planning.

FE - Field Experience, subjects taught self-constructed science unit.

PCA_1 - perceptions of science instructor and graduate assistant attitudes toward science and science teaching.

PCA_2 - perceptions of university supervisor, cooperating teacher, and peer team member attitudes toward science and science teaching.

$PCC_{1,2}$ - perceptions of all communicators' credibilities.

SF,E - Science Fair and course Evaluation.

Figure 1. Research Design.

Results

A summary of the relevant findings for each question follows:

Question 1. Did the preservice elementary teachers' attitudes toward science and science teaching change during and following the treatments?

Attitudes toward science did not change substantially, whereas the population's attitudes toward science teaching indicated substantial change after all treatments.

The attitudes toward science population mean increased 2.76 from pretest to posttest and decreased -0.32 from posttest to postposttest. (Table 1).

The population mean for attitudes toward science teaching increased 6.16 from pretest to posttest and 4.40 from posttest to postposttest (Table 2.)

Table 1

Science Attitude Statistics

Statistics	Pretest	Posttest	Postposttest
Mean	78.64	81.40	81.08
Standard Deviation	7.40	6.23	8.25
Median	77.25	82.83	80.50
Maximum	91.00	95.00	97.00
Minimum	66.00	71.00	67.00
Range	25.00	24.00	30.00

Table 2

Science Teaching Attitude Statistics

Statistics	Pretest	Posttest	Postposttest
Mean	53.64	59.80	64.20
Standard Deviation	6.09	6.06	7.08
Median	53.00	59.25	65.50
Maximum	64.00	71.00	79.00
Minimum	36.00	44.00	52.00
Range	28.00	27.00	27.00

Question 2. Which communicator was perceived as being most credible during and following the methods course?

The population's perceptions of credibility rank did not change from posttest to postposttest. Thus, the communicators were ranked from most to least credible as follows (Table 3):

1. Science Instructor
2. University Supervisor
3. Graduate Assistant
4. Unit Evaluator
5. Peer Team Member
6. Cooperating Teacher

However, the science instructor cannot be claimed as the most credible communicator for all members of the population. The graduate assistant and a university supervisor also received very high credibility ratings. The answer to Question 2 is not one particular communicator, but rather that of three principal communicators: Science Methods Instructor, Graduate Assistant and a Supervisor/Unit Evaluator. On the postposttest credibility measures, 68% of the population perceived more than one of the three principal communicators as being of equal credibility. For the purpose of answering Question 2, the Science Instructor can be claimed most credible. However, in this team teaching situation credibility recognition was often shared and should be considered in the study of attitude changes and determining the efficacy of the credibility principle.

Table 3

Posttest-Postposttest Changes in Communicator Credibility

	Posttest		Postposttest		Difference	
Communicator	Sum	Mean	Sum	Mean	Sum	Mean
Science Instructor	65.93	2.64	67.48	2.70	1.55	0.06
University Supervisor	61.71	2.41	64.87	2.59	3.16	0.12
Graduate Assistant	58.00	2.32	63.16	2.53	5.16	0.21
Unit Evaluator	47.03	1.88	54.54	2.18	7 51	0.30
Peer Team Member	44.14	1.84	45.16	1.88	1.02	0.04
Cooperating Teacher	25.78	1.03	32.28	1.69	16.50	0.66

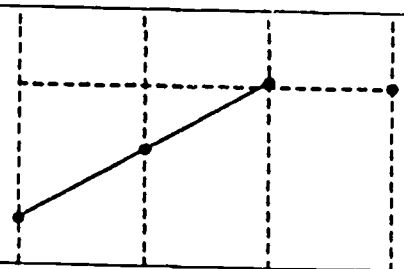
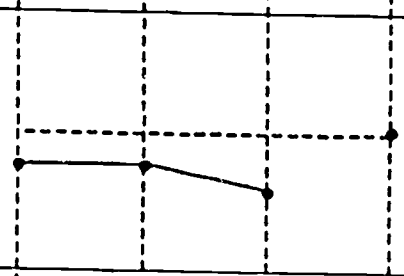
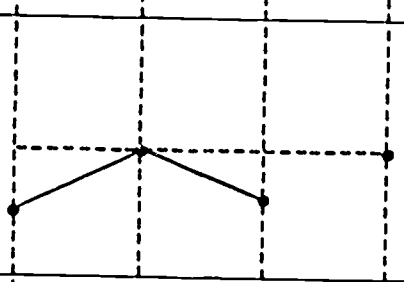
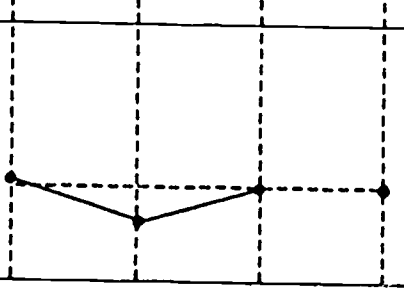
Question 3. Did the preservice elementary teachers' attitudes change toward what they perceived as being the attitude level of the most credible communicator (PCA)?

Attitudes toward science. Profiles contained in Table 4 represent individual attitude direction and level changes of at least 3 raw score points. Forty percent of the population's attitudes changed toward, matched or exceeded perceptions of most credible communicator attitudes (PCA). Thirty-two percent changed toward the PCA during the pretest-posttest-postposttest interval, 12% changed toward the PCA during the posttest-postposttest interval, and 16% did not change toward the PCA throughout the teatments.

Neither the research question nor Hovland and his associates specified when movement toward the PCA could be expected. Considering Profiles 1 and 3 of Table 4, 72% of the population exhibited science attitude changes toward and approached the PCA level after one or both treatments. These findings represent positive relationships between individual attitudes and the science attitude perceptions of the most credible communicators. The existence of individual and PCA relationships, in general, provides an affirmative answer to Question 3; preservice elementary teacher attitudes changed in the direction and approached the perceived attitude level of the most credible communicator at various times throughout the course.

Table 4

Science Attitude Changes and Perceptions of Communicator Attitudes

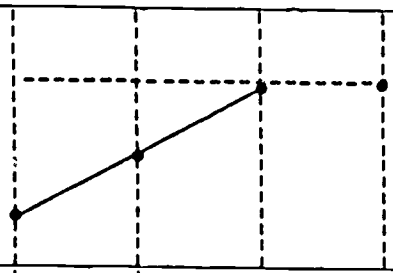
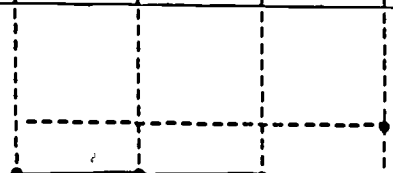
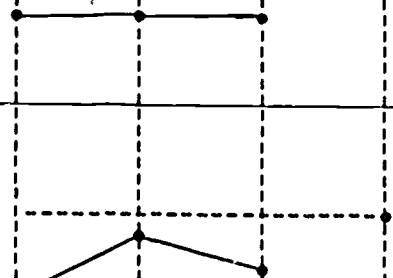
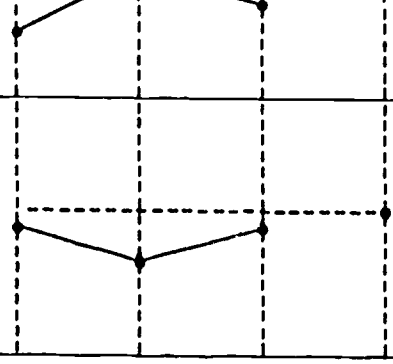
Profile Number	Profiles* PRE POST PPOST PCA	Frequency	Frequency Percent	Identification Numbers
1		10	40	1*, 2, 4*, 5*, 8*, 13*, 14, 16, 21, 25*
2		4	16	3, 15, 18, 22
3		8	32	6, 7, 9, 10, 11, 12, 17, 24
4		3	12	19, 20, 23

*Attitudes exceeded perceived attitudes of most credible communicator.

Attitudes toward science teaching. The profiles of Table 5 provided individual science teaching attitude changes. Profile 1 is representative of the attitude changes experienced by 72% of the population -- steady increases of science teaching attitudes toward the PCA after both treatments. Profiles 3 and 4 revealed that 20% of the population experienced attitude changes toward the PCA after one treatment, but not the other. Only 8% of the individuals did not display science teaching attitude changes after the treatments. These findings represent relationships between individual science teaching attitude changes and the PCA at various times throughout the course. Existence of these relationships supports the conclusion that pre-service elementary teacher attitudes moved toward the perceived science teaching attitude level of the most credible communicator.

Table 5

Science Teaching Attitude Changes and Perceptions of Communicator Attitudes

Profile Number	Profiles* PRE POST PPOST PCA	Frequency	Frequency Percent	Identification Numbers
1		18	72	1, 2*, 3, 4, 5, 6, 7*, 8, 9, 11, 12, 14, 15, 16, 17, 18, 21, 24*
2		2	8	20, 23
3		3	12	10, 22, 25
4		2	8	13, 19

*Attitudes exceeded perceived attitudes of most credible communicator.

Implications

Hovland's Credibility Principle

Hovland's communicator credibility principle maintains that a communicator's expertise and trustworthiness influences the respondent's evaluation of the attitude change messages and affects the degree to which messages are accepted and attitudes changed. Basic is the assumption that communicator credibility affects attitude changes of the respondents toward the position advocated by the communicator. In general, this study has shown the validity of this assumption through population attitude change profiles in which a major attitude movement occurred as predicted by the principle at various points throughout the study. As simple as the principle seems, the results were not as simply explained. Because many individuals of the population did experience attitude changes but did not exhibit movement toward the PCA, the researcher suspects that the communicator is not the key agent of attitude change. Furthermore, according to the principle, an individual's attitude should move toward a lower level if the individual perceives the most credible communicator's attitude to be lower. Close scrutiny of individual attitude changes and PCA revealed mixed findings on this item. In the context of this study, the principle was too simple and did not serve as a total explanation of attitude change. In general, the principle applied, but would have better helped to explain attitude changes when coupled with the attitude change findings of additional respondent factors (DeBruin, 1977). While credible communicators may not be the key agents of attitude change, the researcher suspects that

credibility is an agent of attitude change useful to improving attitudes in science education.

Science Education

Appropriate attitudes toward science and science teaching are important factors in successful science teaching by elementary school teachers. If preservice teacher attitudes toward science and science teaching can be increased to an acceptable level and maintained, then the students of these teachers will be well served through improved teaching behaviors. Hovland's principle suggests that if the respondent is brought into the environment of a credible communicator, then the respondents' attitudes will change toward their perceptions of the most credible communicator's attitude level. If this principle holds to a high degree, the training and preparation of highly credible communicators should be encouraged. A respondent's identification of the most credible communicator may depend upon characteristics of the communication environment apart from the communicator, e.g., the respondents' content areas of specialization, grade point averages in science, number of science courses taken, and perceptions of science training. Therefore, the matching of preservice teachers, as classified by their characteristics, with the appropriate communicator is suspected to result in improved science education for the preservice teacher via improved attitudes. Credible communicator characteristics must also be identified and nurtured in an effort to arrange an appropriate match between teachers and communicators.

Credibility Characteristics

That the most credible communicator will have a positive attitudinal effect on preservice teachers through verbal persuasion is an inference made possible by the relationships inherent in profile comparisons of this study. Teacher education programs which desire to improve attitudes should select instructors who are perceived by preservice teachers as being both expert and trustworthy in the content area of desired change. Where team teaching occurs, all communicators should maintain the highest credibility possible to achieve maximum attitude change results. The high credibility ratings shared among several of the teaching team members of this study can be interpreted as evidence that all communicators need expertise and experience in the subject area of desired attitude change.

A study conducted by Shrigley (1976) reported that a credible science methods instructor was perceived as one who:

1. Refers to practical teaching activities in class.
2. Has taught science to children.
3. Assumed responsibility for teaching content.
4. Models teaching modes similar to those proposed for children.
5. Assists science professors in designing science content courses.
6. Counsels student teachers.
7. Assists inservice teachers (p. 451).

However, the following were not found to enhance credibility: (1) teaching general education topics; (2) teaching subjects other than science; (3) conducting research; and (4) authoring content and methods textbooks. Shrigley (1976) suggested that the most credible communicator who might best affect a positive attitude change should be a practitioner, one who could draw upon a store of experiences with the content area, demonstrate several modes of teaching, change theory into practice, and counsel preservice and inservice teachers.

What is known about credibility characteristics should guide the selection of a university instructor or members of a teaching team if optimal attitude change results are to be realized.

But, the university must also consider the nature of cooperating school programs and the credibility of the field school's teachers. In effect, a position of attitude change responsibility has been delegated to the classroom teacher once the teacher education program enlists the services and facilities of field schools as practical learning laboratories for its preservice teachers. To provide a successful and supportive environment for the nurturing of attitude changes, it is necessary to ensure that the classroom teacher is able to fulfill her responsibilities. It seems inequitable that cooperating teachers were ranked last in the preservice teacher perceptions of credibility which resulted in this study. Teacher education programs must do more to help the classroom teachers improve their credibility. The results of this study may be viewed as a need for the teacher education program to assess the needs of its students and cooperating teachers and to provide inservice training or program indoctrination as a means of enhancing communicator credibility, maintaining effective communication, and reaping the mutual benefits of increased, positive preservice teacher attitudes. Failure to articulate and coordinate a systematic program of preservice teacher education, which relies upon credible communicators, will result in the education of new teachers who have low affect and and insubordinate the school curriculum and schooling.

Summary

This study has provided support, in general, for the application of the credibility principle in the preparation of elementary science teachers. The investigator suggests that the principle is indeed important to attitude change, but that credibility is not the main cause for change. The attitude change process, as presented by proponents of Hovland's principle, is too simplistic and cannot account for all factors which affect an individual's predispositions toward an attitude object. Who says what to whom with what effect? merits more controlled study than the identification of communicators, respondents, and the reporting of the respondents' attitude changes. Already studies have reported the more credible characteristics of communicators as perceived by respondents (Shrigley, 1980; 1976). What remains is a need for intensive study of the persuasive characteristics of verbal and nonverbal attitude change messages, the characteristics of teachers which affect their responses to the communications, and the attitude change effects which result from cross matching.

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