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AUTHOR West, Shelly L.; And Others
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ABSTRACT

One very important component of elementary science student achievement is the teacher. This paper describes the effect of student teaching on attitude and anxiety toward science and science teaching among preservice elementary student teachers (n=71). Attitude was measured using the Revised Science Attitude Scale. Anxiety was measured using the State-Trait Anxiety Inventory. After comparing pretest and posttests for these instruments, the conclusion was made that there was a significant improvement in attitude towards science and science teaching as well as a decrease in anxiety about science and science teaching. (PR)

The Effect Of The Student Teaching Experience Upon Preservice Elementary Teachers' Attitude And Anxiety Involving Science And Science Teaching

Shelly L. West

W. Scott Thomson

Scott B. Watson

Helen Parke

School of Education
East Carolina University
Greenville NC 27858
919-757-6219

ABSTRACT

THE EFFECT OF THE STUDENT TEACHING EXPERIENCE UPON PRESERVICE ELEMENTARY TEACHERS' ATTITUDE AND ANXIETY INVOLVING SCIENCE AND SCIENCE TEACHING

A review of the literature indicates that in order to enhance science achievement in the United States, elementary school science programs need to be examined. One very important component of elementary science student achievement is the teacher. This paper describes the effect of student teaching on attitude and anxiety toward science and science teaching among preservice elementary student teachers. Attitude was measured using the Revised Science Attitude Scale (Thompson and Shrigley, 1986). Anxiety was measured using the State-Trait Anxiety Inventory (Spielberger, Gorsuch, and Lushene, 1970). Pretests were administered using both instruments prior to the treatment, (student teaching). Following student teaching posttests were administered using the same instruments. A forced choice interview form was also utilized. A total of 71 students participated in all facets of the investigation. The results of the study indicated a significant improvement in attitude towards science and science teaching as well as a decrease in their anxiety involving science and science teaching.

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Introduction

According to Duschl (1983, p. 745) "elementary education majors generally teach all school subjects and receive preparation in math, reading, language arts, social studies, and science." Science, however, is a subject about which most elementary teachers are anxious, an apprehension that has been well documented in the literature (Duschl, 1983; Gabbel and Rubba, 1979; Shrigley, 1974). Often, this anxiety results in a negative attitude toward science and science teaching, (Czerniak and Chiarelott, 1990; Cox and Carpenter, 1989). According to Perkes (1975) the consequences involving both negative attitudes and high anxiety levels surrounding teaching science in the elementary school have led to avoidance of teaching science by prospective teachers. At the same time, a decline in students' science interest from elementary school through college has also been documented (Hall, 1990; Yaegar and Yaegar, 1985), as has a decline in science achievement scores (Rakow, Welch, and Hueftle, 1984). Institutions that prepare teachers are aware of the seriousness of these issues surrounding science education, and in response they are continually modifying existing programs to improve the attitudes of preservice elementary teachers towards science (Hall; 1990, Cox and Carpenter, 1989; Perkes, 1985; Kennedy, 1973).

An additional problem is that science can be taught from either a content knowledge approach or a process approach. According to Duschl (1983), these two different methodologies of teaching science are causing further confusion and anxiety for the preservice elementary teachers. Research has also revealed conflicting results regarding attitudes and anxieties of elementary preservice teachers involving their general student teaching experiences; in fact, a review of the literature has shown little investigation into attitude and anxiety levels of preservice science teachers during their student teaching experience involving science.

Purpose of the Study

The purpose of this study was to determine if the student teaching experience of preservice elementary teachers has an effect on their attitudes and anxieties toward science and science teaching.

The first hypothesis, stated in the null form, was that no difference would be found between pre-student teaching and post-student teaching attitude levels toward science and science teaching for the elementary education majors involved in the study.

The second hypothesis, stated in the null form, was that no difference would be found between pre-student teaching and post-student teaching anxiety levels toward science and science teaching for the elementary education majors, involved in the study.

Sample

During the 1993 Spring semester, this study was conducted at East Carolina University in Greenville, North Carolina, with 98 subjects enrolled in four sections of ELEM 4525, Classroom Organization and Management in Early Childhood and Elementary Education. ELEM 4525 is a course designed specifically for preservice elementary teachers who are embarking upon their student teaching experience. These students were placed at 40 different elementary schools for their student teaching experiences. Due to absences, scores of 27 students who were not present for both the pretest and posttest were eliminated. This left a total of 71 students (68 female, 3 male). All the instruments were administered during regular class time.

Instrumentation

The Revised Science Attitude Scale (Thompson and Shrigley, 1986), developed specifically to measure pre-service teachers' attitudes toward science

teaching, was used for data collection in this study. The Revised Science Attitude Scale (RSAS) consists of 22 items using a Likert-type scale, with 10 negative statements and 12 positive statements. The instrument is reported by the authors to have a high internal consistency (coefficient α =0 .92) (Hall, 1990). The State-Trait Anxiety Inventory, Form Y (Science Teaching STAI) (Spielberger, Gorsuch, and Lushene, 1970) was given to measure anxiety levels the students have toward science and teaching science. "The STAI has been used in hundreds of studies in the field of psychology" (Westerback, Gonzalez, and Primavera, p. 69, 1985). It consists of 40 Likert type scale items. State anxiety (s- anxiety) is measured through the first 20 questions and trait anxiety (t- anxiety) is measured in the last 20 questions. In the state anxiety scale, questions are asked such as "I feel calm "and "I feel self-confident." The trait anxiety section poses questions such as "I feel like a failure" and "I feel nervous and restless." Westerback (1982) reported the reliability coefficient of the Y form of the STAI to be 0.95. For this study, the STAI heading was changed on the first portion of the test to reflect anxieties toward science teaching. Permission was granted from the publishers to use and modify the heading to read "HOW DO YOU FEEL ABOUT TEACHING SCIENCE?".

Design and Procedures

A single-group pretest-posttest design was utilized for this study. The dependent variables were science attitude and science anxiety. The independent variable was the student teaching experience. Differences ascribed to student teaching relating to science attitude and science anxiety were determined by comparing the pretest and posttest scores, and t-tests for correlated means were utilized for comparing these scores. The Revised Science Attitude Scale (Thompson and Shrigley, 1986) and the State Trait Anxiety-Inventory (Spielberger, et al. 1970)

were utilized as both pretests and posttests. They were administered as pretests during the first week of the enrollment in the final semester of their senior year (before student teaching), and as posttests in the last week of the semester (after student teaching). A forced choice interview form was also administered to the students in an attempt to gather more information about the treatment as well as about the larger issues involving attitude and anxiety surrounding science and science teaching.

Results

Results of the study are reported in two major sections: (1) Quantitative Findings; and (2) Qualitative Findings. The purpose of this study was to investigate the student teaching experience on both attitude and anxiety involving instruction in science in the elementary classroom.

Quantitative Findings

The quantitative results are presented in relation to the two hypotheses. Several tables of data are also included for further illustration. The first hypothesis, stated in the null form, was as follows:

(1) No difference will be found between pre-student teaching and post-student teaching attitude levels toward science and science teaching for the elementary education majors as measured by the Revised Science Attitude Scale (Thompson and Shrigley, 1986).

As shown in Table I, the mean score for the 71 preservice elementary student teachers on the Revised Science Attitude Scale was 83.36 and the mean for the posttest on the Revised Science Attitude Scale was 87.16. When subjected to a two-tailed t-test, a significant difference was indicated between the mean score of the two groups ($t = 3.46$, $p = .0009$). The first null hypothesis was rejected. A significant

improvement in attitude towards science and science teaching occurred during the student teaching experience.

Table 1

Comparison of Attitude Before and After Student Teaching

	n	Mean	SD	t	p =
Attitude Pretest	71	83.37	8.78		
				3.47	.0009
Attitude Posttest	71	87.17	10.33		

The second hypothesis, stated in the null form, was as follows:

(2) No difference will be found between pre-student teaching and post-student teaching anxiety levels toward science and science teaching for the elementary education majors involved in the study (as measured by the STAI Form Y, Spielberger, Gorsuch, and Lushene, 1970).

As shown in Table 2, the mean score for the 71 preservice elementary education student teachers on the STAI pretest was 41.81 and the mean score for the posttest was 35.49. When subjected to a two-tailed t-test, a significant difference was indicated between the pretest and posttest scores ($t = -5.5$, $p = .0001$). Therefore, the second hypothesis was also rejected. Results indicated that the anxiety levels of this group for science and science teaching were reduced during the student teaching experience.

Table 2

Comparison of Anxiety Before and After Student Teaching

	n	Mean	SD	t	p=
Anxiety Pretest	71	41.81	10.11		
				-5.52	.0001
Anxiety Pretest	71	35.49	9.36		

The "How Do You Feel in General?" portion of the STAI was evaluated and no students were determined to be overly anxious. The pupose of this portion of the instrument is to eliminate any people who are overly anxious in general. Therefore, no participants were excluded in the study.

Qualitative Findings

A forced choice interview form served to give a more in-depth picture of the preservice elementary student teachers and their classroom experiences involving science and science teaching. All of the results indicated that the participants did plan and initiate science lessons at some point during their student teaching experience, and that all of the student teachers actually taught science during their student teaching experiences. However, all of the participants ranked science in the lower half of importance of the subjects that they were required to teach at the elementary school level.

As shown in Table 3, reading, writing, and language arts were ranked first in importance by the preservice teachers, followed by science and social studies. Three students rated science as being third when answering the item "Rank the following in order of importance from 1-6 with 1 being most important in students' lives." Fifteen of the teachers ranked science as fourth, with 26 ranking it fifth, and 29

ranking it last. Social studies was also listed predominantly in the lower half of the subjects, with two respondents ranking it second, three respondents ranking it third, ten respondents ranking it fourth, 24 respondents ranking it fourth, and 30 respondents ranking it sixth.

Table 3

Preservice Elementary Student Teachers Ranking of the Subjects of Importance to Their Students.

	1st		2nd		3rd		4th		5th		6th		TOTAL	
	Raw	*%*	*Raw*	*%*	*Raw*	*%*	*Raw*	*%*	*Raw*	*%*	*Raw*	*%*	*Raw*	*%*
Language Arts	14	19.4	16	22.2	18	25.0	12	16.7	9	12.5	3	4.7	72	100.0
Math	2	2.8	14	19.4	26	36.1	22	30.6	4	5.6	4	5.6	72	100.0
Reading	57	79.2	10	13.9	4	5.6	0	0	0	0	1	13.9	72	100.0
Science	0	0	0	0	0	0	15	21.4	26	37.1	29	41.4	70	99.0
Social Science	0	0	2	2.9	3	4.3	10	14.5	24	34.8	30	43.5	69	97.0
Writing	2	2.9	29	1.4	15	21.4	14	20.0	7	10.0	3	4.3	70	100.0

In the category of planning time, the item was phrased "How much time did it take a day for your planning to teach a science lesson?" As shown in Table 4, the students all reported spending more than 0 to 15 minutes planning. In this category, six of the student teachers declared that they spent 30 to 45 minutes in planning their science lessons. Seventeen students reported spending 15 to 30 minutes in planning, with 16 spending more than one hour, and 12 preservice teachers reporting planning for a lesson from 45 to 60 minutes.

In response to the question "How often did you teach science when student teaching?", only one student reported teaching science one day per week. Teaching

science two days and four days each week were reported as the next lowest amount (by 11 students each, respectively), and ten teachers reported teaching science three days per week. Remarkably, the majority of the preservice elementary students (42) reported teaching science five days per week.

Table 4

Preservice Elementary Student Teachers Response to the question "How much time do you spend planning science lessons and how much time per week do you spend implementing those lessons."

Time Spent	Planning	Implementing
0-15 minutes	0	1 (1.4%)
15-30 minutes	17 (23.9%)	12 (16.9%)
30-45 minutes	26 (36.6%)	20 (28.1%)
45-60 minutes	12 (16.9%)	12 (16.9%)
more than 1 hr	16 (22.5%)	4 (5.6%)
2-4 hours	0	7 (9.8%)
more than 4 hours	0	15 (21.1%)

In response to the question "How much time was spent each week instructing in the sciences?", 15 of the students reported spending more than four hours per week instructing science, seven reported instructed two to four hours. Four students reported instructing one hour, 12 reported instructing 45 to 60 minutes, 20 teachers reported instructing 30 to 45 minutes, 12 reported instructing 15 to 30 minutes, and finally, one reported teaching science less than 15 minutes per week.

In the category in which preservice elementary student teachers were asked to list all the areas in which they felt comfortable teaching, physics was the least common choice, with only eight students reporting feeling comfort in teaching it. Chemistry was next with 18 choosing it. Geology was next with 36 students reporting feeling comfortable teaching it, and biology was reported by the preservice

elementary teachers as being the subject with which they felt most comfortable (Table 6).

Table 6

Subject Areas the Preservice teachers felt comfort in teaching *

Subject Area	Number of Respondents/Percentage
Physics	8 (11.2%)
Chemistry	18 (25.3%)
Geology	36 (50.7%)
Biology	53 (74.6%)

* Respondents could make multiple responses to this question.

conclusions and Implications

The results of this study indicate that both of the null hypotheses should be rejected. Accordingly, preservice elementary teachers' attitudes toward science and science teaching were significantly improved during student teaching. Anxiety levels of the preservice teachers were also reduced significantly during the student teaching experience.

On the Revised Science Attitude Scale, the mean score for the 71 pre-service elementary student teachers was 83.36 and the mean for the posttest on the Revised Science Attitude Scale was 87.16. When subjected to a two-tailed t-test, a significant difference was indicated between the two groups ($t = 3.46$, $p = .0009$). According to Koballa and Crawley (1985) the time and manner in which science is taught is directly affected by the teacher's attitudes toward science. A majority of the research is in agreement that elementary teachers' attitude and anxiety levels towards science shape the way in which the subject is taught; furthermore, many researchers have indicated that preservice elementary teachers are

both anxious and have negative attitudes toward science (Cox and Carpenter, 1989). Other researchers' findings have revealed that "the teacher was the most important single influence on attitude [of the student] towards science" (Westerback, p. 45, 1982). With these points in mind it seems inevitable that all those involved will continually try for improvement in science teaching. The results of the current study indicate that student teaching did offer the preservice elementary student teacher a positive experience in affecting attitude since their scores were markedly improved.

On the State-Trait Anxiety Inventory, the mean score for the 71 preservice elementary education student teachers on the pretest was 41.81 while the mean score for the posttest was 35.49. When subjected to a two-tailed t-test, a significant difference was indicated between the pretest and posttest ($t = -5.5$, $p = .0001$). A negative self perception of ability to teach science was reported by Cox and Carpenter (1989) to cause high anxiety levels among preservice elementary teachers. Westerback has reported that those students with positive attitudes toward science and science teaching will have less anxiety about this subject (1982). Results of the present study support this research in that those students with better attitudes tended to report less anxiety as well.

The results of the qualitative portion of this study indicate that science is not considered of high importance by the preservice teachers involved. The respondents reported spending an average of 30 to 45 minutes planning their science lessons and an average of 30 to 45 minutes instructing these lessons. The majority of the preservice elementary student teachers reported teaching science five days per week, with only three reporting teaching two days or less per week. Finally, the preservice teachers reported feeling best prepared to teach biology, with only eight of 71 reporting well prepared to teach physics.

This study has implications for both the college teaching of science methods classes and for exercising caution in the placement of student teachers. In this study, the student teaching experience exerted a significant influence on the attitude and anxiety levels of these preservice elementary student teachers. This emphasizes the importance of providing positive role models for science teaching at the college or university and in the public school setting.

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