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ABSTRACT

The purpose of this study was to investigate whether the field experience component of an undergraduate science methods course for preservice elementary school teachers was effective in: (1) shifting student concerns about science teaching from concerns about themselves to concerns about the impact of inquiry-oriented science programs on pupils; and (2) improving student attitudes toward science and science teaching. The influence of a number of variables such as age, grade point average, and school assignment on the dependent measures was also examined. Results indicated that science methods students working with teachers and children in schools did not show a significant shift from self to task and impact concerns. The students did show a significant change in attitudes toward science, but it was questioned as to whether or not the field experience component was responsible for the change. (TW)

THE INFLUENCE OF FIELD EXPERIENCES ON STAGES OF CONCERN AND ATTITUDES OF PRESERVICE TEACHERS TOWARD SCIENCE AND SCIENCE TEACHING

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The Influence of Field Experiences on Stages of Concern and Attitudes of Preservice Teachers Toward Science and Science Teaching

Field Experiences in science methods courses can be justified only if they result in effects which are consistent with course objectives. While the inclusion of a field experience component is intuitively desirable because it provides opportunities for students to relate theory to practice as they teach science to elementary children, there is no guarantee that participants will develop the attitudes and behaviors required to implement activity-oriented science programs. The purpose of the study was to investigate whether the field experience component of an undergraduate science methods course was effective in: (1) shifting student concerns about teaching science from concerns about self to concerns about the impact of inquiry-oriented science on pupils, and (2) improving student attitudes toward science and teaching science. Age, grade point average, openmindedness, and school assignment were examined as factors which might explain some of the variance in the dependent measures (Bogut & McFarland, 1975; Cunningham & Blankenship, 1979; Malone, 1982; Strawitz, 1977).

Although previous studies have shown that desirable attitude and behavioral changes can result from appropriately designed methods courses (Barufaldi, Huntsberger, & Lazarowitz, 1976; Malone, 1982; Sallam, 1981; Strawitz, 1976; Sunal 1980a), supporting evidence for similar attitudinal and behavioral effects from field experience involvement is somewhat less clear. For example, students enrolled in science methods courses with and without field experiences have been found to exhibit similar attitudes toward science and science

teaching (Krustchinsky, 1979; Sunal, 1980a; Weaver, 1978) but more teaching behaviors appropriate for new elementary science curricula (Sunal, 1980a). The present study was designed to assess the impact of one component of a science methods course on student concerns and attitudes. Increased attention to attitudinal outcomes appears to be warranted because results from recent studies have indicated that student attitudes toward and interest in science teaching are significant predictors of teaching behaviors (Sunal, 1980b; Taiwo, 1981). Student concerns about teaching science were assessed to determine if involvement with field experiences enhanced or hindered developmental growth. The Teacher Concerns Model (Fuller, 1969) postulates that concerns students have about a new experience are developmental. Students are expected to progress from lower to higher stages of concern as they become more comfortable with the new experience.

Methods

Subjects

The subjects were 63 students (mean age 23.4 years) enrolled in three sections of an undergraduate science methods course at a university in Louisiana during the 1983 spring semester. Sections were assigned to three schools for field experiences and students were assigned to cooperating teachers depending upon their schedules. This was the first semester that students were expected to schedule methods courses in science, social studies, and mathematics as a block and the first time that they completed field experience requirements for different methods courses in the same school. Most of the students were enrolled in three methods courses, but some were

enrolled in that three. During the approximately 20 hours spent in elementary schools as part of the requirements for the science methods course, students observed their cooperating teachers, interviewed children to assess developmental levels and understandings about science concepts and principles, and used discovery and inquiry strategies while teaching science lessons to small groups of children.

Design and Procedures

A one-group pretest-posttest design was used. Subjects were administered the Teacher Concerns Questionnaire (TCQ) (George, 1978) and the Science Teaching Attitude Scales (STAS) (Moore, 1973) at the beginning and end of the field experience component of the methods course. They were also administered Form E of the Rokeach Dogmatism Scale (D-Scale) (Rokeach, 1960) as a measure of openmindedness. Posttest were administered approximately eight weeks after the pretests.

Instruments

The Teacher Concerns Questionnaire (TCQ) (George, 1978) consists of 15 statement with 5-point Likert-type response categories scaled from "Not concerned" to "Extremely concerned." The TCQ was developed from the 56-item Teacher Concerns Check List Form B (TCCL-B) developed by George, Borich, and Fuller (1974). Factor analysis on data from over one thousand pre- and inservice teachers was used to select items for each of the three major phases in the Teacher Concerns Model developed by Fuller (1969): Concern About Self, Concern About Teaching Tasks, and Concern About Impact. George

reported test-retest reliabilities of .79, .71, and .77 for the items measuring self, task, and impact concerns respectively, and alpha coefficients of .80, .67, and .83. A study of concern differences between preservice and inservice teachers indicated that the self and task scales had some validity; results on the impact scale were not definitive. An intercorrelation matrix indicated that the three subscales were reasonably independent but slightly positively correlated.

Scores were generated for each subscale by assigning student responses a value of 1 to 5 according to the level of concern expressed and summing items. Because concerns are hypothesized to develop from self to task to impact, an overall measure of concern was generated by multiplying each mean subscale score by 1, 2, or 3. Weighted scores for each subscale were then added to create a score for the total instrument. A high score generated by this weighting system indicates that a student is more concerned about the needs of pupils than about self.

The Science Teaching Attitude Scales (STAS) (Moore, 1973) is a 70 item Likert-type instrument containing 40 items (Maximum score of 120) designed to assess teachers' attitudes toward science (ATS subscale) and 30 items (Maximum scores of 90) to assess attitudes toward science teaching (ATST subscale). Response categories scaled from "Disagree strongly" to "Agree strongly" are assigned a value of 1 to 4 and summed to obtain a score. The STAS was developed from the Science Attitude Scales (SAS) written by Moore and Stuman (1970). Moore (1973) reported a test-retest realiability on the STAS of .916 and determined construct validity using pretest to posttest changes in attitude with known groups.

Form E of the Rokeach Dogmatism Scale (D-Scale) (Rokeach, 1960) is a 40 item instrument with possible scores ranging from +3 (I agree very much) to -3 (I disagree very much). Rokeach (1960, p. 90) reported test-retest reliabilities ranging from .68 to .81 for samples of college students and used the method of known groups to establish the validity of the scale. The total score on the D-Scale was obtained by summing item scores after a constant of 4 was added to each.

Results

Dependent t-tests were used to examine pre-post changes in concern and attitude scores. One-way ANOVA's were used to determine whether factors such as age, grade point average, openmindedness, and school assignment affected changes in the dependent measures.

The analysis of differences in pre-post mean concern and attitude scores is shown in Table I. Field experiences did not significantly change student concerns about teaching science but significantly improved student attitudes toward science and science teaching.

Insert Table I about here

Descriptive statistics for the dependent measures for each factor are presented in Table II. The results of the statistical analyses for mean changes in pre-post scores for each factor are

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Insert Table II about here

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presented in Tables III, IV, anf V. Tables III, IV, and V show that there were no significant differences in changes in teacher concerns

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Insert Tables III, IV, and V about here

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and changes in attitude toward science and science teaching between students who differed in age, grade point average, and openmindedness. Students assigned to different schools did not differ significantly on changes in concerns and changes in attitude toward teaching science, but they differed significantly on changes in attitude toward science. Scheffe tests for all pairwise comparisons indicated that students assigned to school 3 changed in attitude toward science signficantly more than students assigned to school 1.

Discussion

The purpose of this study was to determine whether the field experience component of an undergraduate science methods course was effective in : (1) shifting student concerns about teaching science from concerns about self to concerns about the impact of their teaching strategies on pupil, and (2) improving student attitudes toward science and teaching science. The influence of a number of variables on the dependent measures was also examined. Results indicated that science methods students working with teachers and children in schools did not show a significant shift from self to task and impact concerns. According to the Teacher Concerns Model, this means that the methods students were concerned more about themselves than about teaching strategies or the impact of those

strategies on pupils. Because lower-level concerns (self) had to be resolved before higher concerns emerged (impact) attempts to focus students attention on applying specific teaching strategies were probably inappropriate because the focus was not stage relevant. For example, a student extremely concerned about "doing well when a supervisor was present" (TCQ Item #3) was probably not concerned or certainly less concerned about "whether each student was getting what he or she needed" (TCQ Item #12).

Although field experiences significantly improved student attitudes toward science and science teaching, mean gains of 2.308 (.31SD) and 3.918 (.47SD) on instruments with maximum possible scores of 120 and 90 cannot be considered educationally significant. These results are consistent with those of Krustchinsky (1979) and Weaver (1978) who found that students enrolled in science courses with and without field experiences did not differ significantly in attitudes toward science and science teaching. Also, these results are particularly interesting when compared to those of Sunal (1980a). Sunal found that students exposed to different amounts of field experiences did not differ significantly in attitudes toward science, however students exposed to more field experiences were able to demonstrate more teaching behaviors consistent with activity-oriented science teaching.

The finding that students assigned to school 3 changed in attitude toward science significantly more than students assigned to school 1 cannot be explained in terms of initial differences in pretest scores. Differences in learning environments in these schools and in teacher attitudes toward science may have influenced student attitudes.

The notion that educationally significant attitude changes result from science field experiences has not been confirmed in this study nor in the literature reviewed. Given that field experiences are such a significant component of science teacher preparation programs, it is recommended that attitudinal, concern, and behavioral outcomes of those experiences be investigated on a more thorough and systematic basis.

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Table I

Analysis of Differences in Pre-post

Mean Scores on the Dependent Measures

Measures	Pretest Means	Posttest Means	SE	df	t	Prob.
TCQ	101.483	104.213	2.282	58	1.09	.208
STAS-ATS	144.228	146.536	1.047	50	3.22	.002
STAS-ATST	104.967	108.885	1.096	58	3.50	.001

Table II

Descriptive Statistics For the Dependent Measure By Levels of Each Factor

		TCQ				STAS-ATS				STAS-ATST			
		Pretest		Posttest		Pretest		Posttest		Pretest		Posttest	
Factor	Level	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	20-21(52%)	105.645	18.656	107.030	21.035	144.379	7.409	147.577	7.844	104.563	6.720	109.484	8.906
	22-34(48%)	97.034	21.585	100.893	24.258	144.071	7.333	145.633	9.233	105.414	5.660	108.266	7.249
GPA	2.5(27%)	100.467	16.621	102.400	19.467	144.067	7.430	143.937	8.760	105.250	6.233	106.706	7.687
	2.51-3.10(50%)	101.806	21.204	108.063	22.532	144.517	8.547	148.038	8.248	104.419	6.179	109.188	8.708
	3.11(23%)	101.857	23.566	97.357	25.409	143.769	3.723	146.500	9.040	105.857	6.561	111.167	6.631
Open-	122(32%)	97.900	19.363	100.429	24.435	145.105	6.822	146.647	9.486	105.714	6.357	110.300	9.319
mindedness	123-148(34%)	102.272	20.764	103.905	21.312	146.105	8.027	147.136	8.380	105.904	5.281	110.773	8.252
	149(34%)	104.500	21.672	108.737	22.238	141.474	6.527	145.647	8.374	103.105	6.855	105.211	5.116
School	1(36%)	108.400	24.119	110.524	24.192	145.450	6.947	145.450	9.500	104.190	5.528	108.545	8.064
	2(24%)	97.200	16.165	97.500	21.682	143.154	7.151	143.143	7.167	102.714	6.281	105.733	5.625
	3(40%)	98.520	18.746	102.080	21.411	143.870	7.996	150.095	7.726	106.640	6.435	111.870	8.444

Table III

One-way ANOVA's For Changes in

Teacher Concerns By Factor

Source	df	MS	F	Prob.
Age	1	230.534	.75	.39
Error	57	308.705		
GPA	2	524.804	1.75	.18
Error	56	299.591		
Openmindedness	2	20.639	.06	.93
Error	56	317.598		
School	2	24.764	.08	.93
Error	56			

Table IV

One-way ANOVA's For Changes in Attitude

Towards Science By Factor

Source	df	MS	F	Prob
Age	1	38.858	.68	.41
Error	48	57.033		
GPA	2	137.498	2.58	.09
Error	47	53.221		
Openmindedness	2	48.296	.85	.44
Error	47	57.018		
School	2	183.463	3.58	.04
Error	47	51.266		

Table V

One-way ANOVA's For Changes in Attitude

Toward Science Teaching

Source	df	MS	F	Prob
Age	1	94.414	1.46	.23
Error	56	64.533		
GPA	2	83.311	1.28	.29
Error	55	64.430		
Openmindedness	2	107.273	1.69	.19
Error	55	63.522		
School	2	11.363	.17	.84
Error	55	67.010		
Total	57			