

A GREENHOUSE LABORATORY EXPERIENCE: EFFECTS ON STUDENT KNOWLEDGE AND ATTITUDE

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Abstract

The purpose of this study was to assess the effectiveness of instruction in horticulture using and not using a greenhouse laboratory experience with the traditional classroom lecture/discussion technique. Data were collected on selected student and teacher characteristics as well as post-experiment knowledge and attitude scores. Teachers at participating schools received a unit of 15 lessons in growing poinsettias. Both treatment groups were taught by the local instructor with lesson plans provided by the researcher. Data were analyzed for 168 high school horticulture students in grades 9-12. Of the characteristics noted, seven of the total group of 168 had a home greenhouse, 65 had a horticultural supervised agricultural experience and 126 had horticultural work experience. There were 107 students in the group provided a greenhouse laboratory experience and 61 students in the group not provided a greenhouse laboratory experience. In this study, students who received a greenhouse laboratory experience scored significantly higher on the knowledge test than did students who were taught the same lessons, without a greenhouse laboratory experience. However, no significant difference was found between the post-experiment attitude toward poinsettia production scores for the two groups.

The national Strategic Plan for Agricultural Education (1990) adopted as one of seven goals "to develop educational programs that continually and systematically respond to the trends and demands of the marketplace" (p.2). Agricultural educators have worked hard to keep pace with agricultural changes, therefore, ornamental horticulture has become an important part of agricultural education.

Lamberth (1983) noted that ornamental horticulture has been emerging as one of the more rapidly growing areas in the agricultural field with horticulture jobs expanding in rural as well as urban communities. Greenhouse production in the United States has grown appreciably in the last 20 years. In 1986, there were 6,607 growers in the United States with a total of 341 million square feet of growing space, and in the state of Missouri there were 121 growers with a total of five million square feet of growing space (Wells & Anderson, 1990).

In studying the characteristics of secondary horticulture teachers, it was concluded that more

training in horticulture was necessary for teachers to effectively teach horticulture. Lamberth (1983) developed a list of 108 competencies for greenhouse management and recommended that these be incorporated into agricultural education and horticulture programs. Students, parents, employers, and school administrators agreed on the value of the extended contract for the horticulture teacher (Watkins & Miller, 1984). In another study, a group of employers and greenhouse workers identified 265 tasks as necessary for greenhouse workers (Waddy, Yoder, & McCracken, 1975).

In general, recent studies in education have documented that specialized treatment that creates a real world context will produce achievement gains equal to or greater than traditional instructional methods. The studies draw on the theoretical base of cognitive psychology. They "posit that a contextualized view of the thinking and learning process is needed so that knowledge is increased and made meaningful" (Prestine & Le Grand, 1991,

p. 62). Although it was found that students who received both lecture and laboratory instruction did not have a significantly higher score, it was perceived that the retention of learning was greater with students applying what they had learned in a laboratory setting (Wiebold & Slaughter, 1986). In a study of middle school students, enrolled in a science course, it was found that the laboratory made a difference (Enderlin & Osborne, 1990). The value of a laboratory experience in reinforcing learning was emphasized when a comparison was made of the effectiveness of laboratory and lecture-discussion methods with the control group.

Using task sheets and a greenhouse production record book resulted in a higher test score for students when studying poinsettia and chrysanthemum production (Scanlon & Newcomb, 1983). The use of a grading sheet to determine the final quality of the crop resulted in higher scores for the quality of the crop by those students that used a greenhouse production record book and unit of instruction (Rhodes, 1980).

The FFA's motto of "Learning to Do, Doing to Learn" reflects the need for experiential learning. Hughes and Barrick (1993) stressed classroom and related laboratory instruction in a proposed model for agricultural education in the public schools. This position was supported by Rossetti and McCaslin (1994), who reported that state FFA executive secretaries believe "students benefitted from the hands-on experience in the classroom" (p. 26). Research has supported the theory that students retain and learn best when learning can be reinforced by some physical or hands-on activity such as one that can be learned in a laboratory setting (Enderlin & Osborne, 1991; Oen & Sweany, 1971). However, additional research should be conducted to provide information about the extent to which a greenhouse can be used to provide an effective laboratory learning experience.

Purpose and Objectives

The purpose of this study was to assess the

effectiveness of instruction in horticulture using and not using a greenhouse experience with the traditional classroom lecture/discussion technique. The focus of the unit in this study was on poinsettia production. Data were collected on selected student and teacher characteristics as well as post-experiment knowledge and attitude scores. Most specifically the objectives for this study were:

1. To determine if there was a significant difference in knowledge scores between students in agricultural education horticulture programs that do or do not provide a greenhouse laboratory experience?
2. To determine if there was a significant difference in attitude toward horticulture between students in agricultural education horticulture programs that do or do not provide a greenhouse laboratory experience?

Related null hypotheses were formulated and tested at the .05 alpha level.

Procedures

This study involved two groups of high school agricultural education-horticulture students: one groups was taught a unit on growing poinsettias and was provided a greenhouse laboratory experience and the responsibility for raising a crop of poinsettias and one group was taught a unit on growing poinsettias with no greenhouse laboratory experience. The population consisted of all first year secondary agricultural education-horticulture students in the state of Missouri which were enrolled in courses in which poinsettia production was an appropriate lesson topic during the 1992-93 school year. A cluster sampling technique was used. A total of 168 high school agricultural education students provided usable data for the analysis. Students from seven schools did, and students from six schools did not have, a greenhouse laboratory experience.

Teachers at participating schools received a unit of 15 lessons in growing poinsettias. Both treatment groups were taught by the local instructor with lesson plans provided by the researcher. At the conclusion of the unit, students completed a posttest. Teachers were requested to complete a questionnaire to provide information about variables such as teacher's work experience and pre and inservice courses taken in horticulture. Each student was also requested to complete a questionnaire to check for variability in their horticulture background.

The knowledge test was developed based on the curriculum guide. The test was evaluated by a panel of experts. The content of the curriculum guide was based on information obtained from several sources, but primarily the Third Edition of Ecke's Poinsettia Manual (Ecke, Matkin, & Hartley, 1990), 15th Edition Ball Red Book (1991), and Poinsettia Production, Ohio State University Extension (1988). A pilot test was conducted using the University of Missouri horticulture class in greenhouse management and a high school horticulture class. There were 65 multiple choice questions in the revised knowledge instrument which yielded a Kuder-Richardson estimate of reliability of .913.

The 20-item subject matter attitude scale was a modified form of the "Attitude Toward Any School Subject" by Remmers (Purdue Research Foundation, 1986). The words "subject matter" were replaced with "poinsettia production" to modify the instrument. A seven point Likert-type scale which included a neutral response category was used. Mauer and Simonson (1984) reported a test/retest reliability of .90 and an internal consistency of .94 for the original instrument. The internal consistency reliability estimate for data for this study was .95 using Cronbach's alpha procedure.

The instruments were mailed along with demographic questionnaires for both teachers and students. Teachers who did not respond within four

weeks received follow-up calls. Data were obtained from 168 students in 13 schools.

Analysis of Data

Means and standard deviation for scores of students on both the knowledge test and the attitude test were calculated. Statistical analysis was also conducted for correlation between scores on the knowledge test and the seven variables specified.

Descriptive statistics were computed for student characteristics, attitude toward subject matter, and teacher characteristics to determine total numbers, percentages, means, and standard deviations. An analysis of variance (ANOVA) procedure was used to test hypotheses one and two.

Results

Data were analyzed for 168 high school horticulture students in grades 9-12. Of the characteristics noted, seven of the total group of 168 students had a home greenhouse, 65 had a horticultural supervised agricultural experience, and 126 had horticultural work experience. There were 107 students in the group provided a greenhouse laboratory experience and 61 students in the group not provided a greenhouse laboratory experience.

While the small teacher numbers precluded a statistical comparison of data, the teacher groups reported similar types of information. One teacher in each group had three or more years of work experience and up to 30 course credits in horticulture. The remaining teachers had a mean of 2.4 months work experience and 4.3 college course credits in horticulture.

The first null hypothesis of no significant difference between the mean post-experiment knowledge scores between students in agricultural education-horticulture programs that do or do not provide a greenhouse laboratory experience was rejected. There was a significant difference between the post-experiment knowledge test mean

scores. The analysis yielded an F value of 20.86 with a p of .01 as reported in Table 1. Table 2 summarizes the test data by groups. The no greenhouse group had a mean score of 32.62, a standard deviation of 11.13 and a standard error of 1.43. The greenhouse group had a mean score of 40.51 with a standard deviation of 10.56 and a standard error of 1.02.

The second null hypothesis of no significant difference between the mean post-experiment attitude toward horticulture scores between students in agricultural education-horticulture programs that

do or do not provide a greenhouse laboratory experience was not rejected. There was no significant difference between the post-experiment attitude mean scores for the two treatment groups. The analysis of the data yielded an F value of 2.6 with a $p = .11$ as reported in Table 1. The data obtained from this instrument are summarized in Table 2. Responses were recorded on the survey forms. The mean score for the no greenhouse group was 83.72, with a standard deviation of 22.77 and a standard error 3.32. The mean score for the greenhouse group was 90.19 with a standard deviation of 21.04 and a standard error of 2.45.

Table 1. Analysis of Variance of Post-Experiment Knowledge and Attitude Scores by Treatment Group

| Source | <u>df</u> | <u>SS</u> | <u>MS</u> | <u>F</u> | <u>p</u> |
|-------------------------|-----------|-----------|-----------|----------|----------|
| <u>Knowledge</u> | | | | | |
| Main effect (treatment) | 1 | 2419.229 | 2419.222 | 20.86 | .0001 |
| Error | 166 | 19251.056 | 115.970 | | |
| Total | 167 | 21670.279 | | | |
| <u>Attitude</u> | | | | | |
| Main effect (treatment) | 1 | 1201.674 | 1201.674 | 2.55 | .1132 |
| Error | 166 | 56164.755 | 471.972 | | |
| Total | 167 | 57366.429 | | | |

r -square = .12 for knowledge and .02 for attitude.

Table 2. Knowledge and Attitude Test Data by Groups

| Variable | <u>M</u> | <u>n</u> | <u>SD</u> | SE |
|---------------------|----------|----------|-----------|------|
| <u>Knowledge</u> | | | | |
| No greenhouse group | 32.62 | 61 | 11.13 | 1.42 |

| | | | | |
|---------------------|-------|-----|-------|------|
| Greenhouse group | 40.51 | 107 | 10.56 | 1.02 |
| <u>Attitude</u> | | | | |
| No greenhouse group | 83.72 | 47 | 22.76 | 3.32 |
| Greenhouse group | 90.19 | 74 | 21.04 | 2.45 |

Conclusions and Discussion

Conclusions and recommendations resulting from this study may be generalized to the population of agricultural education-horticulture classes and students in Missouri from which the sample was drawn. However, these conclusions are limited to the specific poinsettia production program and teaching strategies which were used in this study.

1. There is an advantage in knowledge acquisition for students who receive instruction with access to a greenhouse laboratory experience.
2. Students' attitudes toward poinsettia production are not greatly affected by whether or not they have a greenhouse laboratory experience.

In this study, students who received a greenhouse laboratory experience scored significantly higher on the knowledge test than did students who were taught the same lessons, without a greenhouse laboratory experience. As both treatment groups were similar for the student characteristics examined, the difference between student knowledge scores for the two treatment groups was an indication that when students apply what they learn, they score better on a knowledge test at the end of the unit. This finding supported the research conducted by Enderlin and Osborne (1991).

No significant difference was found between the post-experiment attitude toward

poinsettia production group scores for the two groups. Swindell and Phelps (1991) found a change in students' attitude toward science with use of a laboratory in a science enrichment study. However, a significant difference in attitude toward poinsettia production was not found in this study. A possible explanation would be that the attitude test was specific to poinsettia production and not to greenhouses or horticulture in general. Students in the no greenhouse group may have been exposed to a crop of poinsettias in production via field trips to greenhouses or believed the subject to be interesting or important. It should also be noted that the raw scores of 84 and 90 of a possible 140 placed the attitude of both groups in the positive range which may have also been influenced by positive perceptions about their total program experience. Therefore, they reported a positive attitude about the subject.

Overall, the positive knowledge gain with the laboratory instruction supports the emphasis in agricultural education on experimental learning. The greenhouse should be used to provide "hands on" contextual experiences for students studying horticulture.

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