Teaching Methods

Students as Research Partners at a 2-Year Agriculture College

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Summary. Student involvement in two research projects at a 2-year agricultural college is described. The students assisted in the process of data collection, tabulation, and the preparation of publications. From participating in these research projects, the students earned academic credit and learned the concepts and processes of scientific methodology. Several student shills, including observation, making judgements, and cooperation among peers, were enhanced through hands-on experience. The research proved to be a very enjoyable learning experience for all of the participants.

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The Agricultural Technical Institute (ATI) is a 2-year instructional unit of The Ohio State Univ. ATI s mission is to provide instruction to students in 21 agricultural majors or technologies. Upon completion of the student s required curriculum in his/her chosen technology, the student is granted an Associate of Applied Science degree. ATI s faculty are on 100% teaching appointments. However, research or scholarly activity by the faculty are additional requirements to fulfill Ohio State Univ. requirements for tenure and promotion.

Scholarly activities for ATI s faculty include publishing manuscripts that summarize innovative teaching techniques and/or the results of laboratory research. Faculty also present papers at national meetings and author textbooks for use in vocational high schools and 2-year institutions.

Students attending 2-year institutions typically have graduated from vocational high schools and high schools with college preparatory programs. However, a recent trend has been the increasing proportion of nontraditional students who are returning to continue their education. Some of these students have been out of high school for many years and wish to change careers. Others are homemakers who wish to start a career. The ultimate goals of the majority of students attending 2-year institutions are to gain technical skills to improve their marketability in their chosen industry, or to manage their own business.

It is likely that a lower proportion of students attending 2-year institutions are interested in research than students attending 4-year institutions. However, Lord (1989) states that student research at 2-year institutions of higher learning is possible. He also states that involving students in research projects is an excellent way to apply what they learn. This hands-on approach is exactly what 2-year institutions emphasize for teaching methods. Starke (1985) reports that undergraduate student participation in research is becoming a popular teaching method for colleges whose missions do not emphasize research.

The academic quality of undergraduate students involved in research has varied from average to excellent (Nealson, 1988; Siebert, 1988; Singleton et al., 1984). Singleton et al. (1984) observed that enthusiasm and interest in research projects by undergraduate students is a common characteristic of the participants. The quality of the research has also been found to be correlated positively to the degree of student enthusiasm and interest. Siebert (1988) states that students should have a clear mind, purpose, perseverance, alertness and critical thinking in order to conduct good research.

In order to involve students in research, experience has shown that instructors must trust the students and that the most successful research occurs when the students are treated more like colleagues than the traditional instructor-student role (Schwartz, 1988; Walker, 1991). This involves the instructor giving up some of the authority, and trusting students to think on their own and to contribute responsibly to the research. Not only do students assist in writing about and discussing the research, they should also be involved in collecting data. Schwartz (1988) reports that, when students know that their efforts do matter, they strive to perform at their best during the research project.

While some instructors pay their undergraduate students for assisting in research projects (Schwartz, 1988; Siebert, 1988), many students receive academic credit instead (Lord, 1989; Siebert, 1988; Singleton, et al., 1984). This can be accomplished by the student receiving credit through independent studies courses, or by receiving credit as a regular course.

Several research projects have been conducted at ATI on the biological control of selected floriculture pests and on the use of composted yard wastes as a potting soil amendment. From one to six students majoring in

greenhouse production and management have been involved in this research every year. One student participated in 1987 and 1988, two students participated in 1989, and six students were involved in 1990 and 1991.

Student participation in these research projects has been strictly voluntary. Students have earned academic credit for their participation by receiving 1 credit of an independent studies course. To receive credit, an ATI learning contract is completed by the student and professor, which states the description, objectives, activities, and evaluation method (Fig. 1). One credit is given because the time requirement of 3 h/week equates to 1 quarter credit at The Ohio State Univ. By filling out a learning contract, the student knows exactly what is expected and how he/she will be evaluated. The main objectives emphasize learning about the research topic in depth through hands-on experience.

Training students how to collect data has been a critically important step because keen observational skills are required for research. Training involved familiarizing the student with the subjects being observed as well as demonstrating the process of data collection. Students practiced taking and recording data after the training session until they demonstrated proficiency. The 3-h block of time for data collection was added to the student s weekly schedule as if it were a regular class. In addition, students were given pertinent journal articles to read. These were discussed after subsequent data-taking sessions.

ATI Learning Contract*

Name: Pamela B. Denison Date: 9/24/91

Course Title/Number: PLNT SCI TEC / T293 Credits: 01 Qtr: AU

Course Instructor: Dr. R.W. McMahon Completion Date: 12/06/91

Project Title & Description:

"Biological Control of Sweet Potato Whitefly on Poinsettia Using Encarsia formosa From Two Sources"

The effectiveness of commercially produced Encarsia formosa will be compared to the effectiveness of locally produced Encarsia formosa in controlling sweetpotato whitefly populations on poinsettias.

Objectives:

1. Implement biological control principles in an experimental setting.
2. Participate in the processes of data taking and tabulation.
3. Derive conclusions based on research results.

Activities:

1. Read assigned publications on biological control of poinsettias and participate in discussions.
2. Take and tabulate data on a weekly basis (approximately 3 hours per week).
3. Prepare a report at the end of the project summarizing the experience.

Evaluation Techniques and Percent of Grade:

1. Participation in the 10 weekly data-taking sessions, including tabulation of data and discussing assigned articles. 50%
2. Preparation of a comprehensive report that summarizes the research experience. The report must include the following: a) review of literature; b) materials/methods; and c) results and discussion. 50%

Student Signature: Pamela B. Denison Date: 9/24/91

Course Instructor Signature: R W McMahon Date: 9/24/91

Division Chairperson Signature: E.O. Anderson Date: 9/25/91

* A copy of this learning contract must be forwarded to the Divison Chairperson for approval in order for the student to enroll for credit. DEADLINE: At time of registration.

1/29/88

Fig. 1. *A completed ATI learning contract that is required from students enrolling in an independent studies course.*

During the initial data-taking sessions, student data-taking has been monitored. It was emphasized to students that if they had any doubts in taking data, they were to confer with the senior author. Consistency in taking data among students is essential for good research (Lanza and Smith, 1988), and monitoring the students initially during data-taking sessions was a method to assure consistency. During the first 2 to 3 weeks of data-taking, students frequently had the senior author clarify or confirm their observations. Usually by the third data-taking session, however, the students felt comfortable with their observational skills and very few clarifications were necessary thereafter.

The senior author participated with the students in taking data; everyone took turns collecting and recording data. This assured scholarly interactions among all participants and unusual observations were shared. At the conclusion of each data-taking session, the group met to tabulate the data. Results were then discussed and compared to previous findings by other researchers.

The results of student involvement in both research projects have been beneficial to both the student participants and the senior author. The students earned academic credit, which applied toward graduation requirements. The independent studies course at ATI is offered only with a satisfactory/unsatisfactory grade option. In order for the students to receive a satisfactory grade, they must participate in all data-taking sessions and assist in tabulating the data; this accounts for 50% of the grade. The other half of the grade is based on a written report due at the end of the quarter. The format includes a literature review, material and methods, results, and discussion. It is graded on the basis of how well the student synthesized the results into logical conclusions and related the conclusions to the objectives and literature. By the end of the quarter, students are expected to understand the methodology of applied research and the commitment required for successful research.

Although not required by the students because of the short lo-week quarter, students have been encouraged to assist in writing articles to be

submitted to professional journals. Research results have been used to write three articles, two of which have been recently submitted to professional journals for publication. Student participants have coauthored the articles. About half of the students have participated and they all had the opinion that this experience helped to finalize their involvement because published articles are one of the desired outcomes of research.

There is no course prerequisite for participation in these research projects. Some difficulties arise during the training phase with students having varying academic and floriculture backgrounds. The more-advanced students frequently assisted students having difficulty during training, which was an additional learning experience in peer interaction.

All of the students have enjoyed the research experience. Comments included it is exciting to be involved with original research, the entire experience was a lot of fun, I had no idea that so much work is involved in research, and I look forward to being involved again in your research programs. Several of the greenhouse students have decided to co-major in ATI s laboratory science technology as a direct result of participating in these research projects. The only negative comments that were received related to the tediousness of data collection, but all the students understood that this is common in carefully conducted research projects.

The fact that the students learned how to conduct research properly in an enjoyable fashion is important. Through hands-on experience, the concepts and processes of scientific methodology were grasped by the students with relatively little difficulty. Student enthusiasm contributed to their efforts to conduct proper research and to learn from it. The benefits of teamwork with peers was another positive result. Because the students were treated like colleagues, a bond developed between the students and senior author that contributed to the interest and enthusiasm of everyone and therefore contributed to the quality of the research results. The bond also helped the senior author to better know the students. Thus, another benefit for the students has been stronger recommendations for students applying for jobs upon graduation.

All of the students increased their observational skills and critical thinking abilities, which undoubtedly helped them in their other courses. The academic quality of the greenhouse students has varied from average to honors. However, 80% of the research participants have been honor students, in agreement with findings by Nealson (1988) and Siebert (1988). The greenhouse students who were of average academic ability also proved to be reliable, thorough researchers because of their interest in the research (Singleton et al., 1984).

Students received extensive individual instruction that would not have been possible in a classroom setting. It is doubtful that the quality and outcome of these research projects would have been as positive with a large group of students because individual professor-student interactions would have been limited.

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