used with three projectors, we again have two simultaneous images on the screen and again have two control units.

The split- and tri-screen projection systems have the advantage of maintaining images for a longer period of time and to compare two or more images at the same time. For example, I use line drawings of plants in one projector and a close-up photograph of the same plant in another projector. Thus, a comparison is possible. In this way, it is possible to forge strong associations between genera, species and varieties of plants. Utilizing this system the student is able to note minute details during an indoor lab session and then see these details on the living plant during an outdoor lab session.

Obviously these systems are not without pitfalls. First, the student cannot possibly take adequate notes during split- or tri-screen presentations. It, therefore, becomes necessary to do some "spoon feeding." With printed class handouts, the student can concentrate on the slide presentation and not worry about detailed notes. Secondly, it takes time to properly set up a lecture or laboratory in a logical and meaningful sequence. Finally, it would seem that the details of lecturing and the operation of split- or tri-screen systems would boggle the mind. However, with some practice the operation becomes automatic to the lecturer.

I have found these systems to be well received by students. In addition, I find that I can present my material in a more organized and meaningful manner. Although it is exhausting to deliver, I find it very exciting and challenging as an instructor.

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Innovative Educational Programs at Washington State University[1]

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Early last year, 24 project proposals relating to new and innovative educational programs, in undergraduate education, were initiated at Washington State University with a total funding of $155,000. Most of the funds, or $100,000, were awarded to 16 projects for planning, development, and support of individualized instruction programs. Six projects were given a total of $20,000 for the development of off-campus work study programs. Two projects received $19,000 for other experimental programs.

The tremendous amount of interest in developing innovative educational programs was evidenced by the fact that 67 proposals were submitted and would have required funding of approximately $877,000.

The project proposals were the result of action taken by the 1971 Washington State Legislature which earmarked $155,000 of the total University appropriations to be used only to develop and implement new and innovative programs in undergraduate education. Funds were similarly earmarked in the appropriations to each of the other institutions of higher learning in the State of Washington. The motivation for such action by the Legislature was the desire to find ways of providing an education at lower cost and also to increase the relevancy and effectiveness of our educational programs. The specific wording of the legislation points out that these new programs "shall be designed to provide a more meaningful educational experience, a fuller understanding of the practical application of educational concepts, the development of new techniques for instruction of a larger number of students without unnecessary capital construction and shall recognize that the same period of time may not be necessary for each student to complete an undergraduate educational program."[2]

At Washington State University the job of allocating the $155,000 to innovative educational programs was assigned to an ad hoc committee consisting of four faculty members, two undergraduate students, and two deans. The committee drafted a policy statement which established the criteria for selection of project proposals and prepared procedural guidelines for solicitation of proposals, evaluations and recommendations for funding, coordination of funded projects, monitoring, and reporting to appropriate government agencies.

Learning for Mastery in Genetics

Of the 16 projects categorized as individualized instruction, Project No. 4, "Use of Audio-tutorial Techniques and Learning for Mastery in Genetics" is representative of this group and is the one most closely related to agriculture. With funding of approximately $17,000, an undergraduate course in genetics was redesigned to utilize the audio-tutorial method of learning. The technique was patterned after the audio-tutorial approach developed by Dr. S. N. Postlethwait at Purdue University.

Students go to a Genetics Learning Center and listen to audio-tapes, view films, slides, and demonstrations and conduct short experiments. They also attend a one-hour discussion session weekly. The course is divided into basic and optional mini-courses and the students take weekly tests to pass each mini-course. The students receive credit for a mini-course only after they pass the test at a level of 80% or above (learning for mastery). Because of the repeated testing, the tests are being converted to computer random generation. Under a differential rewards system students earn points by taking special tests, reading Scientific American Offprints, completing projects and attending discussion sessions. The final grade depends on the student passing all basic mini-courses and obtaining a certain number of points. The course depends upon individualized instruction, mastery of basic material and the rewards are oriented towards student performance. The student response, since the innovative program began two years ago, is overwhelmingly positive and the enrollment doubled in the fall semester.

Off-Campus Internships

Another of the major categories of innovative educational programs at Washington State University is off-campus work-study or off-campus internships. Six of the 24 funded projects are in this category and were allotted a total of $20,000. Although funded for only $1,000, Project No. 21, "An Experiment in Agri-Business Work-Study as an Extension of the Campus Classroom," is representative of this category and is the only project, in addition to Project No. 4, that is in the College of Agriculture.

This project seeks to establish an experimental program for student work-study in the agri-business industry so as to enable students to explore agri-business occupational fields in which they have an interest and to thereby determine the suitability of those fields. In addition, it provides the student with the opportunity to clarify those theoretical principles presented in the classroom through a personal acquaintance with their practical application. It is hoped that this will provide a vehicle whereby the training required by the agri-business industry can be more readily adapted to classroom discussion and departmental curricula.

Last fall one of our majors spent the first semester of his senior year as an intern in one of the County Extension Service offices. His work included preparation of radio and television programs and arranging meetings of agri-business leaders in the county. His work was greatly appreciated and he came back to campus greatly enthused about the program.

This summer we will have one student intern with the State Department of Agriculture, one student assistant with the Statistical Reporting Service, and one student trainee with John Deere Company. We now have more students interested in the program than we have positions available. The work experience, the credit hours earned, and the money they get are all incentives for students to participate in the program. The credit hours earned and the emphasis on a learning experience seem to be the factors that differentiate this program from the usual summer job in the mind of the student. Similar programs were initiated in Political Science, Communications, Computer Science, and Sociology.

Computer-Based Testing Recognized

Project No. 8, "Computer-Based Testing" is one of two projects in the category of other experimental programs. This program has proven to be very successful and was recently given national recognition in Business Administration circles.

Computer Generated, Repeatable Testing (CGRT) encompasses several important improvements over typical testing procedures. First, tests are given more frequently. Second, students are allowed to schedule tests at their own convenience, within broad limits. This is made possible by the provision of multiple test forms. Third, immediate feedback is provided on test performance: students are given the correct answers to all questions as soon as they turn in their response sheets. Finally, students can repeat tests several times to satisfy either achievement needs or letter grade aspirations. This program consists of a computer generated repeatable testing system which enables the student to be tested more frequently, and in addition, gives immediate feedback of his test results.

The ultimate aim is to encourage the student to use diagnostic information and to re-study material he has not mastered, and it thereby decreases the student's aversion to the examination process while maintaining appropriate demands for the mastery of the course content. Allowing the student to repeat the same test for a better grade yields positive psychological reinforcement.

The other program in this category is the Audio-Visual Center program for campus-wide coordination of the individualized instruction projects.

Summary

Washington State University has recently implemented many new and different educational programs that are working. Student interest in these programs is evidenced by higher enrollments and positive student feedback. Faculty interest is shown by the number of project proposals submitted and the amount of time spent on the projects now underway. The interest of the Legislature and related government agencies continues to be at a high level and the progress of existing programs is being carefully and closely evaluated. Our brief but intensive experience with innovative educational programs suggests that the exploration should be continued, and that the types and results of such programs should be shared both within and among institutions.

[1] Paper by Martin M. Waananen, Professor of Agricultural Economics, for presentation at the 1973 NACTA Convention June 14, 1973. This paper draws heavily from "Report on Innovative Educational Programs," Washington State University, January, 1973.

[2] Washington State Legislature, Substitute H.B. 151.

AGRICULTURE'S RESPONSE TO A CHANGING ENVIRONMENT*

Milford Heddleson – The Pennsylvania State University

Much is being both spoken and written today concerning the need for change – change in our approach to solution of complex environmental problems – change in our level of understanding of the problems themselves and their interrelationship of one to another – change in public attitudes, which will bring about economic and/or social adjustments – change in teaching methods and content, in order to better equip our young people to meet the future demands of society. We hear much discussion on these issues, and the problems themselves are evaluated at great length, but there is little agreement as to the most appropriate method of reaching future goals or avoiding obvious pitfalls, which are most certainly in our way.

One of the major criticisms expressed both with respect to training of students and attempts at understanding our immediate problems, is that we do not look at the problem in its entirety, but continue to look at each fragment separately. We continue to see only one or at most two tentacles at a time and never realize that both are attached to an octopus. We fail to realize that many legs are contributing to the motion of the octopus, and even though one or more legs might appear to be moving in a backward direction at the moment, it is still contributing to the overall forward motion of the mass. As we observe our environmental conditions and problems, we usually look at only one segment at a time and seldom try to understand the total system of which we are a part.

As we scan the literature, we find many suggestions and attempts at bringing about changes in our educational institutions which will provide more meaningful ways of seeking rational solutions to environmental problems. The motivation for change does not appear to be the desire of the institution itself to change, but because of pressures being applied by the students or by the public asking for answers to questions that currently appear not available. The institution, therefore, must defend its position and justify reasons for not making changes or it must attempt to adjust to its new environment. These efforts of change range from merely a change of course name or number to creation of new institutions with specific objectives and methods in mind. Most will agree that little is accomplished by changing either course number or instructor without modifying the course to the extent that understanding of ecological principals is an important part of the course.

New Major in Environmental Resource Management

At the Pennsylvania State University, a new undergraduate major in Environmental Resource Management was approved and initiated in 1971. The requirements were drawn up by a committee composed of staff members from Agronomy, Agricultural Economics, Rural Sociology, Forest Resources, Horticulture, and Agricultural Engineering. The advisors also are selected from various departments within the college. Student enrollment was about 35 the first year of offering, about 140 the second year, and will be an estimated 200 this fall, the third year. About 10% of the current enrollment is female. The first class graduates this June 1973, and at this point employment prospects appear to be quite good.

Within the past two years, some administrative changes have been made in the College of Agriculture in order to bring about closer coordination between the various departments where environmental problems were a factor. Prior to 1972, there was no individual within the college who had responsibility for coordinating the on-going work within the college. A number of research projects which were environmentally related were being conducted by various departments such as Agricultural Engineering, Agronomy, Plant Pathology, Entomology, Horticulture, and others. Extension programs were quite varied as well and only through voluntary specialists' cooperation was the adult educational programs tied together.

Coordination Developed

In July 1971, a committee was appointed to advise the Dean on environmental matters and to study ways by which effort of these various departments could be more closely coordinated. As a result of that study, an office of Environmental