Project-Oriented Work For Preservice Biology Teachers

INGRITH D. OLSEN

FEW PEOPLE would challenge the proposition that biology teachers today, whether in grade schools or colleges, have an awesome task to perform. On the one hand they are charged with introducing their students to a scientific field that is growing explosively and is also emerging as a major, often controversial, partner in such crucial human affairs as provision of food, disease control, and regulation of heredity. At the same time teachers are responsible to their students in ways that were rarely thought of by earlier generations of teachers. They are facilitators of learning and must be sensitive and responsive to the individual student's needs, problems, and patterns of development within a society that is struggling with itself to become more just. Teachers may be called upon to defend the rights of their students to access to controversial areas of biological knowledge—evolution, reproductive control, and so on.

From a point of view expressed more specifically in terms of biological science, the biology teacher today must have not only authentic up-to-date knowledge but also the versatility, skill, and imagination to offer students a wide range of experiences and opportunities to engage in biology as an active process of investigation and problem-solving. And beyond these demands placed on teachers by modern expectations and the complexity of biology itself, there are severe extraneous pressures. Budgets are tight and working conditions in the classroom often unfavorable, with large class sizes and inadequate support personnel, equipment, and supplies. If there is any lesson to be learned from these considerations, it is that preservice education should prepare the teacher to develop to the fullest intellectual flexibility, the urge for active involvement in biology, and the skill and self-confidence to experiment and master new approaches, both to biology and to the techniques of teaching.

How many of the existing preservice programs for teachers attain these goals? Biology courses in colleges and universities are predominantly geared to the effective transmission of information. Thus, most of the hours spent by young people preparing themselves to teach are devoted to familiarization with facts already accumulated and set down in textbooks and course lectures, or to reviewing well established models in pre-set laboratory exercises. In preservice programs, it is relatively rare that the student is allowed chances to explore, to test, and to escape from the passivity of the conventional learner.

Nonpassive Preservice Education

At the University of Washington, as elsewhere nationwide, attempts are in progress to help preservice teachers meet the complex demands made upon them. This paper will describe briefly one component of the preservice program for secondary biology teachers, designed to give them at least minimal experience in developing approaches to investigation in the biological field and in the modern teaching context. The component is a one-quarter course, typically taken at the end of the student's undergraduate years and just before professional certification. The course focuses on discussion and demonstration of curriculum design and the application of different techniques of teaching, yet its main thrust and most significant feature are the projects which the students themselves design and carry out. The scope of the projects is suggested by the list in table 1, selected more or less at random from the roster of projects carried out in the past few years.

Students who have studied primarily in the teacher-initiated, teacher-directed atmosphere of many existing college and university biology courses may not easily make the transition to more active roles. Indeed, experience has indicated that a considerable range of resources is needed in order to allow students to develop their ideas to the point at which they recognize the teaching potential of their projects, and realize the rewards of ideas carried out to effective conclusions. These resources include direct personal guidance, written references, equipment and supplies, and opportunities for application in classroom conditions. One project area is described elsewhere in considerable detail (See "Photography for Preservice Biology Teachers," in this issue). In general terms, the resources available to the students at the University of Washington are based in part in a laboratory equipped with a variety of instruments and biological organisms,

The author is professor of zoology at the University of Washington, Seattle 98195. For information on her background, see *ABT* 37(9):533.

materials, and supplies including most of the elements that would be found in any conventional secondary or college teaching laboratory. Opportunities to work with some of the newer teaching techniques are made possible through the University's coordinated audiovisual and closed circuit television services, and the Biology Learning Resource Center. The student can test new ideas in peer teaching in elementary biology classes within the University, or in the context of secondary classrooms. Participants work individually or in teams—indeed, the latter arrangement often seems more productive because it encourages the cooperative interaction so essential to later teamwork in professional life. Towards the end of the quarter, the students describe their projects to their classmates, and at this point the experience of each individual is widened in the discussion of the spectrum of projects of the class as a whole.

What is the outcome of participation in a project-oriented experience of this sort? Generally, the students express appreciation for the opportunity to participate actively in biological inquiry and teaching design in this way, although in every class there are a few individuals who feel unable to cope with its novel elements or threatened by its unconventional demands. As yet, no attempt has been made to carry out consistent follow-up studies, chiefly for lack of time and support for such studies. Nevertheless, there is considerable random evidence, mostly quite positive in nature, that preservice teachers who developed an active interest in their project work continue to exploit it, and feel attracted to new approaches in their later teaching careers. Is this outcome directly related to the project experience, or does it reflect primarily the nature of the students themselves—that is, because they are open-minded, interested, and imaginative as preservice teachers, can they simply be expected to show similar positive characteristics in their later teaching careers? So far, data do not exist to distinguish critically between these alternate hypotheses. Even without such data, however, it seems worth while to persist in searching for a variety of models, of which this program is one example, to assist preservice teachers in developing their own potential for versatility and active engagement in the practice of biology. There is no group of students more deserving of such effort. For teachers, far more than ever before, must play key roles in fostering the general understanding of biology. Only when the level of this understanding is high can society use the tools of biological science to solve its urgent problems.

Acknowledgment—The laboratory facilities described in this paper were funded in large part by NSF grant GY-5727.

Table 1. Student projects or preservice biology teachers at the University of Washington.

Project type	*Representative topics*
laboratory investigation	soil ecology; ant farming
videotape	brain-behavior interrelations (in a marine mollusk); resuscitation (made in cooperation with a local fire department)
biological photography	six-sided figures in nature
slide-tape program	diversity in mechanism of locomotion
autotutorial program	biology of insects; desert plants and animals
take-home investigation	hydroponics (effects of iron deficiency in pea seedlings); biological rhythms and clocks
teaching aids and games	demonstrations of probability and genetic crosses; how to make artificial smog
other	self-paced biology program for deaf student; program for Earth Week (carried out in a local high school); analysis of biological learning-teaching resources in an isolated fishing village; analysis of biological content of local newspapers, television programs, and other public media

Volunteer Positions Open to Students

The Student Conservation Association offers high school and college age young people the opportunity for *volunteer* work in national parks or forests under the supervision of professional personnel. Most of these are summer positions, but there are a few opportunities available during the other seasons.

Assistance has been requested by the parks and forests to enable them to offer additional visitor services and to accomplish certain conservation projects which they otherwise could not afford. While providing this assistance, each Student Conservation Program volunteer has the opportunity to expand his awareness of the vital conservation of our natural and historic heritage through actual field experience.

High school work group applicants, who must be at least 16 years of age, should be available for a period of 3 or 4 weeks. There is no charge for participation, and some financial aid for travel and equipment is available to eligible participants.

Positions as Park or Forest Assistants are open to college undergraduates and graduates aged 18 and older. These volunteers work from 8 to 12 weeks and receive travel and subsistence grants to defray reasonable expenses.

Applications are competitive and will not be accepted after March 1; the date the completed application is received is a factor in the selection. Write to the Student Conservation Association, Olympic View Drive, Route 1, Box 573A, Vashon, Wash. 98070.