SOME RADICAL DEPARTURES ON THE TEACHING OF BIOLOGY

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The psychology of science teaching is now sufficiently clarified and the experimental determination of the relative values of method of instruction sufficiently advanced to warrant certain radical changes in our courses of study in biology and the technique of presentation.

All subject-matter should be eliminated from the course that is not socially worth while, and at the same time of prime interest to the pupils. The only justification for the taxation of the people to cover the expenses of the education of their children is that education contributes to the efficiency of those educated as members of the community. Interest is a prime prerequisite. For any educational process is the result of self activity and that is conditioned in its intensity by interest. We know from the studies of Mau, Finley, Trafton, and others that pupils are interested primarily in the activities of animals and plants, their identification and relation to the environment—not in their structure, classification, utility. Further, that the interest is chiefly in birds, insects, and common mammals among the animals, and in wild flowers, trees and garden plants. Our biology should deal largely with these groups and it should be concerned chiefly with behavior and environment relationships.

The subject-matter should be organized in relatively small units, with topic titles that challenge attention, for the mental grasp of High School sophomores is not extensive. The pupil needs to progress by small, well defined steps, so that he may have a constant sense of mastery and not feel lost in the intricacies of a hazy, large subject.

The unit, or a small group of them, should eventuate in a comprehension of a biological law or generalization of major social importance, because in proportion as one gets his knowledge generalized is it applicable to a new situation, and then only as he has had drill in such application. The teacher must therefore spend time in

carrying over these biological generalizations into life situations. A few such general laws well selected for their social values, well mastered and applied, are of real value. A mass of unorganized biological detail is useless.

Many of these units should be organized in problem or project form to give drill in accurate methods of scientific thinking, for such ability is more important than the acquisition of knowledge. Some units should be organized with a view to giving an aesthetic appreciation of one's environment, others to give an appreciation of the value of science and of the devoted labors of scientists; some to develop a sense of the lawfulness of nature, and the moral obligation of the student to obey her laws.

The recent experiments of Cunningham, Cooprider, Anibal, and others have shown that as far as the acquisition of knowledge is concerned, the lecture demonstration is more efficient than the laboratory method of instruction, and much more economical of time and material. Science instruction is neglected in the small High Schools because of the unjustified notion that expensive laboratory equipment is essential. The cost of instruction per pupil in the sciences is well toward the top of the list in high school subjects. The writer is convinced that we waste a large amount of time of students in muddling around in the laboratory. Teach them by the lecture demonstration method. Reduce laboratory work to a minimum. Bar the compound miscroscope from the High School biology course, and replace it with the demonstration projection microscope. Omit all dissections by students; such a dissection is rarely instructive—it is futile hash. Use prepared dissections when structure is to be studied, remembering that such studies are to be made only when structure is essential to a comprehension of activities. Omit from the notebooks all detailed sketches and replace them with diagrammatic drawings. Ayers investigation has shown that such drawings are much more efficient in fixing in mind the essential points.

In working out problems and projects, the early work should aim to habituate the pupil to the solution of a problem in the logical way, by following the detailed guidance of the teacher. Gradually the teacher's help should be withdrawn as the student is instructed in the essential steps of the problem solving process. Finally the pupil should be led to work out his individual problem or project unaided.