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RELATING THE OUT-OF-DOORS TO THE INDOORS IN TEACHING BIOLOGY

H. E. JAKUES

Knowing the names of plants and animals and their phylogenetic relationship to each other is highly essential for success in any field of biological study. In spite of the immense numbers of species of plants and animals, it is surprising how much can be accomplished in learning to recognize the common species of a region, by giving it some consistent attention.

It would seem that plant and animal recognition should have a fairly large place in nature study work in the grades and in biology classes in high school. Such work is easily within the ability of students of that age and provides a foundation to support the later and more advanced work. There seems to be a natural tendency for inexperienced high school teachers to begin teaching their students at the place these young teachers left off their own work in biology in college. That leaves their students rather helpless with a load of poorly related information, which is often lacking in significance or apparent value to them. Certain rather simple and highly basic facts and skills are essential as a foundation for later work.

The field of biology is so large that it would seem that matters like plant and animal identifications should be made as easy as possible whether it is being taught in high school or at the graduate school level. The objective should be to attain results. The student should be helped to master these skills as easily and quickly as possible.

Most classes in the biology departments of our schools contain two categories of students; those who plan to make professional use of the instruction and those whose only actual use of these experiences will be in their cultural or avocational values. For both of these groups combining outdoor experiences with indoor class and laboratory work makes achievement easier and impressions more lasting and usable.

Take an example. Suppose the laboratory work of the day is on *Protococcus viridus*. Specimens could be taken from a ten years supply put up in preservative, or an assistant could have ready as many pieces of freshly collected bark as there were students in the laboratory. The latter, of course, would be the better, but it would be of much greater value still to take the class out of doors to some nearby trees or other sources of *Protococcus* and discuss the outdoor features with the class, noting which parts and how much of the tree was covered, and where it grew best. The class could then discover the plant growing on walks, buildings, etc. To get a better appreciation of the plant, the area of the tree covered by the plant could be estimated. Each student would actually collect his own specimens to take in for his work. Perhaps some of the students would wish

to collect from several different places to determine, when again indoors, how much difference in size and form these several habitats may cause. Back in the laboratory in addition to the usual routine study of the plant, an intelligent interest could be created by having each student measure the diameter of representative plants. With further microscopic observation he could estimate the depth (in plants) of the green layer on the tree. With these three figures (area on the tree, thickness on the tree, and the diameter of an average plant) he would go on to compute the approximate number of *Protococcus viridus* plants on the tree. It would likely be as incomprehensible number as our national debt, but some comparisons would make it more understandable. The individual plants could "be strung as beads" (in imagination) and the length of the string computed, each school person of the United States could be presented with his determined share; the string of beads could be found to reach "n" times around the rim of the home state or some other way found for giving meaning to the figures. For the rest of his life, *Protococcus viridus* would have definite significance for a student of this class. It would not mean just some uninteresting thing taken from a smelly bottle on a dusty shelf in the laboratory, and devoid of apparent value.

Field trips taking part or all of the day's laboratory time may have much value. It should be understood from the start that these trips are purposeful and serious. Our trips rather invariably end with a quiz over the things seen and discussed during that and on preceding field days. With this quiz in the offing mental alertness is kept at a much higher level than would be the case otherwise. Each student takes his own manual along. A few plants or animals may be keyed to group or species. Many others are named and discussed by the teacher. The students find them in the manual and note their relationship to other plants or animals.

We wish of course that the greatest possible number of our students will come to so sincerely love the out-of-doors that it can provide them with healthful recreation the remainder of their lives. A judicious blending of outdoor projects and observations with indoor interpretations is necessary to attain the most favorable results. The frequent field trips with purposeful direction already mentioned get results.

Even high school students can make a success of small research problems and get the thrill of original production. The campus, garden, pond, or field is full of little unsolved problems, many of which could piece into some major research of real value but all of which offer fine opportunities for student training. Problems which may be finished within a few weeks are better for sustaining the interest of beginners. When completed, the results and conclusions of the research should be written up in good scientific style. Publication sources, even if only local should be found for the better papers. All of them should be filed where student and teacher can refer to them and use made of the facts discovered by these beginning scientists in

class and laboratory discussions. Attaching serious value to the results of these research problems gives greater interest and stimulus to later classes when doing similar work.

Making department collections of groups of plants or animals is always good. These collections should be kept growing and be made available to all the students for comparisons in making determinations. Every young biologist should understand and become adept in making determinations of new material both by keys and by reference to collections. But, after all, doubtless the greatest value of a collection comes to the one who makes it. Students young or older should be taught early to find things for themselves and not to depend too much on the class field trips or on fellow students to help them.

It has been attempted to speak of a few ways in which outdoor work may be coordinated with the indoor work. Opportunities vary with the region and location of the school, but we cannot think of a situation where considerable work of this kind could not be done profitably.

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