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LABORATORY OR BUSYWORK?
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Louis Agassiz is usually credited with the introduction of the laboratory method into American education, and its use, like so many innovations in science, has spread widely and extensively into other fields so that we now have laboratories in the social sciences, arts, and other disciplines. At the time of its debut into science education, the laboratory provided an invigorating stimulus to the student which has been reflected in scientific progress down to our present time. With the introduction of the laboratory, the student, for the first time, was presented with tools and an avenue of escape from the "bookish" instructional tradition inherited from the Middle Ages.

The laboratory can be and still is a stimulating and meaningful method of instruction, but it must be admitted that it has too often deteriorated into an end in itself rather than a means to an end. All of us can recall courses from our undergraduate and graduate days in which the laboratories were insufferably boring to the end that their value was dissipated and lost. Have we, then, forgotten the prime reasons for using the laboratory? The author does not think so, but a restatement would not be out of order.

The laboratory offers the instructor in the biological sciences, particularly in the more descriptive aspects, unparalleled opportunity to introduce the student to a mass of material from which he may, with proper guidance, derive basic concepts and principles which otherwise would have scant significance or meaning. There is no other method by which taxonomy, anatomy, morphology, and physiology may be taught and made significant to the student. He must see, feel, examine, rearrange, and manipulate this material in order that the ideas and concepts presented in lecture and text may come alive and assume a significant pattern in his personal experience, providing foundation for further enlargement of his intellectual horizon. The student may, and we say may, also experience to some degree the spirit of those who have formulated the basic theories and principles prevalent in modern science by attempting to duplicate some of the effort and procedure which gave rise to those conclusions. It would appear that the physical sciences have advantages over the biological in this respect. And, finally, we often claim that laboratory is to teach technique and to create desirable research habits.

How well do we achieve these aims, and if we fail, why? An examination of our own efforts may be rewarding and, at the same time, point out means by which we may make the desired correlations and establish the desired habits and techniques.

The science instructor today may be confronted with several problems: large classes, insufficient time, inadequate equipment, inadequate secondary preparation of the student, and sometimes undesirable physical facilities. Also, our store of scientific knowledge has mushroomed and expanded to a bewildering and almost discouraging extent and depth. It is not the purpose of this paper to propose remedies or to apologize for conditions as they exist. Certainly anything which may alleviate them is to be condensed and encouraged. The objective is, however, to examine present practices and determine if we are using our laboratories most efficiently and effectively under conditions which we are forced to accept.

As is true for any teaching situation, the laboratory requires careful planning and preparation, otherwise it degenerates into a stultifying routine. Administrative authorities should be aware of this and make adequate adjustments in the teaching load and schedule of the instructor. At the same time, the instructor is under the ethical obligation to use whatever time resources and allowances are placed at his disposal. While an overloaded instructor may be pardoned for the administrative sins of his superiors, no excuse exists for failure to do some planning for the laboratory period.

Regardless of the methods employed, one must first determine what objectives are to be met by the laboratory, and then how much information is to be imparted
or material covered. Here again the vast quantity of material now available in any area of science renders it imperative that the instructor determine beforehand what will be covered and how much of that relegated to the laboratory period.

In connection with the conservation of time, it is the writer’s opinion that the demonstration method has hardly been employed to the full extent of its usefulness. Surely each individual here can recall pertinent examples from his specialty which, if presented as a demonstration, would more adequately correlate observation with lecture material and save time which could more profitably be employed on other laboratory work. These same experiments or observations, if left to the student, are often time consuming and have little end value. The chemist faces the problem of equating and ever-expanding quantity of information with a rather fixed length of time in which to do it. This is especially true in those courses of a general nature which any field of science may have to offer. One effort to solve the problem in chemistry has been to increase the laboratory period from two to four hours. In general, this may not be effective as it simply gives the student more time in which to stand around and wonder more and understand less about what he is doing. An overly-long laboratory period is robbed of much of its effectiveness by the increasing factor of fatigue. This criticism could be made of any field of science. It is, therefore, encouraging to learn that some institutions are again adopting the two-hour laboratory period, and that a more adequate use of the demonstration method is contemplated here in our own state.

No matter how long the laboratory period, it is well that the students be briefed on general procedure, material available, and the pertinent points to be kept in mind while working. Students are students. We should accept the fact that they are, and that they forget in varying degree whatever instructions may have been given them in lecture prior to the laboratory period. However, there is a danger to be avoided here. The instructor may be too solicitous, with the result that the student fails to develop any confidence in his ability to work on his own, and exhausts the teacher by asking for decisions which he and not the instructor should make. If the briefing is adequate, this sort of thing should be eliminated, provided the teacher has correctly judged his class. There is unfortunately, no set formula for adjusting briefing to a class, but the experienced instructor can usually handle the problem. After all, teaching is an art as well as a science.

Development of a feeling of self-reliance in the student and his ability to work on his own are generally agreed to be legitimate objectives of laboratory instruction. We should not, however, overemphasize this aspect as we also are under the obligation to develop in the student the ability to work as a member of a team. This is all the more important for our advanced students who have decided on a career in science and who may be called upon for research. Since modern research is tending more and more toward the team effort, we are obligated to recognize this need. It can be achieved to some extent by organizing students into small groups and insisting that the members of the group work out their problems, and that the group exchange ideas with other groups.

Because we recognize the necessity for developing individual initiative, we should beware of the danger inherent in a laboratory program which constantly overloads the student so that he is always behind. This is psychologically disruptive in that the student develops a feeling of never achieving any mastery of the subject matter. Provisions should be made for a few laboratory periods which the student might be able to complete a few minutes early. It appears to the writer that there is some merit in this procedure in that it would give the student a sense of accomplishment. Of course, the student must always feel the necessity for working or he becomes intellectually indolent. But the “push” can and has been overdone.

And finally, what are we doing in this matter of equipment? Everyone realizes that, depending on the course and science, there is a minimum amount of equipment necessary for laboratory work. If this minimum is not available, the laboratory would be better abandoned and the course accepted for what it can only be under the circumstances -- a book course -- and taught accordingly. There is nothing more demoralizing to the student that subjection to a laboratory regimen which tries to achieve certain ends, yet has not the means wherewith to do
At the same time we must realize that an elaborately equipped laboratory can be the source and scene of educational malpractice. Many would agree that today we have too much instrument manipulation and not enough thinking. We should be certain that we are resourcefully using what equipment we have available before becoming involved with an array of gadgets.

The writer does not have the audacity to claim originality for the ideas and comments expressed. Of a certainty all present are already aware of what has been said. But is it not true that we often forget the proper use of the laboratory and permit it to become an end in itself? We have laboratory because a science course just naturally has to have a laboratory to be a science course. We constantly need to reexamine our employment of this teaching device so that it may contribute to that which is most essential: the education of the student.