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SEMI-MICRO PROCEDURE IN HIGH SCHOOL LABORATORIES

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In July of 1941 our high school burned, destroying all of our chemistry equipment. The next ten years were spent in a junior high school building with very poor laboratory facilities. Since we had not planned on a decade in this building, we kept our chemistry equipment to a bare minimum.

In September 1951 we were to move into our new building with fine chemistry facilities. The question in equipping the new laboratories was whether to order equipment for macro or for semimicro chemistry. We consulted the chemistry instructors at Mankato State Teachers College and salesmen of scientific equipment, and after seriously considering their suggestions we decided upon semimicro.

We had to pioneer in this work, as no school in this state or nearby states used the semimicro method for laboratory work; thus, we were the first school in the state to use semimicro in the high school.

The first problem was to find a manual. After writing to the major publishers the best manual we were able to locate was one written by Schiller, O'Donnell and Morrison and published by the Globe Book Co. of 175 5th Ave., New York 10, New York. We ordered the manual then proceeded to make out the list of equipment and chemicals needed for 75 students with the generous help of Dr. L. A. Ford of the Mankato State Teachers College. Our order amounted to slightly less than $1100 for seventy-five students; this amount included $210 for a water still. Had we ordered equipment for the macro method we would have spent twice that amount.

Having taught chemistry by the macro method for twenty-one years I was sure I would learn much with this new method. My first observation was how slowly the students seemed to work. The reason for this seemed fairly obvious. In the macro laboratory the students had worked in pairs hence the experiment moved faster; now they were working individually. Our laboratory is equipped to handle thirty-two students in each class so there were thirty-two individuals each doing his own work.

During the summer of 1951 I spent ten weeks at the University of Colorado where I tried to find more information about the semimicro method. There is little available. I did find another manual published by

the D. C. Heath & Co., written by Fred T. Weisbruch. However, I should state that this manual, as all others, has too many experiments. It would be better for the instructor to write his own manual if he has the ability and time to do the work.

In my opinion, there are three methods of teaching semimicro laboratory. First, a set of chemicals may be made for each student to keep in a tray in his desk. This method is described in the Clearing House Magazine for May of 1953, by Fred B. Eiseman Jr. of John Burroughs School, Clayton, Mo. This seems to require more extensive supplies than are normally needed besides dozens of man hours of preparation. Of course, after the work is done it gives each student an opportunity to stay at his desk for concentrated work and gives the instructor more time for supervision.

The second method is to use a set of chemicals in trays for each table, in our our case I would need at least four trays; eight would be better. This is the method recommended by the two manuals. This method would require many hours of bottle filling and labeling at the beginning of the year. It is true that competent students can be used to help do the necessary work in the two methods I have just explained. Either of these methods cuts down on laboratory traffic and makes supplies available close at hand. The second method is used at the Owatonna, Minn., high school and is working very satisfactorily according to Mr. Collins, the instructor.

The third method is to use two supply stations, one on each side of the laboratory; this is the method I use. I have 250 cc. brown dropper bottles for all liquids, and the solids are placed in properly labeled bottles with two sets of dropper bottles, 125 bottles are required for the 30 or more experiments done during the year. I admit there is a bottle neck at the very beginning of each experiment, but that is for just a few minutes after which there are no delays. I plan to use four stations next year making this as efficient as any of the methods.

Our laboratory has two centrifuges; there is no filtering with semimicro. We also have adjustable steel stools for each student; with semimicro, stools are an asset to more efficient work.

Semimicro, in my opinion is more desirable for the following reasons: (1) it is much cheaper to operate; (2) each student works individually, thus getting more out of the experiment; (3) there is less danger of explosions and acid burns because of the small amounts of chemicals used as compared with macro; (4) a student must be more accurate with these smaller amounts; (5) results are at least just as evident and in most cases more evident than in macro because of accuracy; (6) less offensive odors result from smaller amounts.

Wisconsin high schools, both public and parochial, are rapidly changing to semimicro, and in Minnesota the change is becoming evident especially where new buildings are being built.

I have checked my classes these past three years and find they are well satisfied with the method. The most common answer is, "I can do it myself and work at my own speed." I grant they have never worked the

macro method but from their own reactions I am sure they wouldn't care to use it.

In conclusion may I ask, why not try this new method? Why use cubic centimeters when a few drops do the same, or why use grams when a spatula full gives the same results? Medicine droppers, spatulas, microscope slides, 10mm. test tubes, 50 ml. beakers, 50 erlenmeyer flasks, microburners, etc. are more interesting to use than the large cumbersome, expensive macro equipment. Why not be a starter instead of a follower. Try it. You and your students are in for a new lease on Chemistry, in the laboratory.

THE ROLE OF THE LABORATORY AND DEMONSTRATION IN COLLEGE PHYSICAL SCIENCE IN ACHIEVING THE OBJECTIVES OF GENERAL EDUCATION

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ABSTRACT

The major aim of the study was to determine the role of the laboratory and demonstration in college physical science in achieving the objectives of general education. Specifically, the problem resolved itself to comparing the relative effectiveness of three instructional methods in physical science laboratory. The experimental sections were taught by either the demonstration method, the individual laboratory method, or the combined demonstration and individual laboratory method.

The following were the general education objectives chosen:

1. To develop a functional understanding of scientific facts, principles and laws.
2. To develop scientific attitudes, interests and appreciations.
3. To develop skill in the use of scientific instruments and apparatus.

The experiment was carried out during the Fall, Winter and Spring Quarters of 1952-1953. All subjects in the experimental study were students enrolled in Physical Science 101, a general education course in physical science at Mankato Stae Teachers College. Two sections of 24 students each were used each quarter and the 48 students involved were randomly assigned at the time of registration before the beginning of each quarter.

A 2 x 3 randomized block design with equal subclasses was used in this investigation. The experiment was controlled carefully with respect to the instructional time, the subject matter, audio-visual aids, laboratory apparatus and experiments, and the evaluation instruments.