TECHNICS FOR LARGE GROUP DEMONSTRATION

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The use of the lecture demonstration method for large group instruction involves many difficulties. In the development of the Survey course of the Physical Sciences in the Chicago City Colleges the lecture demonstration method was adopted. With the lecture sections running as high as three hundred students most of the usual types of demonstration apparatus are unsatisfactory on account of visibility; therefore the three colleges embarked on a program of developing specially built equipment, first through a shop, then through the collaboration of WPA project 3702. The following pieces of apparatus have been found useful.

1. Test tube rack, 37 x 9 x 13 cm. with openings for 40 x 300 mm. test tubes. The rack has a bulb and reflector below to illuminate the tubes. Test tubes of 65 x 500 mm. size are used occasionally. To increase visibility the tubes may be sand-blasted.
2. Apparatus showing the reaction of nitrogen and oxygen at high temperatures, consisting of an inverted 5 liter or 10 liter round bottom flask provided with a 4-hole rubber stopper for the copper electrodes, inlet and outlet of air.
3. Model Geyser, five feet high, made of sheet iron to illustrate the action of a geyser. The apparatus consists of a constricted vertical tube which is filled with water and has a source of heat at the bottom. A large tray on top serves to collect the erupted water.
4. Long wire apparatus to illustrate magnetic forces acting on a wire which is carrying an electric current. The terminals are attached to a source of direct current; when the commutator is at the lower position the current flows in the same direction in both wires which then attract each other. Reversing causes repelling. A number of other standard pieces of apparatus were built on a larger scale, such as apparatus for the magnetic field of a helix, collision apparatus, thermal expansion of metals, etc.

Aside from the use of larger pieces of apparatus and special illumination to increase visibility, it has been found that for large group demonstrations the experiments have to be carefully selected and rehearsed. The function of the demonstration experiment must be critically evaluated. In the experience of the authors, it has been found that although a skilled experimenter, acting with assistants, can perform many more experiments in three lecture periods per week even while lecturing, than a neophyte can perform even in six laboratory periods. Such a procedure defeats the function of demonstrations. Aside from the motivation and arousal of interest which is often desirable in large group demonstration, the chief function of the demonstration is believed to be observation of events and facts, their explanation and the checking of the explanation. Unless a demonstration experiment is carefully and slowly performed and explained, it fails to accomplish its main objective. It has been found advantageous to select the experiments, avoid a large number, perform a few, prepare the students for each, and explain in detail each step.

However, even with the best of efforts many students are found to be dissatisfied with being merely onlookers to demonstrations. To satisfy the normal desire to handle things for themselves, a survey experiment room was developed where the students were free to go whenever they pleased and view at close range the demonstrations of last week's lectures. Other exhibits were added on related topics. This has led slowly to the development of simple experiments for the non-professional student. Among those that can be briefly mentioned are (a) evolution of oxygen from hydrogen peroxide by the addition of manganese dioxide, (b) determination of the densities of various metals or objects having approximately the same volume, (c) change of state by using ethylene bromide which has a melting point of ——°C. (d) use of a pH universal indicator to demonstrate differences between strong and weak acids and

bases, and the relative hydrogen ion concentration of soil, saliva and other common substances.

Work is in progress toward this end. In general, the authors are firmly convinced that there are certain concepts in science which are difficult if not impossible for the average student to understand without some first hand experience with the facts from which conclusions are drawn and the *methods* which are used to check these conclusions.