A TEACHING AID FOR LABORATORY TECHNIQUES

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In the teaching of many practical sciences there are several basic manipulative operations which students must learn before they can proceed with other more important practical studies. If a student does not learn these operations or techniques properly, he is handicapped in all the future work in that subject. Typical of such fundamental operations are the use of a balance, a pipette, or a microscope. Even bending glass tubing could be included as can much more complex operations such as those entailed in the handling of a precipitate in gravimetric analysis or the use of a petrological microscope in the thin section analysis of rocks. In days gone by when laboratory classes were small, students learned such skills in very small groups gathered around a staff member who was proud of his own skill. All could see the demonstration clearly and the instructor could likewise watch the whole group as it practised the skills and corrected the mistakes.

Unfortunately this is no longer the universal rule. Classes, especially at the universities, may excede forty and classes of seventy or even several hundred and not unknown. With such huge classes it is impossible for every student to see clearly and the instructor cannot watch the whole class as thoroughly as the perfecting of such techniques demands. There are special experiments that can be devised to check and detect poor technique but it is very easy for lazy students to cheat and go undetected. To ensure that these vital techniques are truly mastered, the instructor has either to divide large classes into small group and teach each separately or bring in extra staff just for this initial period. As these techniques are usually fundamental, it is difficult to find alternative work that can be done unsupervised while the instructor deals with each group in turn. It is equally difficult to find sufficient staff members skilled in the necessary techniques and in sufficient numbers to provide simultaneous instruction to all the students while keeping the groups small in number. It is certainly not economic to hire staff especially for this purpose as the degree of supervision needed later in such courses is much less. Again, if an instructor does try to take large classes, not only do some students acquire poor technique but there is a risk of them breaking expensive equipment, often beyond repair.

On the other hand, educational film and videotape are relatively cheap to make and projectors and videotape viewers are items that can be used by a large number of classes for many different subjects. Hence it is quite feasible to make good demonstration films or tapes in which a real professional, with far more experience than any staff member in the average university, can be seen carrying out the desired operation. This takes care of the pro-

blem of demonstrating techniques to large classes but not of the related problem of checking that a student can carry them out properly. It is suggested that a modification of the well-known language laboratory could be used for this. As such equipment is usually installed by experts, very little of the actual wiring details will be given here, but the overall operations will be described.

It may be argued that the use of a special teaching aid gives the student an extra skill to learn. In a way this is true but, once learned, this single skill can be used to learn many other skills. Also if the circuitry is carefully designed it can be so made that really expensive disasters such as the erasure of the master videotape or the destruction of the master film is impossible. In fact, if the controls are kept simple and a clearly worded instruction card is provided, it could be argued that the only operations the students have to learn are to do what they are told and to push buttons.

After the students have watched the master film or tape as many times as necessary, they can familiarise themselves with the apparatus used and, working single or in groups depending on the availability of the apparatus and on whether group criticism is advantageous, they can then practise, with the master film or tape available for reference in case of doubt. If a set of the necessary apparatus is placed on a well-lit section of the bench which is fitted with one or more small television cameras feeding to a videotape recorder, it is possible for a student to record his or her own efforts and to compare them with the master film or tape by viewing both on a small television screen at the side of the bench. In this way a student could practise in his spare time until satisfied and then leave a tape for the instructor to inspect and comment on .

The cost of this layout depends on how complicated and foolproof it is. The simplest layout would consist of a table for holding the experimental equipment, a bright light and a videotape recorded with a small television camera and viewing screen. This would cost about $3,000 (Eth.). The ideal layout would consist of several benches, each with its own camera, recorder and screen, and an extra channel on the viewing screen switch so that the master film or tape could be viewed on the screen. The master film or tape would be transmitted from a separate videotape player or projector so fixed that it could neither record nor erase the precious master film. Students who were satisfied with their performance would hand in their final tape for the instructor to inspect and comment on at his leisure and either pass as satisfactory or send back with comments for further practice. If a really big installation were made, it could be made even more versatile and useful by adding a few extra commercially-available accessories. For instance, instruc-

tors could have a small camera and recorder with which they could record any bad workmanship seen in the laboratory and take the appropriate student to a booth to show him or her the actuall mistake. The set-up could also be used for lecture demonstrations where there is no time for every student to observe the actual performance. A surgical operation is an ideal illustration but similar demonstrations exist in Chemistry and Biology.

There is equipment on the market whereby a lecture may be given using film or tape or slides to illustrate it and the lecturer may view the projection through plate glass, write on the plate and have the writing superimposed on the projected picture which the students see on their screens. Instead of drawing complicated diagrams on the board and then marking them, the basic diagram can be kept on a slide. All these latter items are frills but very useful frills. Such a big installation might cost about $3,000 per student-bench plus about an extra $1,000 for the master recorder or each other accessory added. The great teaching advantages of such a set-up are that a large number of students can watch a demonstration at the same time and that the students can see and correct their mistakes.

Ultimately a moderate-to-large installation will pay for itself not just in better instruction but in allowing a more economical use of expensive laboratory supervision. Once installed, the installation is reusable by several departments. The special player for master tape is amply justified by the extra security it gives against the loss of valuable master tapes. Very few master tapes or films of basic laboratory operations are currently available but staff could use the equipment to produce their own at little more expenditure than the cost of the tape and the time involved.

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