What did we learn from the dry labs workshop?

Ian Johnston and Mary Peat
UniServe•Science, University of Sydney
director.science@uniserve.edu.au

Why a workshop devoted to Dry Labs?

The original reasons for proposing this workshop were clear. Many science departments in this country are finding difficulty in maintaining their traditional teaching programs in experimental laboratories. In some cases this is because of pressure of student numbers and the cost of laboratory work. In others, it is the difficulty posed by the use of hazardous chemicals or animal experimentation or radioactive substances. The problems are particularly acute in those departments with large first year classes.

It has been suggested many times that first year students could be offered alternative experiences to some of their traditional 'wet' labs — perhaps simulated laboratory experiments, perhaps structured computer managed tutorials. The arguments in favour of such an approach are not only on the grounds of cost efficiency. There is no doubt that practical skills can be taught, and taught well, by computer simulations — teaching airline pilots or astronauts by flight simulators is an obvious example.

However there is sincere opposition to the very idea of 'dry' labs from many academics, which mainly centres round the key role that experiment plays in science. They argue that to take away from students the reality of experimental experience, is to denature the subject itself.

In order to judge which of these points of view we should be most swayed by, we need answers to these two questions:

(1) have any departments in this country introduced dry labs successfully, as a major, formal part of their teaching curriculum? and

(2) how did they solve the problems they must have faced?

That is why this workshop was organized.

What we saw at the workshop

The workshop began with overviews given by speakers from two different perspectives — from someone in a big multimedia unit (Jon Pearce, from the University of Melbourne's Science Multimedia Teaching Unit) and from someone with links to the scientific profession outside the University circuit (Rob Learmonth, who is a member of the editorial board of The Journal of Biochemical Education).

Next there were workshops run by two people who have been responsible for introducing a substantial program of computer experiences to first year students in their home departments, as alternatives to standard 'wet' labs — Rob Capon, School of Chemistry at Melbourne University, and Fred Pamula, Department of Biology at Flinders University.

There were demonstrations of particular packages which are being used as alternative-to-laboratory experiences, from Bill Loneragan (University of Western Australia) and Ralf Cord-Ruwish (Murdoch University of Technology). And lastly there were examples of materials designed to prepare students for traditional laboratory work — "pre-lab" packages from Audrey Wilson and Roger Lewis of the University of Wollongong.

What did we learn?

(1) Teaching effectiveness

For those who might not have been convinced already, it was clearly demonstrated that it is possible to develop new materials which contribute substantially to the learning experiences of students in the laboratory setting. It was shown that computers can bring to life difficult concepts, especially in the visualization of three-dimensional structures in chemistry, biology and biochemistry. They can offer a rich compendium of resources on which students can graze at their leisure, which should, in principle, lay down patterns of learning they will use for the rest of their lives.

At the same time it was stressed that the development of these kinds of materials is inordinately time-consuming and costly. Were it not for the CAUT teaching development grant scheme, it is doubtful if many of the items on show would ever have seen the light of day. How the next generation of innovations is to be financed, or how any updating is to be achieved is anybody's guess.

It was agreed however that the greatest area of deficiency at present lies in the *evaluation* of materials being produced. Flinders University takes steps to monitor how students perform in standard examinations after having been exposed to the new materials; but by and large the questions of whether the new materials really do improve learning is too difficult. Perhaps that is the next hurdle, and we can only hope that future teaching development initiatives will provide the necessary funding to ensure that research into student learning is part of the deal.

(2) Teaching efficiency

Perhaps the most striking fact that emerged from the workshop was that, of the 200 or so university science departments in Australia, only a very small number indeed (of order 10) have actually replaced wet labs with dry labs. Of particular interest were the two examples where the first year practical (wet) laboratory teaching has been cut in half, and 50% of the time formerly allocated to that is now filled with computer-centred experiences. These are mainstream courses, taken by the majority of first year students in those institutions. The question begged to be answered: how did the two developers persuade their host departments to allow this Trojan horse into their midst?

There seemed to be two major considerations.

(a) The Melbourne model was careful to single out for replacement, only those particular learning exercises which didn't necessarily belong in a laboratory in the first place (construction of molecular models). "Real" laboratory experiments were left alone.

(b) The Flinders model took care to identify particular experiments which were particularly expensive (spectroscopy) or dangerous and to replace those. Again, the safe, inexpensive "real" experiments were not touched.

Perhaps it was this concern for the sensitivities of their colleagues which won the day.

In both cases, the projects were carried out because of the enthusiasm of particular persons, and the question must be asked: what will happen to those courses when those people leave, or go on sabbatical or move on to different teaching duties? With many teaching innovations, when the person responsible bows out, the innovation is often allowed to stop, simply because that is the easiest thing for the host department to do. In these two cases, since the dry lab courses are a major component in the curriculum, it would in fact be quite expensive for the department to replace them. Perhaps these two do represent a permanent change to the way we teach science. Only time will tell.

Conclusions

It is not surprising that the workshop did not come up with definitive answers to any of the big questions. What was interesting was that, of the nearly one hundred academics who attended, and who were all there because (presumably) they were pre-disposed to look favourably on the idea of dry labs, not one believed that science courses should abandon the ideal of having students perform real experiments in 'wet' laboratories. Rather every one believed that the proper job of the new technology was to *enhance* the laboratory experience, whether by pre-lab packages, or by streamlining analysis of results, or by better graphical representations of theoretical models — or by replacing some experiments.

At the same time, however, everyone was aware of the costs of the new technology. It may well be that the crippling expense of re-equipping computer labs every few years may yet sink the whole enterprise. But at least the financial burden of *developing* materials can be contained.

The way universities organize their teaching has often been likened to a cottage industry. Each teacher develops their own course from the ground up with little reference to what has gone before. In some respects this is a feature, not a bug. It guards against students' continuing to receive ideas and opinions that have passed their use-by date. But, because of the expense of the new technologies, we must join the industrial revolution. We cannot all afford to develop our own materials. We must get into the habit of working in consortiums and share the load. The fact that this workshop brought together many of the active developers in the country may make that goal just a little less remote, and perhaps UniServe•Science might be able to take a leading role in making such consortiums happen.

On that there was agreement.