

How Can We Encourage Teachers to Use Computer-based Alternatives: The UK Higher Education Experience

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Summary — Computer-assisted learning (CAL) programs, which are now widely available, have the potential to make a significant contribution to reducing the use of animals in teaching, particularly in pharmacology and physiology. A number of databases exist to support teachers in finding information about potential alternatives. The evidence from a number of evaluative studies is that computer programs that provide a virtual simulation of an animal lab can achieve many of the teaching and learning objectives for many students at least as effectively as the live experience. However, the key to reducing animal use is persuading teachers to integrate the alternatives into mainstream practice. Proven strategies to facilitate this process are described.

Key words: *computer-based alternatives, higher education, implementation.*

Introduction

Across Europe, animals have been traditionally used in teaching undergraduate students in courses in which pharmacology and physiology are major components. Over the past decade, the number of animals used for this purpose in higher education in the UK, as recorded in Home Office statistics (1), has fallen, despite a large rise in student numbers. Although the recorded numbers may be an underestimate of the actual numbers of animals used, it is clear that other factors have contributed. One of the contributing factors is undoubtedly the widespread availability of computer-based alternatives at relatively low cost. Most have been developed by enthusiasts to support their own teaching, and the pedagogical basis is well established. Some are designed to better prepare students who will perform the animal lab at a later date; others are designed to offer a viable alternative to a class that, for a variety of reasons, has now been dropped from the curriculum, e.g. large animal practicals, such as the traditional dog lab in pharmacology, are now much too expensive. Where these programs have been developed by a teacher for their own use, they are usually well-integrated into the curriculum, deployed by an enthusiast (the developer) and effective in achieving the learning objectives for which they were designed.

However, the situation is sometimes quite different when these programs are made available to other teachers. The availability of alternatives does not necessarily mean a significant fall in animal use for teaching purposes, as this will not happen unless the alternatives are successfully integrated into mainstream teaching. There are several key

steps in persuading teachers to use alternatives. They need to:

- be made aware that the alternatives exist;
- be persuaded of their usefulness; and
- be given advice and exemplars of strategies that will help them to integrate the alternatives into their teaching practice.

Raising Awareness and Providing Useful Information

A number of alternatives databases exist (e.g. NORINA, InterNiche, Altweb) describing a wide range of alternatives suitable for a variety of levels. The information they provide is product-centred and probably of insufficient detail to enable teachers to decide whether a particular alternative is likely to be of real use to them. Assuming a teacher can identify a number of potential alternatives from these databases, the next stage is to obtain copies so that they can evaluate them. This is time-consuming and many teachers, given the numerous calls on their time, don't get beyond this stage.

A project to actively promote the use of alternatives (European Resource Centre for Alternatives to using animals in higher education: EURCA at <http://www.eurca.org>) has recently been established (2, 3). The project has three major strands: a website containing an information-rich, searchable database (e.g. product information plus commissioned reviews, additional support materials, such as workbooks or study guides, learning objectives,

educational level; results of evaluations, user comments, discussion area); outreach activities such as taking the Resource Centre to relevant scientific meetings to promote the educational effectiveness of alternatives; and establishing a network of teacher contacts in countries across Europe who will act as advocates for the project. The strategy is to provide teachers with as much information as possible about selected alternatives to enable them to evaluate potential usefulness and to give them advice on how to successfully integrate alternatives into their teaching.

Persuading Teachers that Alternatives can be Educationally Effective

One of the most effective ways of persuading teachers of the value of alternatives is to demonstrate how they can be used and to present evidence of their educational effectiveness in a form relevant to their circumstances. A number of studies have been conducted to measure the educational effectiveness of computer-based alternatives by comparing learning outcomes with those from traditional wet labs. In general, these demonstrate that high quality alternatives are able to achieve many of the learning objectives, while concurrently promoting interactive, resource-based learning and the development of IT skills (4–11). Clearly, laboratory skills, animal handling skills and surgical/dissection skills cannot be adequately taught using a virtual environment, and if teachers decide that learning and practising these skills are fundamental objectives of a laboratory class then there really is no alternative to the animal lab.

Integrating Alternatives into Mainstream Practice

Experience suggests that it is not sufficient for teachers to simply make computer programs such as those described available over a campus network (12). This would be analogous to providing students with an animal preparation and a selection of drugs and expecting them to learn something about drug action through non-structured investigation. This scenario would not happen — tutors would be present in the laboratory and would provide students with learning objectives, a practical schedule to give structure to the class and some sort of assessment. As students adopt much more strategic patterns of learning, assessment is the key to successful implementation (13).

In the same way, the computer-based alternatives were designed to replace the animal preparation or to provide data from a tutor-determined set of experiments directed toward meeting certain learning goals. Some of them have exemplar support materials (workbooks/study guides) associated with

them, and some contain built-in learning objectives and self-assessments. They are designed to be used in a tutor-supported learning environment, and if they are to be used for self-directed learning, then tutors must provide adequate support materials and learning must be assessed.

Successful integration of alternatives into teaching depends on several factors, some of which are teacher-centric, others are student-centric. Teachers are often resistant to change and to adopting teaching programmes developed by others (the “not-invented-here-syndrome”). To use an alternative to replace an animal lab requires them to develop some support materials that may be similar to the laboratory schedule they would have developed for the animal lab. This would include learning objectives, a series of tasks and exercises designed to focus students on achieving the learning objectives and some form of assessment. By designing the “wrap-around” support materials themselves, teachers acquire ownership of the teaching session and the computer-based alternative substitutes for the animal or animal tissue as the means of generating data.

Assessment is crucial if students are going to take the teaching session seriously. A government-funded project in the UK under the Teaching & Learning Technology Programme investigated whether providing teachers with a set of exemplar support materials (consisting, for example, of workbooks, self-assessment activities, case-based and problem-based learning scenarios and assessments) could facilitate integration of computer-assisted learning (CAL) into pharmacology teaching. The results of evaluation studies suggest that this approach can be successful (14–16).

Using CAL to Reduce Animal use in Research

CAL programs can also contribute to a reduction in animal use for research. In excess of 50 million animals are used in biomedical research in the world each year (17). For both ethical and economic reasons, it is important that research scientists use experimental animals efficiently and in the minimum numbers consistent with achieving the scientific objectives of the study. More-effective experimental design could help to achieve a significant reduction in the number of animals used and, by improving the repeatability of animal experiments, could make alternative methods easier to validate. A CAL program designed to teach scientists how to estimate the number of animals needed, the importance of uniformity, how to deal with variability and how to increase efficiency, and therefore cost-effectiveness, of their experiments has been developed (18). It is aimed at all research scientists using experimental animals, but the principles of

experimental design are applicable to most areas of biological and medical research. The CAL program combines real life scenarios, working examples and background theory, and throughout, the student learns by exploration and engages in interactive practical exercises that give hands-on exposure to the key concepts in experimental design.

Conclusion

Technological teaching aids can contribute to reducing the use of animals in teaching, through computer-simulations of traditional animal labs and research and through supporting better teaching of experimental design. High quality computer-based alternatives to animal labs in undergraduate pharmacology and physiology are now widely available at relatively low cost, and a number of initiatives are under way to disseminate useful information and to raise awareness of the potential they offer. Persuading teachers of the educational validity of these alternatives is also crucial, and studies that compare the effectiveness of the virtual lab with the animal lab in achieving learning objectives play an important part. To be successful, the alternatives have to be well integrated into the curriculum, and they need to be assessed. Assisting teachers in the development of "wrap-around" support materials is one strategy that has proved successful.

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