



Impact of animal studies and alternatives on learning.

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Main points to be covered:

- ❖ Animal use in HE teaching in UK
- ❖ Learning objectives of laboratory practical classes?
- ❖ What alternatives are there to using animals?
- ❖ Do they work?
- ❖ How can we encourage their use?



The context: Animal use in HE teaching in UK

- ❖ Educational use is <1% of total but still >6000 each year
- ❖ Trend is downwards despite increased student numbers
- ❖ This is probably a gross under-estimate
- ❖ Animals (mostly **isolated tissues from killed rodents**) are used primarily for **undergraduate labs (practical classes) in pharmacology, physiology, animal lab sciences, anatomy**



Animal Labs: what are the learning objectives?

Teaching and practising:

- laboratory skills
- general animal handling skills;
- imparting good ethical thinking
- preparation-specific animal skills
- new knowledge and reinforcing existing
- data handling skills
- experimental design skills
- communication skills (oral, written)
- group work
- promoting staff-student interaction



Animal Labs: what are the benefits and costs?

❖ Benefits:

- promote active, interactive learning
- group activities
- promote staff -student contact
- vehicle for teaching & learning lab skills

❖ Costs:

- heavy on staff and student time
- require technical support, equipment, consumables, animals, specialist accommodation
- negative student perceptions of 'failed' experiments



What alternatives are there?

Ideally these should maintain the benefits & reduce the costs

- ❖ Computer-based simulations
- ❖ Video and interactive video
- ❖ mannekins (Kokar rat, microsurgery), models and simulators
- ❖ human experiments
- ❖ non-animal experiments (e.g. using plant tissues, post-mortem material, cultured cells)



What are computer simulations?

- basically there are two types.

❖ Simulations of preparations:

- use models to generate tissue responses
- allow control over experimental parameters - good for design
- highly flexible
- need direct/indirect tutor support

❖ Examples:

Guinea pig Ileum, Frog Skin, Squid Axon, Exercise Physiology, Blood Physiology

Ileum, Cardiolab, Vascular Rings, Sciatic nerve-anterior tibialis

SciMuscle, SciMuscle, SciMuscle



What are computer simulations?

- basically there are two types.

❖ Simulations of experiments:

- use 'real' data so responses are lifelike
- use tutor-designed i.e. relevant experiments
- may provide on-screen support & SAQs

❖ Examples:

Nerve Physiology, Muscle Physiology, Frog Heart, Intestinal Absorption, Cat Nictitating Membrane, Langendorff Heart, rat

Blood Pressure, Inflammation Pharmacology, Finkleman, Respiratory Pharmacology, Intestinal Motility, Renal Function

Do they work?

The evidence is YES

BUT:

- ◆ it depends on what you measure.
- ◆ a recognition that different objectives are achieved.

Tutors must decide the PRIMARY objectives for their students.

Do they work? - some of the evidence

- ❖ many learning objectives can be addressed:
 - knowledge gain is equivalent
 - data handling skills
 - experimental design skills
 - communication skills (oral, written)
 - group work
 - promoting staff-student interaction
- ❖ students are positive about using CAL
- ❖ costs are less
- ❖ better support for weaker students



Evaluation of computer simulations Retrospective Studies: CAL simulation versus live animal lab.

- ❖ Compare lab marks of **different** cohorts
- ❖ **Control** - undergrads doing live frog nerve experiment
- ❖ **Test** - CAL simulation of same experiment.
- ❖ no significant difference in lab report marks
- ❖ *Clarke, ATLA 14: 134-140 (1987)*
- ❖ *Dewhurst, et al ATLA 15: 280-289 (1988)*



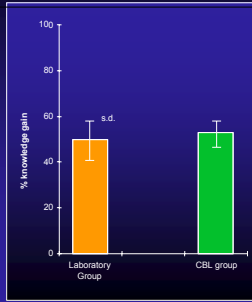
Prospective study: CAL simulation used as an alternative to a specific animal laboratory practical

- ❖ **BSc** (Hons) Physiology students
- ❖ Subject - **intestinal transport of nutrients**
- ❖ Mode: mini project (10 full days) in laboratory
- ❖ Experiment - everted, intestinal sac of the rat
- ❖ CAL simulation of expts + workbook
- ❖ Control & Test groups from same cohort
- ❖ *Dewhurst et al (1994) Amer. J. Physiol. 267 (Adv. Physiol. Educ. 12) S95-S104*



Findings: 1. Mean gain in knowledge

- ❖ students tested before (pre) and after (post) period of study
- ❖ used test comprising 50 questions (MCQ, short answer, problem solving, data interpretation)
- ❖ knowledge gain calculated as (post-test score) - (pre-test score)
- ❖ no significant difference

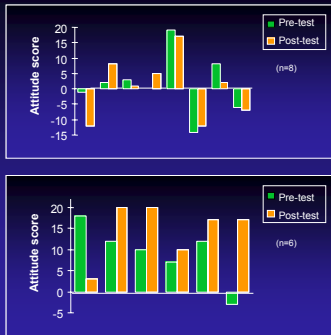


Findings: 2. Attitude to using CAL as an alternative

Attitude Scales

- ease of use
- perception of effectiveness
- learning style preferences
- perception of knowledge gain
- time & place

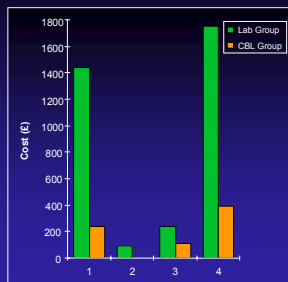
upper graph - Control Group (Animals)
lower graph - Test Group (CAL)





Finding: 3. Comparison of resources required

- ❖ **KEY** (1993 prices)
 1. staff time (lecturers:£40/hr; demonstrators:£10/hr)
 2. technicians time (£10/hr)
 3. materials
 4. total cost





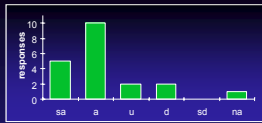
Prospective study: CAL simulations of pharmacology 'wet labs' versus 'dry labs'

- ❖ Five studies of first year BSc Pharmacology students
- ❖ Each study divided cohort into two groups (not random)
 - ◆ 1. performed traditional 'wet lab' practical
 - ◆ 2. Used computer simulation with schedule
- ❖ Teachers assessed performance by quality of 2-part 'write-up'
 - ◆ 1. Practical component
 - ◆ 2. Theory component
- ❖ Results:
 - ◆ Practical: marks of students using simulations significantly better than marks of students performing wet labs
 - ◆ Theory: no difference in performance between groups
 - ◆ Some evidence that 'wet lab' students developed longer-lasting (deeper) learning
- ❖ Hughes (2001) TIPS 22: 2, 71-74



Impact

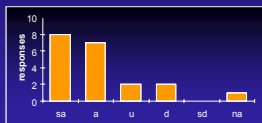
1. Do CAL packages provide a suitable alternative to animal based practicals ?



sa - strongly agree a - agree
sd - strongly disagree d - disagree
u - undecided na - not applicable

2. Has CAL significantly reduced the number of animals used in teaching ?

Reference: Dewhurst & Jenkinson (1995) Alternatives to Lab. Animals 23, 521-530





How can we encourage the use of simulations? - Key steps

- ❖ Make teachers aware of available alternatives (EURCA)
 - ◆ Resource Centre
 - ◆ 'content rich' database
- ❖ Successful implementation requires tutors to develop support materials.
 - ◆ Wrap-around materials often text-based study guides or workbooks
 - ◆ similar to lab schedules and should include objectives and outcomes
 - ◆ exercises, tasks and activities should be built-in



Disseminating information - EURCA project

❖ Resource Centre with a collection of alternatives

- role is to be pro-active in promoting alternatives to teachers
- high visibility at learned society meetings in Europe
- collection of alternatives with which teachers can interact
- 'manned' by academics experienced in using alternatives in their own teaching

❖ Web-based database of selected alternatives for HE

- details, reviews, support materials, data from evaluative studies, users comments/experiences

❖ Electronic Newsletter, discussion groups, network of enthusiasts



What sort of tasks/activities?

May be individual or group-centred.

❖ Record and Measure - test accuracy of measurements

- observe responses of...to...
- compare....
- measure ... quantify....

❖ Data Analysis

- plot... extrapolate.....
- determine... calculate...

❖ Data Interpretation Skills

- describe.... list...
- explain.... discuss....
- formulate a model to... identify unknown X



What sort of tasks/activities?

❖ Presentation Skills

- construct a table to... draw a graph to..
- prepare an abstract... prepare a poster
- give an oral communication to..
- write a report

❖ Experimental Design

- design an experiment to...
- identify the unknown X...
- formulate a hypothesis to explain... test your hypothesis
- determine a range of suitable drug concentrations to...

❖ Knowledge of underlying principles



Summary

- ❖ Animals are still being used (often unnecessarily) in HE
- ❖ Teachers should:
 - audit their courses and define teaching objectives more clearly,
 - justify inclusion of animal labs and use alternatives where possible
- ❖ the evidence is that alternatives:
 - are cost effective providing lab skills are not primary learning objectives,
 - are acceptable to students if they are well integrated into a course,
 - can reduce animal use whilst achieving many learning objectives
- ❖ to have an impact on animal use
 - teachers' level of awareness must be increased - they need a rich information database - EURCA
 - to use them successfully teachers must develop their own support materials

Thank you for listening

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