

Corrections for 03 February 2003 document

Abstract

Paragraph 3, sentences 4 & 5 should be:

Furthermore, of the six studies performed at the undergraduate level with sample sizes larger than 100, three studies show equivalent results, and three find alternatives to be superior. All 58 articles are listed and summarized in Appendix C.

Appendix C

Paragraph 1 should be:

Note: this list was compiled by the Humane Society of the United States and the UIUC Student Senate subcommittee on this issue. Both SILA and the subcommittee have paper copies of all these articles, and they are available upon request.



New additions (to be put in alphabetical order by author under appropriate subsections):

Studies with sample size greater than 100 students, conducted at undergraduate level:

—Predavec, M. 2001. Evaluation of E-Rat, computer-based rat dissection, in terms of student learning outcomes. *Journal of Biological Education* 35 (2): 75-80.

First year undergraduate biology students used either E-Rat (233 students) or an animal dissection (168 students) for their lab. Students using the alternative performed significantly better on all types of evaluation (text questions, picture-based questions, and questions based on actual dissected rats) than students who did the animal dissection.

Studies demonstrating equal or comparable student performance between dissection and alternative methods:

—Greenfield, C.L., A.L. Johnson, D.J. Schaeffer & L.L. Hungerford. 1995. Comparison of surgical skills of veterinary students trained using models or live animals. *Journal of the American Veterinary Medical Association* 206 (12): 1840-1845

Third-year veterinary students were split into two groups, each of which had equal levels of surgical experience. One group did two surgery labs on a real animal, the other groups used a model. There was no significant difference between the performance scores of the two groups. Some scores for certain portions of the lab improved more for the traditional group, other portions showed more improvement with the model group.

—Hughes, Ian E. 2001. Do computer simulations of laboratory practicals meet learning needs? *Trends in Pharmacological Sciences* 22(2): 71-74

The marks obtained by 91 first year BSc pharmacology students exposed to "wet" or simulated practicals are analyzed. "Poorer performance in practical write-ups by students doing 'wet' practicals compared with those doing simulations can be explained by the quality of the data that the students obtain. In examinations, students perform equally well except with questions that are related to the experimental details of 'wet' practicals; students taught using such 'wet' practicals perform better in response to these questions."

—Kirkwood, M, B. Sharp, G. de Vito & M.A. Nimmo. 2002. Assessment of aerobic endurance: a comparison between CD-ROM and laboratory-based instruction. *British Journal of Educational Technology* 33 (2): 159-172.

A CD-ROM that simulated aerobic exercise was compared to a traditional lab (14 students in each group). Knowledge gain was equal in the two groups, and the CD-ROM was well rated by students who used it. However, the CD-ROM appeared to engender less student interaction than the traditional lab.

—Kinzie, M.B., V.A. Larsen, J.B. Burch & S.M. Boker. 1996. Frog dissection via the World-Wide Web: Implications for widespread delivery of instruction. *Educational Technology Research and Development* 44 (2): 59-69.

A videodisc-based frog dissection program was previously found to be equivalent in teaching the material to an animal dissection. Using the program as preparation for students who dissected also enhanced their learning. The program was successfully implemented through the world wide web.

—Pavletic, M.M., A. Schwartz, J. Berg & D. Knapp. 1994. An assessment of the outcome of the alternative medical and surgical laboratory program at Tufts University. *Journal of the American Veterinary Medical Association* 205 (1): 97-100

Laboratory programs using live dogs (36 students) were compared to labs using ethically sourced cadavers (12 students). Each lab performed some procedures more than the other, but overall training was the same. Employers' evaluations of the students (one year after they had graduated and begun work) were not significantly different between the two groups.

—Regula, G., W. Heuwieser, T. Hallmann & K. Schimmpfennig. 1999. Teaching bovine reproduction with the computer: A comparison between a tutorial and a case-based approach. *Journal of Veterinary Medical Education* 26 (1): 10-15

German veterinary students evaluated both a computer tutorial and a clinical case study. After the experiment, 90% of the 105 students wanted more computer-assisted learning in the curriculum. Furthermore, students said that they learned as much or more from the tutorial than from the case study (depending on which order they did them in). However, students generally liked the idea of doing both activities.

Studies favoring alternatives (while not comparing normal practice to alternatives):

—Arluke, A. & F. Hafferty. 1996. From apprehension to fascination with "dog lab" – The use of absolutions by medical students. *Journal of Contemporary Ethnography* 25 (2): 201-225.

This article discusses how students who were uncomfortable performing a terminal vivisection later described it positively. "The authors argue that this is possible because the students learn absolutions that permit denial of responsibility and wrongdoing." It also mentions that "Researchers have had little success in demonstrating the educational effectiveness of hands-on experience with living animals (Blosser 1983; Dawson et al. 1991; Fawver et al. 1990). Not surprisingly, advocates of these labs have had little to argue with other than their own personal, intuitive experience and beliefs (e.g., Randall and Burkholder 1990)."

—Baggott, L.M. & B. Wright. 1996. PhotoCD in biology education. *American Biology Teacher* 58 (7): 390-395.

Describes the integration of Photo CD into cellular biology classes as an alternative to electron microscopy. Student evaluations were positive; 83% said that the experience had increased their interest in and knowledge of cell biology.

—Balcombe, J. 1997. Student/teacher conflict regarding animal dissection. *American Biology Teacher* 59 (1): 22-25.

This article discusses several surveys showing that many students have objections to dissection or vivisection, but don't speak out. It also talks about why some students remain silent, why alternatives should be offered, and the validity of alternatives.

—Barr, G. & H. Herzog. 2000. Fetal pig: The high school dissection experience. *Society & Animals* 8 (1): 53-69.

Seventeen high school biology students in a rural area were interviewed about their experience in a series of fetal pig dissection sessions. "Most thought that dissection was a positive experience, but a substantial minority viewed it primarily in negative terms. Almost all the students had some ambivalence about aspects of the fetal pig lab and believed that alternatives should be provided for students who object to the practice." The authors "argue that dissection remains a viable educational tool but should be an optional rather than compulsory component of the curriculum."

—Bauer, M.S. 1993. A survey of the use of live animals, cadavers, inanimate models, and computers in teaching veterinary surgery. *Journal of the American Medical Veterinary Association* 203 (7): 1047-1051.

A survey dealing with the use of live animals, cadavers, inanimate models, and computers in teaching veterinary surgery was mailed to individuals in the surgery sections of all 31 veterinary schools in the US and Canada. Results showed that the use of cadavers and models is increasing, while the prevalence of live-animal labs is decreasing. The author calls for a greater effort to evaluate the efficacy of each kind of lab in order to determine whether this shift should be encouraged or reversed.

—Boone, R.; Higgins, K.; Williams, D. 1997. Computer-based multimedia and videodiscs: uses in supporting content-area instruction for students with LD. *Intervention in School and Clinic* 32 (5): 302-311.

The application of videodiscs and related multimedia to education of elementary, middle school, and high school students is described, particularly as it pertains to students with learning disabilities. The realism and sense of interaction provided by such media facilitate understanding of abstract concepts in students who learn best through graphic representations.

—Cunningham, P.F. 2000. Animals in psychology education and student choice – Commentary. *Society and Animals* 8 (2): 191-212.

This article identifies some of the important issues that underlie student-teacher conflicts regarding animal experimentation and dissection in psychology education. It also discusses why establishing an openly declared student choice policy at schools that use animals in psychology education is a reasonable thing to do and describes how a student choice policy works in practice.

—Cunningham, P.F. 2003. Animal use, Student Choice, and Nonanimal Alternatives at “America’s Best” Undergraduate Colleges. Unpublished research (will be published in *Teaching of Psychology* in October).

Chairs at 262 prominent U.S. and Canadian colleges and universities (75% response rate) completed a questionnaire about animal use, student choice policies, and alternatives to the use of animals in undergraduate psychology educa-

tion. Also discussed are the educational policy implications of practices in the undergraduate psychology animal-based curriculum at “America’s best” colleges, especially the common practice of advising reluctant students away from animal course work.

—Dewhurst, D., I. Hughes & A. Williams. 1996. An interactive computer program to replace in vivo experiments on rat blood pressure for teaching undergraduate students. *Alternatives to Laboratory Animals* 24 (5): 707-714 (ABSTRACT ONLY)

“An interactive computer program is described, which presents simulated data for a range of tutor-designed, structured investigations performed in vivo in the anaesthetized rat... It has been evaluated with final year BSc (Hons) Pharmacology students at one UK university, where it was used to prepare students for the live animal practical. The results of this small study were largely favourable.”

—Dewhurst, D. & L. Jenkinson. 1995. The Impact of Computer-Based Alternatives on the Use of Animals in Undergraduate Teaching – A Pilot Study. *Alternatives to Laboratory Animals* 23(4): 521-530

Twenty universities using computer-assisted learning (CAL) packages on the use of animals were surveyed. “The study found that in most departments the packages were used in a staff-supervised learning situation, to either replace or support a practical class. Their use saved academic and non-academic staff time, and they were considered to be less expensive and an effective and enjoyable mode of student learning. It was also clear that their use had contributed to a significant reduction in animal use.”

—Hansen, L.A. & G.R. Boss. 2002. Use of live animals’ in the curricula of US medical schools: Survey results from 2001. *Academic Medicine* 77 (11): 1147-1149. (ABSTRACT ONLY)

“During the last seven years, the use of live animals in medical school pharmacology and physiology courses has continued to decline, but the use of live animals in surgery courses has remained stable. Overall, the majority of U.S. medical schools (68%) do not use live animals in any of their pharmacology, physiology, or surgery courses, and when live-animal laboratories are used, attendance is usually optional.”

—Kohlmeier, M., L. Althouse, F. Stritter, S.H. Zeisel. 2000. Introducing cancer nutrition to medical students: effectiveness of computer-based instruction. *American Journal of Clinical Nutrition* 71 (4): 873-877

Computer-based instruction has been introduced at the University of North Carolina at Chapel Hill to augment its nutrition course for first-year medical students. The percentage of correct responses to 20 knowledge questions increased from 22% before the module was used to 86% immediately after its use. When a randomly selected subsample of 25% of the students took the same test 3 mo later, they answered 62% of the questions correctly. The increase in the percentage of students who felt prepared to provide advice regarding nutrition's role in cancer prevention (from 5.7% to 66.9%) suggested a successful subjective learning experience.

—Ralph, C.L. 1996. The illusion of the instructional biology laboratory. *The American Biology Teacher* 58 (3): 142-146.

The author argues that most time spent in biology labs is wasted, and that the replacement of some labs with electronic media designed to disseminate the same information results in a better learning environment for most students, a more efficient use of available time, and similar or improved understanding of subject material. The author briefly summarizes literature from 1969-1994 supporting the idea that electronic media are effective teaching tools in biology labs.

—van der Valk, J., D. Dewhurst, I. Hughes, J. Atkinson, J. Balcombe, H. Braun, J. Gabrielson, F. Gruber, J. Miles, J. Nab, J. Nardi, H. van Wilgenburg, U. Zinko & J. Zurlo. 1999. Alternatives to the use of animals in higher education – The report and recommendations of ECVAM Workshop 33. *Alternatives to Laboratory Animals* 27 (1): 39-52.

Results from the workshop on Alternatives to the Use of Animals in Higher Education are provided. They recommend that alternatives to animal use be implemented wherever possible, and that more work is needed to catalogue what alternatives are available and how effective they are

—Watson, B. 2001. Key factors affecting conceptual gains from CAL materials. *British Journal of Educational Technology* 32 (5): 587-593.

Key factors that affect students' success with computer-assisted learning are identified (120 students were studied). It was found that students with prior experience in CAL gained the most from it, and recommended that first-time users of CAL be provided with a supplement (such as extra tutorials). The study also cites 19 other studies showing simulations to be equal or superior to real experiments.

—Wolfe, M., N.D. Barnard, S.M. McCaffrey. 1996. Animal laboratory exercises in medical school curricula. *Alternatives to Laboratory Animals* 24 (6): 953-956. (Abstract Only.)

In May 1994, a questionnaire on the use of animal laboratory exercises and suitable alternatives was sent to the chairpersons of the physiology, pharmacology and surgery departments of each of the 126 US medical schools. In comparison with earlier surveys, the information returned showed that animal use in medical schools, pharmacology courses, and surgery courses has significantly decreased. For the 53 schools that returned information from all three disciplines, 49% reported having no laboratory exercises involving animals in any of these disciplines. Computer programs and films were the most commonly used non-animal alternatives offered in physiology and pharmacology, while operating room experience was the most common alternative offered in surgery courses.

Studies with neutral or mixed results

—Dennis, M.B. 1999. Alternative training methods II: Incorporating inanimate surgical models. *Lab Animal* 28 (5): 32-36. (ABSTRACT ONLY)

Alternative training methods are increasingly used to teach surgical techniques. The author describes the advantages and disadvantages of traditional live animal laboratories and non-animal training methods.

—Dewhurst, D, H. Leathard & R. Ulyott. 1996. Intestinal motility: A computer simulation of the effects of drugs on colonic peristalsis, for teaching undergraduate pharmacology students. *Alternatives to Laboratory Animals* 24 (1): 11-19. (ABSTRACT ONLY).

Describes an interactive computer-assisted learning (CAL) program which is intended to support or replace an intestinal

motility lab, while achieving the majority of the same teaching and learning objectives. The program covers: a) the actions of drugs that affect cholinergic excitatory neurotransmission in the colon; b) the effects of sympathomimetic amines; and c) an investigation of the mechanism of action of the laxative, phenolphthalein.

—Franklin, S., M. Peat & A. Lewis. 2002. **Traditional versus computer-based dissections in enhancing learning in a tertiary setting: a student perspective.** *Journal of Biological Education* 36 (3): 124-129.

Students in a tertiary, first-year human biology course were surveyed about their usage and perceptions of the usefulness of a cat dissection exercise using real cat cadavers, a computer-based alternative, or a combination of the two. "The real dissection was used as a learning resource by 80% of the student cohort while only 15% used the computer-based dissection material. Of those students who did use the computer-based dissection, two thirds of them found it useful for learning both structure and function of body systems; of those students who used the real dissection, 72% found it useful for learning structure but only 62% found that it helped in learning function. Of the entire cohort surveyed, 90% agreed that biology students should dissect an animal to help learn about anatomy." The introduction also provides a good summary of research in this field.

—Greenfield, C.L., A.L. Johnson, L. Klippert & L.L. Hungerford. 1995. **Veterinary student expectations and outcomes assessment of a small animal surgical curriculum.** *Journal of the American Medical Veterinary Association* 206 (6): 778-782.

The results of surveys completed by 40 UIUC College of Veterinary Medicine seniors prior to graduation, 59 recent graduates of the College of Veterinary Medicine, and a "large group" of small animal practitioners are described. The results suggest that veterinary students receive excessive training on complex surgical procedures that they will rarely use after graduation. The article suggests a "back to the basics" approach in which surgical laboratory sessions concentrate on the most fundamental and frequently used procedures. More complex procedures can be referred to specialists, or learned subsequent to graduation as necessary.

—Marion, R., B.R. Niebuhr, E.R. Petrusa & D. Weinholtz. 1982. **Computer-based instruction in basic medical science-education.** *Journal of Medical Education* 57 (7): 521-526.

This study considers computer-based instruction as an alternative to lectures, traditional tests, and other classroom activities but not including dissection or vivisection. "The literature on computer-based instruction in the basic medical sciences was examined to assess the efficacy of such instruction and to make recommendations about the design of future studies. The research did not indicate that the performance of students is improved with computer-based instruction, although it did indicate that they spent less time studying than with traditional methods of instruction."

—Rosse, C. 1995. **The potential of computerized representations of anatomy in the training of health care providers.** *Academic Medicine* 70 (6): 499-505.

The advantages of cadaver dissection and computer-based models in teaching human anatomy are compared. According to the author, the main advantage of dissection of cadavers is that it provides a first-hand experience to the students, and the resulting feeling of discovery may encourage further learning. Another advantage is that students generally work in teams, and this presents the opportunity to debate anatomy among the team as the dissection unfolds. The chief advantage of computer-based models is that they facilitate the integration of different types of information, for instance, the relationship between three-dimensional structure and function. The use of 3-D models allows a shift in emphasis from memorization of body parts to development of anatomical reasoning skills.