

NON-ANIMAL LEARNING METHODS IN SCIENCE EDUCATION: Pedagogical Efficacy, Cost Savings, and Humaneness



©istockphoto.com/Razvan

Summer 2009

PREPARED BY PEOPLE FOR THE ETHICAL TREATMENT OF ANIMALS

**Non-Animal Learning Methods in Science Education:
Pedagogical Efficacy, Cost Savings, and Humaneness**

Prepared by People for the Ethical Treatment of Animals

2010

Contents:

- Introduction
- Educational Efficacy of Non-Animal Learning Methods in Science Education
- Examples of Computer-Based Learning Methods
- Endorsement of Non-Animal Methods by Scientists, Educators, and Lawmakers
- Conclusion
- Additional Resources



HEADQUARTERS
501 FRONT ST.
NORFOLK, VA 23510
757-622-PETA
757-628-0781 (FAX)

Introduction

Every year in the U.S., an estimated 20 million animals are used for educational purposes.¹ These animals are obtained from a variety of different sources and suffer immensely as a result of being trapped, transported, confined, experimented on, and killed for classroom science laboratories.

Millions of frogs, for example, are captured in their natural habitats every year and are killed for dissection or used while still alive in classroom biology experiments. The U.S. Department of the Interior has even stated that amphibian population declines can be attributed in part to the use of amphibians in dissection.² Fetal pigs are also used in dissection. Biological-supply houses obtain fetal pigs from slaughterhouses; the fetuses are cut from the bodies of pregnant sows after slaughter. These companies also purchase stray, lost, and abandoned cats from animal shelters or "bunchers"—dealers who illicitly obtain animals from back yards and the streets of the U.S. and Mexico. Millions of other animals, such as mice, rats, and rabbits, are bred at facilities that cater to businesses and schools that use animals in experiments and laboratories.

Fortunately, educators can help prevent this suffering *and* enhance students' learning experience by using some of the modern, life-affirming, educationally effective non-animal learning methods that are discussed in this packet.

Educational Efficacy of Non-Animal Learning Methods in Science Education

A recently published peer-reviewed journal article concluded that "alternatives are a viable method of instruction in the field of biomedical education."³ In all 17 studies that the authors reviewed, results associated with the non-animal method of instruction were equivalent or superior to results associated with the conventional animal-based method, including dissection. Another recent publication reiterated these results, concluding that non-animal methods have been responsible for providing students with "superior understanding of complex biological processes, increased learning efficiency, and increased examination results."⁴ It also reported higher confidence and satisfaction levels in students as well as improvements in their information-retrieval and communication skills and preparedness for laboratories. In terms of the benefits to educators, non-animal methods offer increased teaching efficiency, lower costs, and enhanced potential for the customization and repeatability of learning exercises.

In one series of studies, seventh-grade students "who were taught frog internal anatomy via either traditional frog dissection or CD-Tutorial ... retain[ed] the information equally

¹L.A. Hart *et al.*, *Why Dissection? Animal Use in Education* (Westport, Conn.: Greenwood, 2007).

²B. Baker, "New federal task force tackles amphibian troubles," *BioScience* 49.5 (5 May 1999).

³G.J. Patronek and A. Rauch, "Systematic Review of Comparative Studies Examining Alternatives to the Harmful Use of Animals in Biomedical Education," *Journal of the American Veterinary Medical Association* 230.1 (2007): 37–43.

⁴A. Knight, "The Effectiveness of Humane Teaching Methods in Veterinary Education," *ALTEX* 24.2 (2007): 91–109.

with an alternative versus traditional dissection."⁵ A study of secondary-level students in which one group of students used animal dissection and the other group used the Net-Frog interactive software found that the two groups performed equally on a test following the exercises.⁶ In another study, a video-disc simulation program was used to teach introductory undergraduate anatomy, and researchers concluded that "students taught rat anatomy via computer-based instruction scored higher on average than students taught using conventional dissection, regardless of how much time each student spent on the class."⁷

In terms of more "hands-on" learning methods, two recent studies have found that students who learned anatomy by doing something as simple as building clay sculptures of body systems scored higher than their classmates who performed cat dissections.^{8,9}

One software developer, Digital Frog International, Inc., conducted an in-depth study to evaluate the ways in which its programs meet the educational needs of American K-12 students.¹⁰ Evaluations are available for eight states, including California, New Mexico, Oklahoma, Missouri, Florida, Illinois, Michigan, and Texas. In addition, the independent California Learning Resource Network has also evaluated the Digital Frog software tools and found that they meet the state of California's educational objectives.¹¹

Teachers also benefit from using non-animal alternatives. Studies have shown that computer-based teaching methods "saved academic and non-academic staff time, ... were considered to be less expensive and an effective and enjoyable mode of student learning ... [and] contributed to a significant reduction in animal use."¹² Multiple studies have concluded that computer-based learning is more time-efficient than dissection and other animal-based teaching methods.^{13,14}

⁵C.S. Marszalek and J. Lockard, "Which Way to Jump: Conventional Frog Dissection, CD-Tutorial, or Microworld?" Proceedings of Selected Research and Development Papers Presented at the National Convention of the Association for Educational Communications and Technology (Houston: 1999).

⁶R.T. Strauss and M.B. Kinzie, "Student Achievement and Attitudes in a Pilot Study Comparing an Interactive Videodisc Simulation to Conventional Dissection," *American Biology Teacher* 56 (1994): 398–402 <<http://frog.edschool.virginia.edu>>.

⁷M. Predavec, "Evaluation of E-Rat, a Computer-Based Rat Dissection, in Terms of Student Learning Outcomes," *Journal of Biological Education* 35.2 (2001): 75–80.

⁸J.R. Waters *et al.*, "Cat Dissection vs. Sculpting Human Structures in Clay: An Analysis of Two Approaches to Undergraduate Human Anatomy Laboratory Education," *Advances in Physiology Education* 29.1 (2005): 27–34.

⁹H.K. Motoike *et al.*, "Clay Modeling as a Method to Learn Human Muscles: A Community College Study," *Anatomical Sciences Education* 2.1 (2009): 19–23.

¹⁰Digital Frog International, "DFI Software and Curriculum Standards," 2008 <<http://www.digitalfrog.com/resources/curriculum.html>>.

¹¹California Learning Resource Network, 2008 <<http://clrn.org/search/search.cfm?search=1&publisherid=425>>.

¹²D.G. Dewhurst and L. Jenkinson, "The Impact of Computer-Based Alternatives on the Use of Animals in Undergraduate Teaching," *ATLA* 23 (1995): 521–30.

¹³M. Predavec.

¹⁴Christine Youngblut, "Use of Multimedia Technology to Provide Solutions to Existing Curriculum Problems: Virtual Frog Dissection," unpublished doctoral dissertation, George Mason University, 2001.

In addition to the aforementioned benefits, it should be noted that replacing animal-based lessons with humane alternatives creates a more inclusive learning environment for students. Research has shown that students at all levels are uncomfortable with the harmful use of animals in classrooms. In addition, exposing young people to animal dissection as "science" can foster a callousness toward animals and nature and even dissuade some from pursuing careers in science.^{15,16} Students who are forced to take part in actions that they find ethically objectionable (or observe their peers participating in such actions) may also suffer psychological trauma, and placing students in these conflict-laden environments actually hampers their ability to learn new information.^{17,18,19}

Examples of Computer-Based Learning Methods

We are aware that there are many options available and that some, unfortunately, are out-of-date and do not accurately reflect the state of the art of dissection simulation. With such a large selection available, we realize that it can be difficult for educators to navigate the options effectively and find those that suit their needs.

The excellent computer-based simulations listed here can completely replace the use of animals. In addition, these alternatives provide students with a richer, fuller learning experience that enhances their science education; introduce them to ethical, modern science; and teach them compassion for animals and respect for nature. Just a few of the commercially available programs suitable for studying animal anatomy and physiology include DigitalFrog's Digital Frog 2.5, Tactus Tech's three-dimensional V-Frog software, Tangent Scientific's DryLabPlus Fetal Pig or DryLabPlus Suite (frogs, earthworms, rats, fetal pigs, crayfish, and perch), Glencoe's Interactive Dissections (frogs and earthworms), several programs from BioLab (fish, frogs, transgenic flies, fetal pigs, cats, and invertebrates), and Froguts (frogs, starfish, owl pellets, cow eyes, squid, and fetal pigs).

Animals (regardless of whether they are alive or dead) can only be used once, while these resources can be used for many years—an added benefit that could result in significant cost savings for teachers, school districts, and state educational systems. For example, a site license for Digital Frog 2.5—which allows educators to install the software on every computer in their school as well as burn up to 20 CDR copies—costs less than \$900.²⁰ Educators will receive a 30 percent discount on the Digital Frog 2.5 site license when it is purchased through the PETA Web site.²¹ PETA has also worked with Digital Frog

¹⁵D. Solot and A. Arluke, "Learning the Scientist's Role: Animal Dissection in Middle School," *Journal of Contemporary Ethnography* 26.1 (1997): 28–54.

¹⁶M. Stanisstreet, N. Spofforth, and T. Williams, "Attitudes of Undergraduate Students to the Uses of Animals," *Studies in Higher Education* 18.2 (1993): 177–96.

¹⁷P. Cunningham, "Animals in Psychology Education and Student Choice," *Society & Animals* 8.2 (2000): 191–212.

¹⁸E.S. Paul and A.L. Podberscek, "Veterinary Education and Students' Attitudes Towards Animal Welfare," *Veterinary Record* 146.10 (2000): 269–272.

¹⁹J.A. Kelly, "Alternatives to Aversive Procedures With Animals in the Psychology Teaching Setting" *Advances in Animal Welfare Science* (Boston: Martinus Nijhoff Publishers, 1986) 165–184.

²⁰Digital Frog International, "The Digital Frog Shop," 2008
<<http://www.digitalfrog.com/store/home.php?cat=253>>.

²¹<<http://www.petamall.com/PLPShop.asp?RecordID=509>>.

International to offer a 30 percent discount on all products at Digital Frog's Web site (use discount code **PETA30** at checkout).²²

Dr. Nancy L. Harrison, a board-certified anatomic and clinical pathologist at Scripps Memorial Hospital in California, gave a presentation ("Virtual Dissection: The Best of the Best") at the National Science Teachers Association (NSTA) national conferences in November 2007 and March 2008 in which she offered demonstrations of Digital Frog 2 and DryLabPlus's Fetal Pig software. Evaluations of these sessions by educators who attended showed that they strongly agreed that the sessions were useful, that they intended to use the material in their classrooms, and that the presentation should be offered at future NSTA conferences.²³ Dr. Harrison's narrated video demonstrations of both Digital Frog 2.5 and DryLabPlus Fetal Pig are available at peta.org/dissection.

Endorsements of Non-Animal Methods by Scientists, Educators, and Legislators

The growing consensus in the science education literature is that non-animal learning methods are equivalent or superior to animal dissections, whether measured by objective criteria or by student and teacher preferences. As a result, the NSTA amended its official position statement on animal dissection in 2008 to acknowledge the educational equivalence of non-animal learning methods and to encourage their use where teachers find appropriate.²⁴ The position statement of the National Association of Biology Teachers has also recently been amended to support the use of non-animal alternatives.²⁵

As of 2009, 15 U.S. states had enacted dissection-choice laws or policies that allow K-12 students to opt-out of dissection and require teachers to provide non-animal assignments. Many school districts, universities, and secondary schools have similar policies in place. Additionally, in response to ethical concerns about animal dissection and the availability of effective non-animal alternatives, several countries—including Argentina, Denmark, the Netherlands, and Slovakia—have banned dissection at the elementary and secondary levels, while countries such as Australia, India, and Italy no longer include dissection as a curricular requirement.²⁶

The use of non-animal learning methods also improves preparedness of students who are pursuing careers in the medical professions. Nearly 95 percent of U.S. medical schools—including such prestigious institutions as Harvard, Yale, and Stanford—have discontinued the use of live animals in teaching and no U.S. medical schools expect or

²²<http://www.digitalfrog.com/products/frog.html>.

²³Nancy Harrison, "Virtual Dissection: The Best of the Best," NSTA National Conference Session Evaluations, Nov. 2007 and Mar. 2008.

²⁴National Science Teachers Association, "Responsible Use of Live Animals and Dissection in the Science Classroom," 2008 <<http://www.nsta.org/about/positions/animals.aspx>>.

²⁵National Association of Biology Teachers, "NABT Position Statement: The Use of Animals in Biology Education" <<http://www.nabt.org/websites/institution/File/docs/use%20of%20animals.pdf>>.

²⁶Physicians Committee for Responsible Medicine, "Dissection Alternatives" <<http://www.dissectionalternatives.org/concerned/education.php>>. *See also*, "Frequently Asked Questions About Dissection," The Humane Society of the United States, 2008 <http://www.hsus.org/animals_in_research/animals_in_education/frequently_asked_questions_about_dissection.html>.

require students to have participated in animal dissection.²⁷ Furthermore, the American Medical Students Association (AMSA), the oldest and largest independent association of physicians-in-training in the U.S.,²⁸ passed a resolution in 2007 stating that it "strongly encourages the replacement of animal laboratories with non-animal alternatives in undergraduate medical education."²⁹

Conclusion

Replacing the use of animals in education with one or more of the many non-animal learning methods available today offers numerous benefits, including reducing the number of animals who are captured in the wild or bred to be killed for dissection; providing a richer, more inclusive learning experience for students; encouraging students to show respect for animals and nature; and conserving the valuable resources of schools and their educators. We encourage you to pass along this information to your colleagues and to contact People for the Ethical Treatment of Animals (PETA) if you have any questions or comments.

Additional Resources

Software can be obtained, in full and/or demo formats, in several ways. Several organizations offer educational-technology loan programs, including the following:

- ***The Science Bank
Animalearn***

The Science Bank will ship loaned items free of charge; educators pay return shipping only. Some items have limited availability, so educators are advised to send in their loan agreements at least a month ahead of time and allow one week for shipping. (<http://animalearn.org>)

- ***Biology Education Advancement Program (BioLEAP)
National Anti-Vivisection Society***

The BioLEAP program's library of non-animal learning methods includes dozens of high-relief, three-dimensional plastic models, computer software programs, color transparencies, videotapes, and other materials. A wide range of species is included in the library, from invertebrates to frogs, starfish, perch, sharks, rats, cats, fetal pigs, and humans.

(http://www.navs.org/site/PageServer?pagename=ain_edu_dissection_loan_program)

- ***Ethical Science & Education Coalition (ESEC) Lending Library
New England Anti-Vivisection Society***

The ESEC Lending Library offers a variety of educational materials, including computer software, videos, and monitoring equipment. Items can be borrowed for a two-week period and, depending on demand, subsequently renewed. Educators pay return postage only.

²⁷Physicians Committee for Responsible Medicine, "Medical School Curricula with Live Animal Laboratories" <http://www.pcrm.org/resch/meded/ethics_medlab_list.html>.

²⁸The AMSA is made up of more than 68,000 medical students, premedical students, interns, residents, and practicing physicians from across the U.S.

²⁹American Medical Student Association, "House of Delegates 2007 Resolution" <<http://www.amsa.org/about/ppp/vivi.cfm>>.

(http://www.neavs.org/esec/alternatives/alt_dissectionalternatives_ESEC_availability.htm)

- ***Humane Education Loan Program (HELP)***

The Humane Society of the United States

HELP's materials are available for the cost of return postage, although fines are levied for damaged or missing items. Valid credit-card information and an approximate return date are required before materials are released. Educators should contact HELP at least two weeks prior to the anticipated use date.

(http://www.hsus.org/animals_in_research/animals_in_education/humane_education_loan_program_help/)

- ***InterNICHE Alternatives Loan System***

InterNICHE

The InterNICHE Alternatives Loan System is an evolving library of multimedia CD-ROMs, videos, models and mannequins. It covers fields such as anatomy, physiology and surgery. Teachers and students from anywhere in the world can borrow items from the Loan System to trial them. Products are listed by discipline, then medium, and finally alphabetically. Details of each product can usually be found by clicking on the link to the producer. (http://www.interniche.org/alt_loan.html)

There are also online resources that educators can use and/or download free. Some of the programs are provided in full while others are demo versions of software that can be purchased in complete form. Two sites that provide extensive hyperlinks to these resources are the following:

- ***The Physicians Committee for Responsible Medicine Dissection Alternatives Web Site*** (<http://www.dissectionalternatives.org/alternatives/online.php>)
- ***Andrew Knight—Humane Learning Web Site*** (http://www.humanelearning.info/links_and_lists/alternatives.htm)