

PEDAGOGICAL, ETHICAL, AND ECONOMIC BENEFITS

OF NON-ANIMAL TEACHING METHODS IN SCIENCE EDUCATION



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**Pedagogical, Ethical, and Economic Benefits
of Non-Animal Teaching Methods in Science Education**

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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 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 declines in amphibian populations 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 backyards 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 classroom 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 teaching methods that are discussed in this packet.

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).

Educational Efficacy of Non-Animal Teaching Methods in Science Education

Nearly every peer-reviewed comparative study published has concluded that the educational outcomes of students who are taught basic and advanced biomedical concepts and skills using non-animal methods—such as interactive computer programs, DVDs, and lifelike models—are equivalent or superior to those of their peers who used animal-based laboratories.^{3,4,5} In one analysis of comparative studies, the authors found that "[i]n all 17 studies reviewed, results associated with the alternative method of instruction were not significantly different from or superior to results associated with the conventional method."³ Another systematic review concluded that students taught using non-animal methods demonstrated "superior understanding of complex biological processes, increased learning efficiency, and increased examination results."⁵ It also reported that students' confidence and satisfaction increased, as did their preparedness for laboratories and their information-retrieval and communication abilities.

The use of non-animal teaching methods also improves preparedness of students who are pursuing careers in the medical professions by better reflecting the teaching methods that they can expect to encounter in graduate schools. Nearly 95 percent of U.S. medical schools—including such prestigious institutions as Harvard, Yale, and Stanford universities—have discontinued the use of animals to teach medical students, and no U.S. medical schools expect or require students to have participated in animal dissection.⁶ Furthermore, the American Medical Students Association (AMSA), the oldest and largest independent association of physicians-in-training in the U.S.,⁷ states that it "strongly encourages the replacement of animal laboratories with non-animal alternatives in undergraduate medical education."⁸ Today, one can become a board-certified surgeon without ever having dissected an animal, alive or dead.

In terms of the benefits to educators, non-animal teaching methods have increased teaching efficiency and lowered costs, while affording them enhanced potential for the customization and repeatability of teaching exercises.

Economical and Other Benefits of Non-Animal Teaching Methods

Studies have shown that computer-based teaching methods "saved academic and nonacademic staff time, ... were considered to be less expensive and an effective and enjoyable mode of student learning [and] ... contributed to a significant reduction in

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.

⁴Physicians Committee for Responsible Medicine, "Published (39) and Unpublished (4) Comparative Studies of Dissection and Non-Animal Alternatives."

⁵A. Knight, "The Effectiveness of Humane Teaching Methods in Veterinary Education," *ALTEX* 24.2 (2007): 91-109.

⁶Physicians Committee for Responsible Medicine, "Medical School Curricula with Live Animal Laboratories" <http://www.pcrm.org/resch/meded/ethics_medlab_list.html>.

⁷The AMSA is made up of more than 68,000 medical students, premedical students, interns, residents, and practicing physicians from across the U.S.

⁸American Medical Student Association, "House of Delegates 2007 Resolution" <http://www.amsa.org/AMSA/Libraries/Misc_Docs/2011PPP.sflb.ashx>.

animal use."⁹ Multiple studies have concluded that computer-based teaching is more time-efficient than dissection and other animal-based teaching methods.^{10,11} Non-animal teaching methods also allow educators to better customize their lessons and to repeat them.

In addition to the aforementioned benefits, it should be noted that research has shown that many students at all stages of their educational careers are uncomfortable with the use of animals in education and experimentation and that exposing young people to animal dissection as "science" can foster a callousness toward animals and nature and can even dissuade some from pursuing careers in science.^{12,13,14}

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

The growing consensus in the science education literature is that non-animal teaching methods are equivalent or superior to animal dissections, whether measured by objective criteria or by student and teacher preferences.

As a result, in 2008 the National Science Teachers Association (NSTA) amended its official position statement to acknowledge the educational effectiveness of non-animal teaching methods and to support teachers' decision to use them as complete replacements for animal dissection.¹⁵ In 2012, the Human Anatomy & Physiology Society (HAPS) changed its position statement on animal use in anatomy and physiology courses to endorse the use of non-animal teaching methods as replacements for classroom animal laboratories as well.¹⁶

The NSTA, HAPS, and the National Association of Biology Teachers¹⁷ also advise teachers to be responsive to students' objections to harming animals by making humane alternatives available upon request.

Fourteen U.S. states as well as Washington, D.C., have enacted dissection-choice laws or policies that allow K-12 students to opt out of dissection and require teachers to provide

⁹D.G. Dewhurst and L. Jenkinson, "The Impact of Computer-Based Alternatives on the Use of Animals in Undergraduate Teaching," *ATLA* 23 (1995): 521–30.

¹⁰M. Predavec, "Evaluation of E-Rat, a Computer-Based Rat Dissection, in Terms of Student Learning Outcomes," *Journal of Biological Education* 35.2 (2001 Spring): 75–80.

¹¹Christine Youngblut, "Use of Multimedia Technology to Provide Solutions to Existing Curriculum Problems: Virtual Frog Dissection," unpublished doctoral dissertation, George Mason University, 2001.

¹²A. Arluke and F. Hafferty, "From Apprehension to Fascination With 'Dog Lab': The Use of Absolutions by Medical Students," *Journal of Contemporary Ethnography* 25.2 (1996): 201–25.

¹³D. Solot and A. Arluke, "Learning the Scientist's Role: Animal Dissection in Middle School," *Journal of Contemporary Ethnography* 26.1 (1997): 28–54.

¹⁴M. Stanisstreet, N. Spofforth, and T. Williams, "Attitudes of Undergraduate Students to the Uses of Animals," *Studies in Higher Education* 18.2 (1993): 177–96.

¹⁵National Science Teachers Association, "Responsible Use of Live Animals and Dissection in the Science Classroom," 2000 <<http://www.nsta.org/about/positions/animals.aspx>>.

¹⁶Human Anatomy and Physiology Society, "Position Statement on Animal Use," 2012. <<http://www.hapsweb.org/displaycommon.cfm?an=1&subarticlenbr=21>>.

¹⁷National 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>>. ¹⁸Cal. Educ. Code §32255-32255.6 (1988).

non-animal assignments. California,¹⁸ D.C.,¹⁹ Florida,²⁰ Illinois,²¹ Louisiana, Maine,²² Massachusetts,²³ New Jersey,²⁴ New Mexico,²⁵ New York,²⁶ Oregon,²⁷ Pennsylvania,²⁸ Rhode Island,²⁹ Vermont,³⁰ and Virginia³¹ all have statewide laws or department of education policies that allow students to opt out of animal dissection in favor of a non-animal method. In addition, other states—including Arizona,³² Hawaii,³³ North Carolina,³⁴ Texas,³⁵ and Utah³⁶—have more general policies on allowing students to opt out of material they find objectionable on moral, religious, or ethical grounds. Many school districts, universities, and secondary schools have similar policies in place. See this interactive map for a nationwide list of policies on dissection: <http://features.peta2.com/cut-out-dissection/step-two.aspx>.

Internationally, because of the various benefits of virtual dissection and the inherent ethical concerns associated with animal use, many schools and school districts have ended animal dissection. In addition, several countries—including Argentina, Denmark, the Netherlands, Norway, 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.³⁷ In addition, the government of India has issued

¹⁸Cal. Educ. Code §32255-32255.6 (1988).

¹⁹The District of Columbia Office of the State Superintendent of Education, "Non-Regulatory Guidance for Local Education Agencies: Animal Dissection Opt-Out Choice for District Students," 10 Sept. 2012.

²⁰Fla. Stat.: (Educ.) §1002.20 (1985, rev'd 2004).

²¹105 ILCS 112/15 *et seq.* (2000).

²²1989 State Department of Education Policy.

²³2005 State Board of Education Policy.

²⁴New Jersey Statute §18A:35-4.25.

²⁵2005 State Board of Education Policy.

²⁶N.Y. Educ. Law §809(4) (1994).

²⁷Oregon Revised Statutes §337.300.

²⁸24 Pa. Cons. Stat. §15-1522 (1992).

²⁹R.I. Stat. §16-22-20 (1997).

³⁰16 V.S.A. §912.

³¹Va. Code Ann. §22.1-200.01(2004).

³²A.R.S. 15-102. This statute states, in part, that "[p]rocedures by which parents who object to any learning material or activity on the basis that it is harmful may withdraw their children from the activity or from the class or program."

³³Hawaii DOE Regulation 2210.1. This controversial issues regulation states, in part, that schools shall "provide a means through which and deadline by which parents and legal guardians may contact instructional staff or school administrators to exclude their child from the specific lesson or activity."

³⁴The North Carolina State Board of Education references the NSTA's position statement on animal use in education, which supports the use of non-animal teaching methods and allowing students to opt out of animal dissection activities. <<http://www.ncpublicschools.org/curriculum/science/faq/>>.

³⁵Texas Education Code 26.010. This code reads, in part, that parents may remove students "temporarily from a class or other school activity that conflicts with the parent's religious or moral beliefs if the parent presents or delivers to the teacher of the parent's child a written statement authorizing the removal of the child from the class or other school activity."

³⁶UT Admin Code R277-105-5. This administrative code states, in part, that "[a] parent, a legal guardian of a student, or a secondary student may request a waiver of participation in any portion of the curriculum or school activity which the requesting party believes to be an infringement upon a right of conscience or the exercise of religious freedom."

³⁷Physicians Committee for Responsible Medicine, "Dissection Alternatives," <<http://www.dissectionalternatives.org/concerned/education.cfm>>.

guidelines to the Medical Council of India, the Pharmacy Council of India, and the University Grants Commission instructing them to completely stop dissection and experimentation on animals to train both undergraduate and postgraduate students and use non-animal teaching methods instead. In a January 2012 directive, the government stated that non-animal teaching methods such as computer simulations and manikins are "not only effective and absolute replacements to the use of animals in teaching anatomy/physiology but they are also superior pedagogic tools in the teaching of Pharmacy/Life sciences."³⁸

Examples of Non-Animal Teaching Methods

There are many options available to replace animal dissection, but 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, it can be difficult for educators to navigate the options effectively and find those that suit their needs.

The excellent computer-based simulations listed below can completely replace the use of animals. In addition, these alternatives provide students with a richer 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, 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).

For studying human anatomy and physiology, sophisticated interactive software programs such as McGraw-Hill's Anatomy & Physiology Revealed and Benjamin Cummings' PhysioEx 9.0 are used at many schools to effectively teach human anatomy without harming animals. Some programs also contain comparative anatomy features with anatomy sections for cat, fetal pig, and other animal species.

Animals (regardless of whether they are alive or dead) can be used only 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 and can be used indefinitely, while the cost of setting up animal dissections for 300 students over a period of five years can add up to \$6,850.³⁹ PETA has also worked with several virtual-dissection technology companies to provide discounts on their educational software products, which can be found at PETA.org/Dissection.

In terms of more hands-on teaching methods, three recent studies found that students who modeled body systems out of clay were significantly better at identifying the constituent

³⁸Directive No. 1/1/2011-AWD. The Indian Ministry of Environment and Forests. 13 Jan. 2012.

³⁹Digital Frog International, "Comparison to Real Dissection and Other Virtual Dissection Software," 2008 <<http://www.digitalfrog.com/products/frog-price-comparison.html>>.

parts of human anatomy than their classmates who performed animal dissections.^{40,41,42} Another study found that students preferred using clay modeling over animal dissection and performed equally well as their cohorts who dissected animals.⁴³ The system used in these studies was the popular Anatomy in Clay by Zahourek.

Conclusion

Replacing the use of animals in education with one or more of the many non-animal teaching 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 students with a more effective and inclusive learning experience, encouraging students to show respect for animals and nature, and conserving the valuable resources of schools and their educators. We encourage you to visit PETA.org/Dissection for physician-narrated demonstrations of virtual-dissection software, discount codes for educational software, resource lists, and information about PETA's grant program that provides schools with alternatives to dissection free of charge. Please pass along this information to your colleagues and contact PETA if you have any questions or comments.

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⁴⁰J.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.

⁴¹H.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.

⁴²J.R. Waters *et al.*, "Human Clay Models Versus Cat Dissection: How the Similarity Between the Classroom and the Exam Affects Student Performance," *Advances in Physiology Education* 35.2 (2011): 227-236.

⁴³M.E. DeHoff *et al.*, "Learning Outcomes and Student-Perceived Value of Clay Modeling and Cat Dissection in Undergraduate Humane Anatomy and Physiology," *Advances in Physiology Education* 35 (2011): 68-75.