

**PUBLISHED (39) AND UNPUBLISHED (4) COMPARATIVE STUDIES OF  
DISSECTION AND NON-ANIMAL ALTERNATIVES**

**Table 1: Summary data**

Study category	Number of studies
Equivalent teaching efficacy of animal and non-animal teaching methods	20
Superior efficacy of non-animal teaching methods	16
Superior efficacy of animal teaching methods	4
Equivalent teaching efficacy but with other advantages of non-animal methods	3

**A. Studies Demonstrating Equivalent Teaching Efficacy of  
Non-Animal Teaching Methods (19 Published, 1 Unpublished)**

**A1. Bauer, M.S., N. Glickman, L. Glickman, J.P. Toombs & P. Bill. 1992. Evaluation of the effectiveness of a cadaver laboratory during a fourth-year veterinary surgery rotation. *Journal of Veterinary Medical Education* 19(2): 77–84.**

*Learning outcomes were similar between two groups of fourth-year veterinary students, one taught surgery using a terminal and cadaver laboratory format, the other taught using survival laboratories.*

**A2. Carpenter LG, Piermattei DL, Salman MD, Orton EC, Nelson AW, Smeak DD, Jennings PB Jr, Taylor RA. A comparison of surgical training with live anesthetized dogs and cadavers. *Vet Surg* 1991;20(6):373-8. Department of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, USA.**

*During surgical training of veterinary medical students, one group of students was trained using cadavers\*, and a peer group was trained using live anesthetized dogs. Both groups then performed an intestinal anastomosis using a live subject. After reviewers blindly scored each surgical team's performance based on actual inspection of the surgical site and on viewing videotapes of the procedure, no statistically significant differences could be detected between the two groups, either in the quality of the procedure or the time until completion.*

*\*While this abstract did not specify the source of the cadavers, the use of ethically-sourced cadavers, from animals that have been euthanized for medical reasons, or died from natural causes or in accidents, is possible. Therefore, in this study the cadavers were considered the more humane method.*

**A3. Clarke KA. The use of microcomputer simulations in undergraduate neurophysiology experiments. *Alternatives to Laboratory Animals* 1987;14:134-40.**

*One undergraduate student group performed a physiological frog experiment on an isolated sciatic nerve preparation, while another group used a computer simulation of the same experiment. There was no significant difference between student groups in marks derived for the laboratory report, the standard form of assessment for a wet lab. [i.e., similar to Dewhurst et al. 1988].*

**A4. Cohen, P.S. & M. Block, 1991. Replacement of laboratory animals in an introductory psychology laboratory. *Humane Innovations and Alternatives* 5: 221–225.**

*Undergraduate students who studied feral pigeons in a city park scored equally well on evaluations as did students who studied operant conditioning with rats in a traditional lab.*

**A5. Dewhurst DG, Brown GJ, Meehan AS. Microcomputer simulations of laboratory experiments in physiology. *Alternatives to Laboratory Animals* 1988;15:280-9.**

*One undergraduate student cohort (group) performed a physiological frog experiment on an isolated sciatic nerve preparation, while another cohort used a computer simulation of the same experiment. There was no significant difference between student cohorts in marks derived for the laboratory report, the standard form of assessment for a wet lab. [i.e., similar to Clark 1987].*

**A6. Dewhurst, D.G., J. Hardcastle, P.T. Hardcastle & E. Stuart. 1994. Comparison of a computer simulation program and a traditional laboratory practical class for teaching the principles of intestinal absorption. *American Journal of Physiology* 267 (Advances in Physiology Education 12/1): S95–S104.**

*Six undergraduate students working independently with a computer program gained equal knowledge, at one-fifth the cost, as did eight supervised students using freshly killed rats.*

**A7. Dewhurst, D.G. & A.S. Meehan. 1993. Evaluation of the use of computer simulations of experiments in teaching undergraduate students. *British J. Pharm. Proc. Suppl.* 108: 238.**

*Undergraduate students using computer simulations performed equally well as students using traditional approaches in physiology and pharmacology laboratories.*

**A8. Downie, R. & J. Meadows. 1995. Experience with a dissection opt-out scheme in university level biology. *Journal of Biological Education* 29(3), 187–194.**

*Cumulative examination results of 308 undergraduate biology students who studied model rats were the same as those of 2,605 students who performed rat dissections.*

**A9. Greenfield, C.L., A.L. Johnson, D.J. Shaeffer & L.L. Hungerford. 1995. Comparison of surgical skills of veterinary students trained using models or live animals. *JAVMA* 206(12): 1840–1845.**

*Surgical skills of veterinary students were evaluated following training with dogs and cats, or soft tissue organ models; performance of each group was equivalent.*

**A10. Guy, J.F. & A.J. Frisby. 1992. Using interactive videodiscs to teach gross anatomy to undergraduates at Ohio State University. *Academic Medicine* 67: 132–133.**

*Performance of prenursing and premedical students using interactive videodiscs was not significantly different from that of students in traditional cadaver demonstration labs.*

**A11. Jones, N.A., R.P. Olafson, & J. Sutin. 1978. Evaluation of a gross anatomy program without dissection. *Journal of Medical Education* 53: 198–205.**

*Learning performances of freshmen medical students using films, computer-assisted instruction and prosected human cadavers were the same as those of students taught by traditional lecture and dissection.*

**A12. Kinzie, M.B., R. Strauss & J. Foss. The effects of an interactive dissection simulation on the performance and achievement of high school biology students. *Journal of Research in Science Teaching* 1993;30(8):989–1000.**

*Findings suggest that an interactive videodisc was at least as effective as actual dissection in promoting high school student learning of frog anatomy and dissection procedures.*

**A13. Leathard, H.L. & D.G. Dewhurst. 1995. Comparison of the cost effectiveness of a computer-assisted learning program with a tutored demonstration to teach intestinal motility to medical students. *ALT-J* 3(1): 118–125.**

*No significant difference was found in the performances of preclinical medical students who used a traditional live animal laboratory and those who used a computer simulation on intestinal motility.*

**A14. Lieb, M.J. 1985. Dissection: A valuable motivational tool or a trauma to the high school student? Unpublished Thesis, Master of Education, National College of Education, Evanston, Illinois.**

*Post-test scores were equivalent for high school students who dissected earthworms and those who received a classroom lecture on earthworm anatomy.*

**A15. Marszalek, C.S. & J. Lockard. 1999. 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, Texas.**

*Seventh grade students who were taught frog internal anatomy via either traditional frog dissection or CD-Tutorial had significantly higher increases in pretest versus immediate post tests scores when compared to the same scores for students using the desktop Microworld. There were no significant differences in immediate versus delayed post-test scores for three learning methods, showing that students retain the information equally with an alternative versus traditional dissection.*

**A16. Olsen, D., M.S. Bauer, H.B. Seim & M.D. Salman. 1996. Evaluation of a Hemostasis Model for Teaching Basic Surgical Skills. *Veterinary Surgery* 25: 49-58.**

*Veterinary students who practiced vessel ligation and division on a hemostasis model scored as well on evaluations as students who practiced on live dogs.*

**A17. 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. *JAVMA* 205(1): 97–100.**

*No difference was found in surgical confidence or ability of veterinary graduates who had participated in an alternatives course of study versus those who had participated in a conventional course of study.*

**A18. Prentice, E.D., W.K. Metcalf, T.H. Quinn, J.G. Sharp, R.H. Jensen & E.A. Holyoke. 1977. Stereoscopic anatomy: evaluation of a new teaching system in human gross anatomy. *Journal of Medical Education* 52: 758–763.**

*Based on physician-assistant student learning performances, the authors concluded that use of labeled sequential slides of anatomical dissections provided a viable alternative to dissection.*

**A19. Strauss, R.T. and Kinzie, M.B. 1994. Student achievement and attitudes in a pilot study comparing an interactive videodisc simulation to conventional dissection. *The American Biology Teacher* 56(7): 398–402.**

*Two groups of high school students performed equally on a test following either animal dissection or interactive videodisc simulation.*

**A20. White, K.K., L.G. Wheaton & S.A. Greene. 1992. Curriculum change related to live animal use: a four-year surgical curriculum. *Journal of Veterinary Medical Education* 19: 6–10.**

*After hesitancy in their first live tissue surgery, veterinary students from an alternative surgical laboratory program performed on par with students with a standard laboratory experience.*

### **B. Published Studies Demonstrating Superior Teaching Efficacy of Non-Animal Teaching Methods (14 Published, 2 Unpublished)**

**B1. Abutarbush Sameeh M., Naylor Jonathan M., Parchoma Gale, D'Eon Marcel, Petrie Lyall & Carruthers Terry. Evaluation of traditional instruction versus a self-learning computer module in teaching veterinary students how to pass a nasogastric tube in the horse. *Journal of Veterinary Medical Education* 2006;33(3):447-54.**

*Students in the computer module group performed significantly better on the test of knowledge than traditionally instructed students. In hands-on skill, time to pass the NG tube successfully was significantly shorter in the SLCM group than in the traditionally instructed group. The questionnaire found significant preference for the computer-based module, better learning, and greater preparedness.*

**B2. Erickson, H.H. & V.L. Clegg. 1993. Active learning in cardiovascular physiology. Pp. 107–108 in Modell, H.I., & Michael, J.A. (editors). *Promoting Active Learning in the Life Science Classroom. Annals of the New York Academy of Sciences* Vol. 701. New York, NY.**

*Of fourteen learning methods for basic cardiac teaching and ECG interpretation, computer-based active learning was rated the highest in veterinary student evaluations.*

**B3. Fowler, H.S. & E.J. Brosius. 1968. A research study on the values gained from dissection of animals in secondary school biology. *Science Education* 52(2): 55–57.**

*High school students who watched films of animal dissections (earthworm, crayfish, frog, perch) demonstrated greater factual knowledge of these animals than did students who performed dissections on them.*

**B4. Griffon, D.G., P. Cronin, B. Kirby & D.F. Cottrell. 2000. Evaluation of a Hemostasis Model for Teaching Ovariohysterectomy in Veterinary Surgery. *Veterinary Surgery* 29: 309-316.**

*Veterinary students who practiced ovariohysterectomy on an inanimate canine replica scored higher on skills tests and showed more improvement than students who practiced on cadavers.*

**B5. Henman, M.C., & G.D.H. Leach. 1983. An alternative method for pharmacology laboratory class instruction using biovideograph videotape recordings. *British Journal of Pharmacology* Vol. 80: 591P.**

*Undergraduate pharmacology students using biovideograph performed significantly better on post-laboratory tests than those participating in the organ-based laboratories.*

**B6. Huang, S.D. & J. Aloï. 1991. The impact of using interactive video in teaching general biology. *The American Biology Teacher* 53(5): 281–284.**

*Biology undergraduate students using a computer-assisted interactive videodisc system which included dissection simulations performed significantly better than students who had not used the computer-aided instruction.*

**B7. Johnson, A.L. & J.A. Farmer. 1989. Evaluation of traditional and alternative models in psychomotor laboratories for veterinary surgery. *Journal of Veterinary Medical Education*. 16(1): 11–14.**

*Inanimate models effectively taught basic psychomotor skills, and had the advantage over live animals that they could be used repeatedly, enhancing the acquisition of motor proficiency.*

**B8. Lilienfield, L.S., & N.C. Broering. 1994. Computers as teachers: learning from animations. *American Journal of Physiology* 11(1): *Advances in Physiology Education*, pp. S47–S54.**

*Medical and graduate students who used computer simulation achieved a significantly higher grade in the cardiovascular section of the final exam than their classmates.*

**B9. McCollum, T.L. 1987. The effect of animal dissections on student acquisition of knowledge of and attitudes toward the animals dissected. Unpublished Doctoral Dissertation, University of Cincinnati.**

*Approximately 175 high school biology students taught frog structure, function, and adaptation via lecture performed better on a post-test than did approximately 175 high school biology students taught by doing a frog dissection.*

**B10. More, D. & C.L. Ralph. 1992. A test of effectiveness of courseware in a college biology class. *J. Educational Technology Systems* 21: 79–84.**

*Biology knowledge of about 92 undergraduate biology students using computer courseware increased more than did that of approximately 92 students using traditional animal-based laboratories.*

**B11. Olsen D, Bauer MS, Seim HB, Salman MD. Evaluation of a hemostasis model for teaching basic surgical skills. *Vet Surg* 1996;25(1):49-58. Department of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, USA.**

*In a comparison between the effectiveness of the fluid hemostasis model compared with using live animals for teaching basic skills involved in blood vessel ligation and division, the model group had a lower number of errors and lower time to complete exercises; more students in the model group tied square knots and tight ligatures, and instrument grip was rated better for the model group.*

**B12. Phelps, J.L., J.O. Nilsestuen & S. Hosemann 1992. Assessment of effectiveness of videodisc replacement of a live animal physiology laboratory. Distinguished Papers Monograph, American Association for Respiratory Care.**

*Nursing students who studied using an interactive video program on cardiac output principles performed better on a post-test than did students taught by lecture and live animal physiology laboratory.*

**B13. Predavec, M. 2001. Evaluation of E-Rat, a computer-based rat dissection, in terms of student learning outcomes. *Journal of Biological Education* 35(2): 75-80.**

*First-year undergraduate 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.*

**B14. Samsel, R.W., G.A. Schmidt, J.B. Hall, L.D.H. Wood, S.G. Shroff & P.T. Schumacker. 1994. Cardiovascular physiology teaching: computer simulations vs. animal demonstrations. *Advances in Physiology Education* 11: S36–S46.**

*Medical students used both computer demonstrations and animal (dog) demonstrations, and rated the former higher for learning cardiovascular physiology.*

**B15. Waters, J.R., P. Van Meter, W. Perrotti, S. Drogo & R.J. Cyr. 2005. Cat Dissection vs. sculpting human structures in clay: an analysis of two approaches to undergraduate human anatomy laboratory education. *Advances in Physiology Education* 29: 27-34.**

*Undergraduate students who learned human anatomy by building clay sculptures of each human body system scored significantly higher on both low- and high-difficulty questions than their classmates who performed cat dissections.*

**B16. Youngblut, Christine. 2001. Use of multimedia technology to provide solutions to existing curriculum problems: Virtual frog dissection. Unpublished doctoral dissertation, George Mason University.**

*Multimedia-based virtual dissection was more effective than hands-on dissection in helping pre-college students learn about frog anatomy. Students using the virtual program achieved this result in 44% less time than their peers who used animal dissection.*

### **C. Published Studies Demonstrating Inferior Teaching Efficacy of Non-Animal Teaching Methods (3 Published, 1 Unpublished)**

**C1. Cross TR & Cross VE. Scalpel or mouse: a statistical comparison of real and virtual frog dissections. *The Amer Biol Teacher* 2004;66(6):408-11.**

*After being tested via laboratory practicals using both real and virtual frogs, high school AP Biology students who used real frog dissection performed significantly better on the laboratory practicals using real frogs than the students who used a virtual frog dissection. No significant difference was observed in the virtual laboratory practical test scores.*

**C2. Kariuki, P. & R. Paulson. 2001. The Effects of Computer Animated Dissection versus Preserved Animal Dissection on the Student Achievement in a High School Biology Class. Unpublished Paper, Presented at the Annual Meeting of the Mid-South Educational Research Association, Little Rock, Arkansas.**

*High school biology students taught earthworm and frog dissection via traditional dissection scored significantly better on a post-test than high school biology students taught using a CD-ROM. When the scores to the post-tests were separated and compared independently among males and females, the students performed equally.*

**C3. Matthews, D. 1998. Comparison of MacPig to Fetal Pig Dissection in College Biology. *The American Biology Teacher*, 60(3): 228–229.**

*Eight biology undergraduate students who dissected fetal pigs scored significantly higher on an oral test with prosected fetal pigs than did twelve students who studied on a computerized pig (MacPig).\**

*\* Balcombe J. The American Biology Teacher. 1998;60(8):555-6. Criticized the study because MacPig is not advanced enough for college level biology instruction, to which Matthews replied, adding nothing further of substance: Matthews D. Efficacy of fetal pig dissection alternatives questioned. The American Biology Teacher 1998b;61(2):88.*

**C4. Smeak DD, Hill LN, Beck ML, Shaffer CA, Birchard SJ. Evaluation of an autotutorial-simulator program for instruction of hollow organ closure. *Vet Surg* 1994;23(6):519-28. Department of Veterinary Clinical Sciences, Ohio State University College of Veterinary Medicine, Columbus.**

*A simulator program used during the practice laboratory for hollow organ closure was found unsuitable for simulating live stomach tissue, and it could not address several issues associated with live gastrotomy. While the simulator was sufficient for teaching other procedures, there was no significant difference in students' overall gastrotomy technique between students who practiced with traditional methods and students who used the simulator.*

#### **D. Published Studies Demonstrating Equivalent Teaching Efficacy of Non-Animal Teaching Methods but with Other Advantages (i.e. time, cost savings) (3)**

**D1. Dewhurst, D.G. & L. Jenkinson. 1995. The impact of computer-based alternatives on the use of animals in undergraduate teaching. *ATLA* 23: 521–530.**

*Use of computer packages saved teaching staff time, were less expensive, were an effective and enjoyable mode of undergraduate biomedical student learning, and significantly reduced animal use.*

**D2. Fawver, A.L., C.E. Branch, L. Trentham, B.T. Robertson & S.D., Beckett. 1990. A comparison of interactive videodisc instruction with live animal laboratories. *American Journal of Physiology* 259 (Advances in Physiology Education 4): S11–S14.**

*Use of interactive videodisc simulations yielded equivalent test performance, but with greater time efficiency in teaching cardiovascular physiology compared with instruction in a live animal laboratory.*

**D3. Leonard, W. H. 1992. A comparison of student performance following instruction by interactive videodisc versus conventional laboratory. *Journal of Research in Science Teaching*, Vol. 29, No. 1, pp. 93–102.**

*In the use of videodisc or traditional laboratories, no significant difference was found for biology undergraduate students' laboratory grades. However, the videodisc group required one-half the time.*