Table 1: Summary data

<table>
<thead>
<tr>
<th>Study category</th>
<th>Number of studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equivalent teaching efficacy of animal and non-animal teaching methods</td>
<td>20</td>
</tr>
<tr>
<td>Superior efficacy of non-animal teaching methods</td>
<td>16</td>
</tr>
<tr>
<td>Superior efficacy of animal teaching methods</td>
<td>4</td>
</tr>
<tr>
<td>Equivalent teaching efficacy but with other advantages of non-animal methods</td>
<td>3</td>
</tr>
</tbody>
</table>

A. Studies Demonstrating Equivalent Teaching Efficacy of Non-Animal Teaching Methods (19 Published, 1 Unpublished)


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.


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.


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].

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.


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].


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.


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


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.


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


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


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

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.


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.


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


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.


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


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.


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.

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


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)


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.


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


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.


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.

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


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.


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.


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


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.


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.


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.

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.


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.


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


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.


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)


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.


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.

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).*


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)


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.


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.


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.