

## Comparative Studies

Historically animal use in science education has played an integral role in teaching anatomy and physiology as well as a variety of other disciplines. Animals have traditionally been used at all levels of schooling from primary to graduate school. And until several years ago, the pedagogy of such decisions was not questioned. However, in recent years, there has been an increase in concern for animals used in education; concurrently technology had developed to provide students and academics with viable alternatives. Animalearn has compiled a list of studies that compare animal use versus humane teaching methods in science education.

Animalearn's list includes over 60 studies many of which confirm the positive learning outcome or equivalent effectiveness of humane teaching methods in imparting knowledge or clinical or surgical skills. Some studies conclude that alternatives also lower costs, decrease the amount of time required to learn, and increase student comfort levels. This list is divided into four categories based on education level and course of study: secondary education, undergraduate, veterinary school, and medical school. Each category is further divided into three sections based on the studies' results: *the positive learning outcome using the humane teaching method, the equivalent outcome using the humane teaching method versus the animal use method, and the undetermined or negative outcome using the humane teaching method.*

**Table 1: Secondary Education**

Study	Discipline	Humane Teaching Method	Positive	Equivalent	Negative or Undetermined
Akpan, J. et al 2010	Biology	Computer simulation	✓		
Boothby, C. 2009	Biology	Virtual Dissection	✓		
Cross, T.R. et al 2004*	Biology	Virtual Dissection			✓ <sub>1</sub>
Fowler, H.S. et al 1968*	Biology	Film	✓		
Kariuki, P. et al 2001*	Biology	CD-ROM			✓ <sub>2</sub>
Kinzie, M.B. et al 1993*	Biology	Computer simulation		✓	
Lalley, J.P. et al 2010	Biology	Virtual Dissection	✓		
Lieb, M.J. 1985*	Biology	Lecture		✓	
Marszalek, C.S. et al 1999*	Biology	Videodisc		✓	
McCullum, T.L. 1987*	Biology	Lecture	✓		
Montgomery, L. 2008	Biology	Virtual Dissection		✓	
Strauss, R.T. et al 1994*	Biology	Videodisc		✓	
Velle, S. et al 1999**	Biology	Virtual Dissection	✓		
Youngblut, C. 2001	Biology	Virtual Dissection	✓		

**Table 2: Undergrad Education**

Study	Discipline	Humane Teaching Method	Positive	Equivalent	Negative or Undetermined
Clarke, K.A. 1987**	Neurophysiology	Computer simulation		✓	
Cohen, P.S. et al 1991*	Psychology	Field Studies		✓	
DeHoff, M.E. et al 2011	Physiology	Clay Modeling		✓	
Dewhurst, D.G. et al 1994*	Physiology	Computer simulation		✓	
Dewhurst, D.G. et al 1993*	Physiology & Pharmacology	Computer simulation		✓	
Dewhurst, D.G. et al 1988	Physiology	Computer simulation		✓	
Downie, R. et al 1995*	Biology	Models		✓	
Guy, J.F. et al 1992*	Anatomy	Videodisc		✓	
Huang, S.D. et al 1991*	Biology	Videodisc	✓		
Henman, M.C. et al 1983*	Pharmacology	Biovideograph	✓		
Hughes, I.E. 2001**	Pharmacology	Computer simulation			✓ <sub>3</sub>
Leonard, W.H. 1992*	Biology	Videodisc		✓	
Matthews, D. 1998*	Biology	CD-ROM			✓ <sub>4</sub>
More, D. et al 1992*	Biology	Virtual Dissection	✓		
Motoike, H.K et al 2009	Physiology	Clay Modeling	✓		
Phelps, J.L. et al 1992*	Physiology	Videodisc	✓		
Predavec, M. 2001*	Biology	Virtual Dissection	✓		
Prentice, E.D. et al 1977*	Anatomy	Labeled Slides		✓	

Taeger, K.R. 2006	Biology	Virtual Dissection		✓	
Waters, J.R. et al 2005*	Anatomy	Clay Modeling	✓		

**Table 2: Undergrad Education**

Study	Discipline	Humane Teaching Method	Positive	Equivalent	Negative or Undetermined
Waters, J.R. et al 2010	Anatomy	Clay Modeling	✓		
Yuza, S. 2010	Biology	Virtual Dissection	✓		

**Table 3: Vet School**

Study	Discipline	Humane Teaching Method	Positive	Equivalent	Negative or Undetermined
Abutarbush, S.M. et al 2006**	Clinical Skills	Computer simulation	✓		
Baillie, S. et al 2005	Clinical Skills	Computer simulation	✓		
Bauer, M.S. et al 1992*	Surgery	Survival Lab		✓	
Carpenter, L.G. et al 1991**	Surgery	Cadaver		✓	
Erickson, H.H. et al 1993*	Physiology	Computer simulation	✓		
Fawver, A.L. et al 1990*	Physiology	Computer simulation		✓	
Greenfield, C.L. et al 1995*	Surgery	Model		✓	
Griffon, D.G. et al 2000*	Surgery	Model	✓		
Johnson, A.L. et al 1989*	Surgery	Model	✓		
Linton, A. et al 2005	Anatomy	Computer simulation		✓	
Olsen, D. et al 1996*	Surgery	Model		✓	
Pavletic, M.M. et al 1994*	Surgery	Cadavers and Models – The Alternative Tufts Program		✓	
Smeak, D.D. et al 1994**	Surgery	Simulator			✓ <sup>5</sup>
Theoret, C.L. et al 2007	Anatomy	Film			✓ <sup>6</sup>
White, K.K. et al 1992*	Surgery	Alternative Surgical Program		✓	

**Table 4: Medical School**

Study	Discipline	Humane Teaching Method	Positive	Equivalent	Negative or Undetermined
Bowyer, M.W. et al 2005	Clinical Skills	Computer simulation	✓		
Granger, N.A. et al 2007	Anatomy	Video			✓ <sup>7</sup>
Jacomides, L. et al 2004	Clinical Skills	Computer simulation		✓	
Jones, N.A. et al 1978*	Anatomy	Films, Computer simulation, human cadavers		✓	
Leathard, H.L. et al 1995*	Physiology & Pharmacology	Computer simulation		✓	
Lilienfield, L.S. et al 1994*	Physiology	Computer simulation	✓		
Ramshaw, B.J. et al 2001	Surgery	Computer simulation	✓		
Samsel, R. W. et al 1994*	Physiology	Computer simulation	✓		

1. Negative: BioLab Frog was used in this study. The first year of the study, both study groups were tested using real frogs. The second year of the study, the groups were tested using the simulation and the real frog. Students dissecting real frogs performed better on the lab test using frogs. There was no difference between the groups for the computer simulation practical.
2. Negative
3. Undetermined: Performance of students using computer simulation was higher than those who used the wet labs. However when assessing details of the wet lab, the computer simulation group did poorer.
4. Negative: This study had a small sample size of 8 students dissecting fetal pigs and 12 using MacPig. The 8 that used the real fetal pigs scored significantly higher on an oral test using a prosected fetal pig.
5. Negative-Simulator was suitable for teaching overall gastrotomy technique but could not simulate live tissue.
6. Negative
7. Negative

\* Humane Society of the United States. 2005. Source of study and resulting data.

\*\*Knight, A., Balcombe, J. & DeBoo, J. 2008. Comparative studies of student performance: humane teaching methods demonstrate educational efficacy when compared to harmful animal use in biomedical education. Source of study and resulting data.