

The Perception of Students on the Use of Animals in Higher Education at the Federal University of Paraná, Southern Brazil

Bernardo G.F. Deguchi,¹ Carla F.M. Molento¹ and Carlos E.P. de Souza²

¹Animal Welfare Laboratory, Federal University of Paraná (UFPR), Curitiba, PR, Brazil; ²Theory and Practice of Teaching, UFPR, Curitiba, PR, Brazil

Summary — The use of animals in education and research is a controversial issue that involves ethical considerations. In Brazil, Act 11,794, which was approved in 2008, established the National Council on the Control of Animal Experimentation (CONCEA) and a database of institutions that use animals for research and education (CIUCA). This legislation also set out the regulations for the use of animals. In this study, we have evaluated the ethical issues involved in the use of animals for educational purposes at the Federal University of Paraná, through a qualitative–quantitative analysis that relied on written questionnaires. Our objective was to find out the opinions of students and staff from different academic fields, and at different stages in their professional development, on the use of animals for educational purposes. The study involved 101 students and 20 lecturers (i.e. tenure-track professors and all those who teach the students) in Biology, Pharmacology, Medicine and Veterinary Medicine. Approximately half of the students (45.5%) did not know the legislation that regulates the use of animals in education, and most of the lecturers believed that learning goals could not be achieved with alternative methods. Only 38.9% of the lecturers and 31.9% of the students trusted the usefulness of alternative methods. Furthermore, recent graduates were as unaware of the legislation, as were students in the first two years of their university courses. These results suggest that it is necessary to considerably expand the discussion on alternatives to animal use in the academic environment.

Key words: *alternative methods, animal welfare, bioethics, research, teaching.*

Address for correspondence: Bernardo Deguchi, Animal Welfare Laboratory (LABEA), UFPR, Rua dos Funcionários 1540, Juvevê, CEP: 80035-050, Curitiba, PR, Brazil.
E-mail: nani_bd@ig.com.br

Introduction

The use of animals in education and research is a controversial issue, with complex ethical dimensions. Therefore, at universities, both students and teaching staff should be prepared to deal with the inherent ethical dilemmas on the subject. In addition, the use of laboratory animals is regulated by national laws, which establish procedures and norms for their use, according to what a given society considers acceptable. The use of animals in educational classes and for experimentation is common practice (1), and it frequently causes considerable pain and suffering to the animals involved.

Some nations have recognised the weakness of the justification presented to support animal use for teaching, and have decided to prohibit it, preferring instead to employ validated and high-quality alternative methods (2). Alternative methods are those that rely on less-sentient beings or non-living material for the procedures, thereby reducing or eliminating animal suffering. They constitute humane teaching methods without involving the use of animals, and can achieve the same learning objectives as traditional methods

(3). *The Principles of Humane Experimental Technique* (4) first described the Three Rs for animal use in research — i.e. Refinement (improvement in the procedures in order to reduce the suffering of animals involved), Reduction (the use of fewer animals) and Replacement (substitution of living animals by non-sentient animals or non-animal methods to completely eliminate animal suffering). The Three Rs ethos also applies to the use of animals in education.

With regard to legislative matters, the first law that protected animals from cruelty was published in England in 1824. Soon afterwards, various acts and societies were established, leading to the development of academic studies in animal law (5). Nowadays, many types of animal are legally protected. However, the enforcement of these regulations is often dependent on public perception and on the social bonding that exists between the animal species involved and society, and by those directly involved with the animals. Moreover, the level of care provided to animals is often related to their extrinsic value, as exemplified by the difference between a pet rat and pest rat (6).

In the context of laboratory animal use, a new federal regulation was published in Brazil in 2008

— *Act 11,794* (7), commonly known as the *Arouca Act*. This law regulates animal use in research and teaching, and requires an Institutional Animal Care and Use Committee (IACUC) to exist at each institution that uses laboratory animals. In addition, the Brazilian *Environmental Act 9,605* (8) establishes penalties for animal experimentation that causes pain or cruelty, if alternative methods are available.

Even though Brazilian legislation is moving forward in the regulation of laboratory animal use, opinions with regard to the ethics and practicalities of animal use in research and teaching seem to vary widely. In this paper, we report the attitudes of lecturers (i.e. tenure-track professors and all those who teach the students) and students on the use of animals at the UFPR, in southern Brazil. The objective of this study was to survey the opinions of students and lecturers on the major issues posed by animal use for teaching, and to provide an insight into whether the choice of academic field and the academic knowledge obtained during higher education influence such views.

Materials and Methods

The survey

The survey was conducted at the UFPR in April and May 2010, by using a written questionnaire with both open and closed questions. All of the respondents signed a consent form. The same interviewer was present while the questionnaire was being completed, in case any clarification was required. Students of Biology ($n = 30$), Pharmacy ($n = 30$), Veterinary Medicine ($n = 30$) and Medicine ($n = 11$) participated in the study, as well as lecturers ($n = 20$) in these subject areas. Students in their first to third semester of university (i.e. years 0.5 to 1.5) were referred to as freshmen ($n = 56$), while those in the last three semesters of each degree were denominated seniors ($n = 45$). The smaller number of freshmen participants from Medicine, and the total absence of senior respondents from the same discipline, were due to the difficulty experienced in obtaining responses from these students. The strategy employed to improve this low rate of participation was to make contact with the student representative for Medicine at the University. However, no response was obtained. Participating lecturers have different background knowledge, since they hold degrees from different disciplines, but they all teach in at least one of the academic fields cited.

The closed questions in each student's questionnaire were:

— “Do you know the legislation that regulates the use of animals in education and research?”

— “Was pain control used in the procedures on animals?”

— “Were learning goals attained when animals were used in class?”

— “Were learning goals attained when alternative methods were used in class?”

There was one closed question in the lecturers' questionnaire:

— “Were learning goals attained when alternative methods are used in class?”

There was a final open-ended question in both questionnaires, so that respondents could express their overall considerations on the theme of animal use in education.

Responses to the open-ended questions were analysed according to the method of Content Analysis (9), where the main goals were to describe the perspective of the participants and to separate them into different groups based on their answers. Then, multiple choice responses, and the groups obtained with the answers to the open questions, were statistically analysed (Table 1). The understanding of a phenomenon by quantitative methods, through sampling followed by generalisation (10), was used in this qualitative study, in order to increase the chances of understanding the questions raised (11). A qualitative analysis was conducted, with the help of inferences, with the goal of recognising the main characteristics of the messages conveyed by the respondents (12).

Students who provided responses to open-ended questions were classified according to three philosophical approaches:

- 1) a utilitarian approach, whereby a decision is reached by weighing the overall benefit against the disadvantages;
- 2) a Cartesian approach, whereby only the instrumental value of animals is considered; and
- 3) an abolitionist approach, whereby no animal use can be justified.

Data analysis

All of the data collected were analysed by using the IBM Statistical Package for Social Sciences® 17.0 (SPSS 17.0) and Microsoft Excel® 2010. The variables were tested with the non-parametric Chi-squared test, to verify whether the responses were statistically different across the groups. All the tests were analysed with a confidence level of 95% ($p = 0.05$).

Table 1: Chi-squared tests of the relevant comparisons across discipline and year of study

Question (relevant comparisons)	<i>n</i> (missing)	χ^2	<i>P</i>
Do you know the legislation that regulates the use of animals in education and research? (freshmen <i>versus</i> seniors)	101 (0)	0.039	0.843
Do you know the legislation that regulates the use of animals in education and research? (across discipline)	101 (0)	2.509	0.474
Was pain control used in the procedures on animals? (freshmen <i>versus</i> seniors)	101 (2)	14.601	0.001*
Was pain control used in the procedures on animals? (across discipline)	101 (2)	16.562	0.011*
Were learning goals attained when animals were used in class? (freshmen <i>versus</i> seniors)	101 (2)	5.561	0.062
Were learning goals attained when animals were used in class? (across discipline)	101 (2)	19.427	0.004*
Were learning goals attained when alternative methods were used in class? (freshmen <i>versus</i> seniors)	101 (7)	4.736	0.094
Were learning goals attained when alternative methods were used in class? (across discipline)	101 (7)	5.511	0.480
Philosophical orientation according to content analysis (freshmen <i>versus</i> seniors)	101 (12)	1.525	0.467
Philosophical orientation according to content analysis (across discipline)	101 (12)	9.734	0.136
Were learning goals attained when alternative methods were used in class? (students <i>versus</i> lecturers)	121 (9)	0.357	0.837

n = sample size; *missing* = number of responses not received; χ^2 = chi-squared test value; *P* = probability value (*significant differences found at 5% confidence level).

Results and Discussion

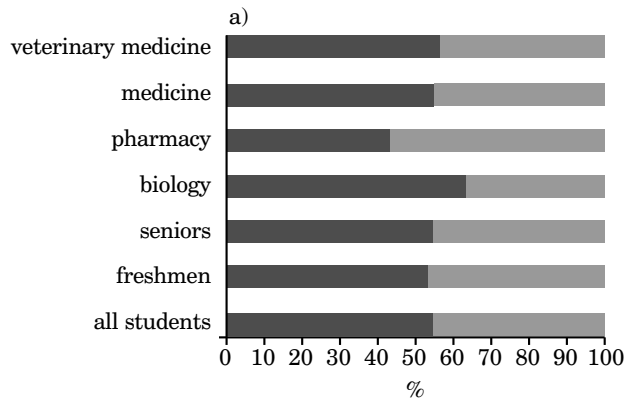
The number of student interviews that had been originally planned for Medicine was not achieved, even with the additional strategy employed. This might suggest that the issue of laboratory animal use is a minor priority for Medicine students in relation to students of other disciplines. However, animals are used in the teaching of Medicine at the UFPR. Further research is needed to understand the reasons underlying this phenomenon.

The overall percentage of students stating that they knew the laws relating to the use of laboratory animals in Brazil was 54.5% (Figure 1a). There were no differences between academic disciplines or between freshmen and seniors (Table 1). If the students in the first semesters at university displayed a lack of information on the subject, we would expect their knowledge to increase throughout their academic lives. However, our results showed that this topic is probably not efficiently covered in the curriculum of the degrees studied. A law that is not known by society can hardly be adhered to, nor can supervision be imposed on the individuals involved. Thus, the relevance of our results becomes clear in both the legal and the animal welfare context. The data obtained suggest that there is a need to increase the information

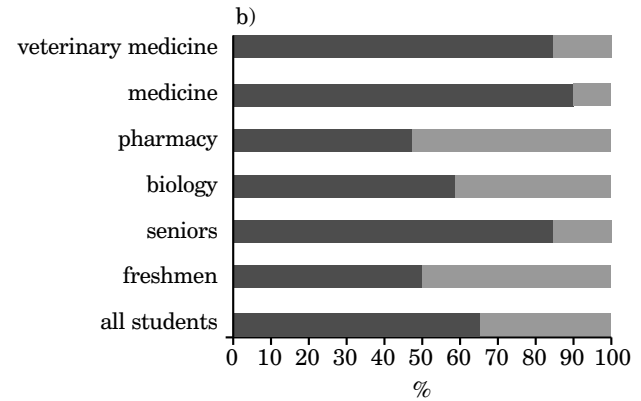
available on the regulation of laboratory animal use in the UFPR, since an unacceptably high percentage of students, who are themselves exposed to animal use, did not know the laws governing it. The lack of similar publications from other higher education institutions in Brazil, suggests that the situation elsewhere might not be significantly different from that at the UFPR.

In relation to pain control, 65.7% of the students reported the use of anaesthetics (Figure 1b). There were significant differences between the answers of freshmen and seniors respondents, and between those of respondents from different disciplines (Table 1). The use of anaesthetics was reported by 84.4% of seniors and by 50.0% of freshmen. This suggests that, at some point during their studies, students start recognising the need for anaesthetics and act accordingly, or the use itself becomes more common due to the severity of the procedures. Pharmacy and Biology were the disciplines with the highest percentage of 'no pain control' reports, while the use of anaesthetics was the standard in Veterinary Medicine and Medicine, with students of these disciplines reporting lower percentages of 'no pain control' during procedures (Figure 1b). Lecturers prevent the use of anaesthetics in some experiments, due to the drugs' inherent characteristics. For example, in Pharmacy, a common rea-

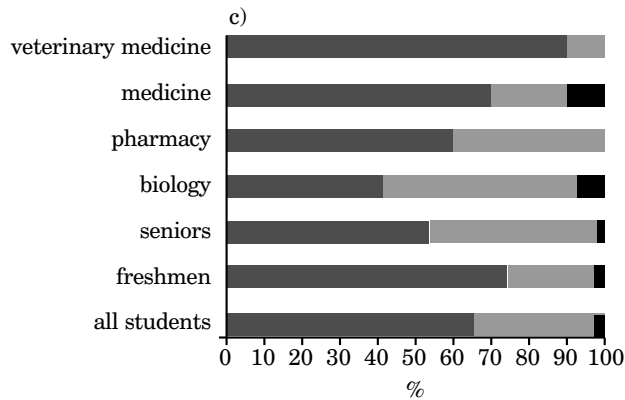
Figure 1: The responses of 101 students and 20 lecturers to various questions regarding animal use in education and research



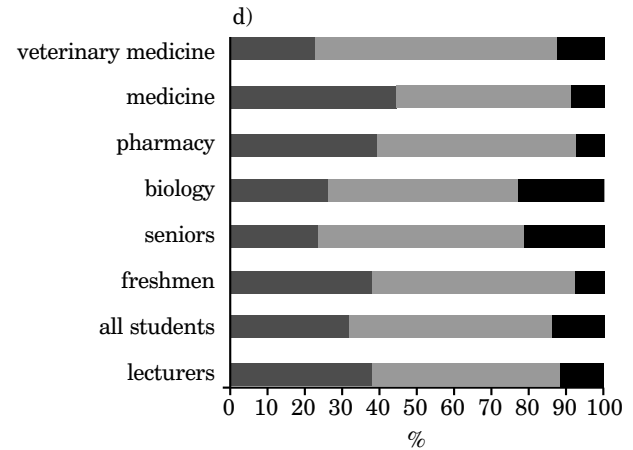
■ = yes; ■ = no.



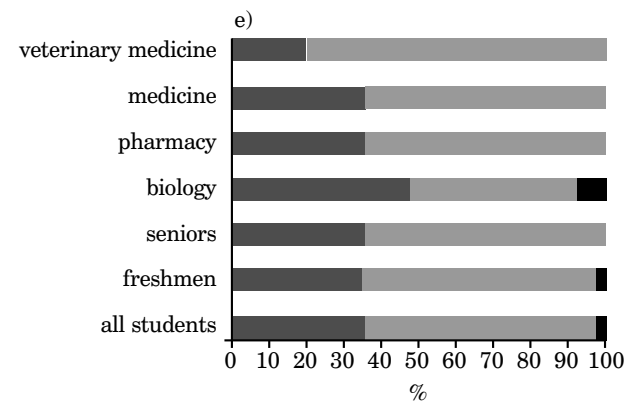
■ = yes; ■ = no.



■ = yes, totally; ■ = yes, partially; ■ = no.



■ = yes, totally; ■ = yes, partially; ■ = no.



■ = Utilitarian approach;
■ = Cartesian approach;
■ = Abolitionist approach.

The questions asked were: a) "Do you know the legislation that regulates the use of animals in education and research?"; b) "Was pain control used in the procedures on animals?"; c) "Were learning goals attained when animals were used in class?" and d) "Were learning goals attained when alternative methods were used in class?". The philosophical orientation of the answers, according to content analysis, is shown in e).

son to use animals is to demonstrate the effects of particular drugs on the organism. For that reason, no interaction with an anaesthetic drug is allowed. However, it is arguable whether this is the only way to reach such learning goals, which makes the whole practice ethically and legally questionable in Brazil. There might be cases in other disciplines where similar situations occur. The Biology degree has a particular characteristic in that invertebrates are used in classes, which might be a reason why anaesthetics are not more widely used. The *Arouca Act* requires that all procedures involving vertebrates be subjected to IACUC approval before taking place, and with time, this might improve the use of anaesthetics and of alternatives as they become available.

To 64.6% of the students, the learning goals were attained in classes that employed animals (Figure 1c). There was no statistical significant difference between the percentages of freshmen and seniors who considered that the learning objectives had been 'completely attained' with teaching techniques that used animals (Table 1). However, this difference was significant when the answers from respondents of different disciplines were compared (Table 1). According to the students, the main reason in favour of animal use was that, in classes involving

studies on the effects of drugs, animal anatomy or surgical techniques, direct contact with live animals improves understanding of the issues involved (Table 2a). In these traditional methods, it could be said that the scenario is remembered due to the traumatic experience and not because of the teaching content (13). This teaching strategy might form the basis of an effort to desensitise students and lecturers to the use of animals in education. The fact that our university system could turn initially compassionate students into less compassionate professionals is a high price for society to pay, and has been referred to as the perversion of higher degrees (14). Moreover, results with some alternative methods, including some of the most difficult replacements — such as teaching manual skills such as surgery — show high levels of student satisfaction (15). On the other hand, while it is beneficial for university teachers to foster the initial contact with the intrinsic activities of each profession, the format of this experience should be carefully considered. Alternative methods and discussions on the subject must be made available to students, who may then choose the option that does not oppose their moral values (16). Most importantly, since the example set in the classroom is likely to last long into the professional lives of the students, the type of human–ani-

Table 2: Examples of comments taken from the student questionnaires

a)	<p>“The use of animals in practical classes is necessary since it helps to learn, and there are no efficient alternative methods”.</p> <p>“Animals used in class are bred for this purpose, and do not present natural and compatible behaviour to live free in nature. They are well treated and euthanised with sedatives without pain. The use of animals helps to understand the subjects and enable practical approaches”.</p> <p>“It is important to use animals in class. They would be killed anyway”.</p> <p>“It is absurd to put the life of a mouse in first place when its use would assist the education of professionals and the development of knowledge to save innumerable human lives”.</p>
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b)	<p>“Classes using animals are remarkable, not because of the content, but due to the shocking images, suffering and death. Computer simulations, videos and images are useful but sometimes lecturers are not prepared to use these resources, so the results are not satisfactory”.</p> <p>“Whenever possible we should substitute the animals by using prototypes and other efficient alternatives”.</p> <p>“The use of videos and images can avoid the need of killing more animals for the same objective”.</p> <p>“I am totally against the use of animals in classes and tests because alternatives exist already”.</p>
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c)	<p>“In my internship, I use animals and noticed that the lack of financial support and adequate equipment can affect the care they receive”.</p> <p>“Lecturers do not correctly conduct the classes and the students perform the procedures alone and inadequately”.</p> <p>“Many students play with the animals when lecturers are not supervising classes”.</p> <p>“In class, students’ lack of interest can promote animal suffering”.</p>

The examples were taken from a total of 44 ‘additional comments’ given by the 101 students interviewed at the Federal University of Paraná. a) 15 support the use of animals; b) 11 support the use of alternatives; and c) 18 show intermediate levels of support.

mal interaction to be fostered is one of professionals in the presence of living beings, not of disposable laboratory material (13). In addition, student exposure to negative experiences may lead to early termination of the studies, absence from specific classes, and a decrease in meaningful learning (2).

The alternative, non-animal methods reported to have been used were pictures (67.4%), videos (56.5%), computer programs with biological function simulations (43.5%), cell cultures (22.8%) and mannequins (2.2%). The total percentage of responses is 192.4%, due the fact that the students could choose more than one answer. The majority of student respondents (54.3%) considered that the learning goals were partially attained with alternative methods (Figure 1d). There were no significant differences between the answers of freshmen and seniors, or across disciplines (Table 1). In all the groups, the option with the highest percentage of responses was that the learning goals were partially attained (Figure 1d). It was evident that the students regarded alternative methods as additional tools to the use of animals, as opposed to robust teaching methods that could be used alone. This might be related to the fact that, according to some of the student replies to the open questions, lecturers take a less careful approach to teaching when alternative methods are used (Figure 2b). The selection of alternative method and the teaching approach are both important in relation to each of the learning objectives. If classes are not carefully planned and properly conducted, students may get discouraged, as would occur with any teaching method (Table 2c). A study that assessed the use of cadavers for the teaching of surgical techniques, found that 88.9% of the students stated that they had satisfactorily learned the contents of the module by using the alternative method. In this case, students had already been introduced to the importance of reducing the use of living animals in classes by a campaign from the IACUC (15). Thus, education campaigns promoted by the IACUC might be an effective way of showing the usefulness of alternative methods.

If the discussion on alternative methods is expanded, another example is the use of a simulator of bovine rectal palpation, which was strongly supported by the students of Veterinary Medicine, as it helped to increase their confidence to perform the procedure (17). In this particular case, undergraduates have limited access to experimental bovines, since guidelines to promote animal welfare restrict the number of examinations allowed per animal. This situation promoted the use of alternative methods and the willingness to adopt the simulator.

Even though there was no structured institutional guidance, or support, for the adoption of alternative methods at the UFPR, some non-animal methods were used. The primary alternative

methods employed in each course were pictures and videos, which could partly explain their low acceptance, since the use of these methods might not be adequate to attain certain learning objectives. Students must be exposed to various forms of teaching; degrees that offer novel and modern methods in their curricula could use this characteristic in advertising (18).

When the opinions of lecturers and students with regard to the efficacy of alternative methods were compared, no significant difference was found (Table 1). A similar trend occurred in both groups: the choice most respondents agreed with was 'partially efficient' (lecturers: 50.0% and students: 54.3%), followed by 'totally efficient' (lecturers: 38.9% and students: 31.9%), and finally, by 'not efficient at all' (lecturers: 11.1% and students: 13.8%; Figure 1d). In relation to the philosophical orientation of the students, the percentage of those that fitted within a Cartesian approach was 61.8%, while 36.0% seemed to follow an utilitarian approach, and only 2.2% had an abolitionist approach. There were no differences between freshmen and seniors, or across disciplines (Table 1). For freshmen, seniors, and those respondents doing degrees in Pharmacy, Medicine and Veterinary Medicine, the Cartesian approach included the majority of responses (Figure 1e). This is in agreement with other findings in our study, but it is surprising, given the existence of many more recent philosophical approaches. In contrast, most of the respondents from Biology fitted a utilitarian approach. The abolitionist approach was only observed in two groups of respondents: those studying Biology and the freshmen (Figure 1e). The influence of the lecturer's attitude on the students may be relevant. During the process of knowledge acquisition, a filtering process takes place according to personal values and the status of the source of information (19). As is the case with parents, lecturers represent authority figures, and may act as role models for future professionals. Thus, their influence on the students is important (2). Besides, according to Moscovici (19), there is always a tendency for the information source, the lecturer in this case, to champion his/her point of view, even if subconsciously. Students learn much more from their teachers than solely the direct content intentionally expressed in classes. Lecturers subtly influence their students through the methods they choose to employ, and the form of animal handling, which might deliver strong messages with regard to moral values and attitudes (2). Therefore, university lecturers are key to the promotion of animal welfare, since they are responsible for guiding the students through all of its ethical aspects, including the deontological and legal factors (20).

Several philosophical and ethical approaches can influence the use of animals in research and education. Nevertheless, it is the common view

among philosophers that the acceptable ethical behaviour must not be partial, but universal (21). Acting ethically requires that we equate the importance of our individual interests to those of others — human beings (22) or sentient beings (21). Education should stand at the crossroads of science and philosophy, economy and politics, where ethics naturally surges (23). Currently, in Brazil, there is detailed legislation to support this discussion. Such legislation, together with education in animal welfare and ethics, may provide the basis for the promotion of an increasingly ethical treatment of animals.

Conclusions

Most lecturers believe that employing teaching methods that use animals is a more-efficient way of achieving learning objectives, an opinion that is shared by most of their students. This tends to result in maintenance of the *status quo* in terms of animal use in teaching. The only differences in responses between freshmen and seniors related to the use of pain control. When the opinions of respondents from different disciplines were compared, disparities were found on pain control and on the usefulness of animal use. The low percentages of freshmen and senior students who reported knowing the legislation on the use of laboratory animals, denotes the lack of appropriate discussion on this topic throughout academic life. Our results suggest that educational activities, focusing on the usefulness and availability of alternative methods, and aimed at both students and teaching staff, would be beneficial. The need for obligatory courses on bioethics and animal welfare within the curricula of all courses where animal handling is allowed, is also evident. This could be employed as a strategy to improve the discussion of issues related to the use of animals for education. In general, the results suggest that it is necessary to expand the discussion on alternatives to animal use in the academic environment.

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References

1. Singer, P. (2002). *Animal Liberation*, 324pp. New York, NY, USA: Ecco.
2. Balcombe, J. (2000). *The Use of Animals in Higher Education. Problems, Alternatives & Recommendations*, 104pp. Washington, DC, USA: Humane Society Press.
3. Balcombe, J. (2006). Assessment of alternatives in education. In *From Guinea Pig to Computer Mouse: Alternative Methods for a Progressive, Humane Education*, 2nd edn (ed. N. Jukes & M. Chiuiua), pp. 40–53. Leicester, UK: InterNICHE.
4. Russell, W.M.S. & Burch, R.L. (1959). *The Principles of Humane Experimental Technique*, 238pp. London, UK: Methuen. Available at: http://altweb.jhsph.edu/pubs/books/humane_exp/het-toc (Accessed 05.04.12).
5. Bekoff, M. (1998). *Encyclopedia of Animal Rights and Animal Welfare*, 446pp. Westport, CT, USA: Greenport Press.
6. Webster, J. (2005). *Animal Welfare: Limping Towards Eden*, 2nd edn, 296pp. Oxford, UK: Blackwell.
7. Anon. (2008). *Lei N° 11.794, de 8 de Outubro de 2008*. Brasília, DF, Brazil: Imprensa Nacional. Available at: <http://www.in.gov.br/imprensa/visualiza/index.jsp?jornal=1&pagina=1&data=09/10/2008> (Accessed 21.03.12).
8. Anon. (1998). *Lei N° 9.605, de 12 de Fevereiro de 1998*. Brasília, DF, Brazil: Imprensa Nacional. Available at: <http://www.in.gov.br/imprensa/visualiza/index.jsp?jornal=1&pagina=122&data=13/02/1998> (Accessed 21.03.12).
9. Lüdke, M. & André, M.E.D.A. (1986). *Pesquisa em Educação: Abordagens Qualitativas*, 99pp. São Paulo, SP, Brazil: Pedagógica e Universitária Ltda. [In Portuguese.]
10. Turato, E.R. (2005). Métodos qualitativos e quantitativos na área da saúde: Definições, diferenças e seus objetos de pesquisa. *Revista Saúde Pública* **39**, 507–514. [In Portuguese.]
11. Landim, F.L.P., Lourinho, L.A., Lira, R.C.M. & Santos, Z.M.S.A. (2006). Uma reflexão sobre as abordagens em pesquisa com ênfase na integração qualitativo-quantitativa. *Revista Brasileira de Promoção da Saúde* **19**, 53–58. [In Portuguese.]
12. Bardin, L. (1977). *Análise de Conteúdo*, 226pp. Lisboa, Portugal: Edições 70. [In Portuguese.]
13. Paixão, R.L. (2008). Métodos substitutivos ao uso de animais vivos no ensino. *Ciência Veterinária nos Trópicos* **11**, 88–91. [In Portuguese.]
14. Vonesch, A. (2005). Associations are changing public opinion and breeding methods to improve animal well being. In *Animal Bioethics: Principles and Teaching Methods* (ed. M. Marie, S. Edwards, G. Gandini, M. Reiss & E. von Borell), pp. 133–155. Wageningen, The Netherlands: Wageningen Academic Publishers.
15. Silva, R.M.G., Matera, J.M. & Ribeiro, A.A.C.M. (2007). New alternative methods to teach surgical techniques for veterinary medicine students despite the absence of living animals. Is that an Academic Paradox? *Anatomia, Histologia, Embryologia* **36**, 220–224.
16. Balcombe, J. (1998). *Animal Dissection*, 15pp. Washington, DC, USA: The Humane Society of the United States.
17. Baillie, S., Mellor, D.J., Brewster, S.A. & Reid, S.W.J. (2005). Integrating a bovine rectal palpation simulator into an undergraduate veterinary curriculum. *Journal of Veterinary Education* **32**, 85–91.
18. Daneshian, M., Akbarsha, M.A., Blaauboer, B., Caloni F., Cosson, P., Curren, R., Goldberg, A., Gruber, F., Ohl, F., Pfaller, W., van der Valk, J., Vinardell, P., Zurlo, J., Hartung, T. & Leist, M. (2011). A framework program for the teaching of alternative methods (replacement, reduction, refinement) to animal experimentation. *ALTEX* **28**, 341–352.
19. Moscovici, S. (1978). *A Representação Social da*

- Psicanálise*, 291pp. Rio de Janeiro, RJ, Brazil: Zahar. [In Portuguese.]
20. Lima, K.E.C., Mayer, M. & Carneiro-Leão, A.M. (2008). Conflito ou convergência? Percepções de professores e licenciados sobre ética no uso de animais no ensino de zoologia. *Investigações em Ensino de Ciências* **13**, 353–369. [In Portuguese.]
 21. Singer, P. (1993). *Ética Prática*, 400pp. São Paulo, SP, Brazil: Livraria Martins Fontes Editora Ltda. [In Portuguese.]
 22. Smith, A. (1999). *Teoria dos Sentimentos Morais*, 462pp. São Paulo, SP, Brazil: Livraria Martins Fontes Editora Ltda. [In Portuguese.]
 23. Pelizzoli, M.L. (2002). *Correntes da Ética Ambiental*, 192pp. Petrópolis, RJ, Brazil: Vozes. [In Portuguese.]