

PERSPECTIVES OF STUDENTS ON TEACHING LABORATORY ANIMAL SCIENCE

PERSPECTIVAS DE ESTUDANTES ACERCA DO ENSINO DA CIÊNCIA DE ANIMAL DE LABORATÓRIO

PERSPECTIVAS DE LOS ESTUDIANTES SOBRE LA ENSEÑANZA DE LA CIENCIA DE LOS ANIMALES DE LABORATORIO



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ABSTRACT: Living with animal use and experimentation is constant during the study of biological sciences. However, many universities lack disciplines focused on this theme. Therefore, the research objective was to evaluate indicators that would reveal the need to implement the discipline “Biotherism and Biosafety” as a mandatory component of the curricular matrix of the Biological Sciences Course. For this, 192 students were interviewed during the four years of graduation. In general, the majority expressed interest in the Bioethics and Animal Welfare theme. In addition, it was verified that most of them had a deficiency in articles related to biotherism and animal sentience. It could be noticed that adding a discipline capable of covering the themes of sentience, bioethics, and animal welfare emerges as a promising initiative to train and instigate the reduction of abuses committed with experimental animals, in addition to training conscious professionals and trainers of opinion.

KEYWORDS: Biosecurity. Biotherism. Education. Teaching.

RESUMO: Durante o estudo das ciências biológicas, o convívio com o uso animal e a experimentação é constante. Entretanto, muitas universidades carecem de disciplinas voltadas a essa temática. Sendo assim, o objetivo da pesquisa foi avaliar indicadores que revelassem a necessidade da implantação da disciplina “Bioterismo e Biossegurança” como componente obrigatório da matriz curricular do Curso de Ciências Biológicas. Para isso, foram entrevistados 192 estudantes entre os quatro anos de duração da graduação. De maneira geral, a maioria expressou interesse pela temática de Bioética e Bem-estar animal. Ademais, foi verificado que grande parte tinha deficiência em temáticas relacionadas com bioterismo e sentiência animal. Pôde-se perceber que a adição de uma disciplina capaz de abarcar os temas da sentiência, bioética e bem-estar animal desponta como uma iniciativa promissora para capacitar e instigar a diminuição dos abusos cometidos com animais experimentais, além de formar profissionais conscientes e formadores de opinião.

PALAVRAS-CHAVE: Biossegurança. Bioterismo. Educação. Ensino.

RESUMEN: Durante el estudio de las ciencias biológicas, la convivencia con el uso y la experimentación animal es una constante. Sin embargo, muchas universidades carecen de disciplinas enfocadas en este tema. Por lo tanto, el objetivo de la investigación fue evaluar indicadores que revelaran la necesidad de implementar la disciplina “Bioterismo y Bioseguridad” como componente obligatorio de la matriz curricular de la Carrera de Ciencias Biológicas. Para ello, se entrevistó a 192 estudiantes durante los cuatro años de graduación. En general, la mayoría manifestó interés en el tema de Bioética y Bienestar Animal. Además, se verificó que la mayoría presentaba deficiencia en temas relacionados con el bioterismo y la sintiencia animal. Se pudo notar que la incorporación de una disciplina capaz de abarcar los temas de sintiencia, bioética y bienestar animal surge como una iniciativa promissora para capacitar e instigar a la reducción de los abusos cometidos con animales de experimentación, además de formar profesionales conscientes y formadores de opinión.

PALABRAS CLAVE: Bioseguridad. Bioterismo. Educación. Enseñando

Introduction

The use of animals for experimentation is an ancient and commonly used practice in biological sciences, presenting positive results and, consequently, advances in the quality of human life, thus ending up becoming essential in the development of technologies such as medicines and vaccines (BASTOS; DA SILVA; SOARES, 2021; PEREIRA *et al.*, 2017).

To supply the allocation of these animals, vivariums emerged, which, according to Polit *et al.* (2008, p. 18, our translation), are defined as “[...] areas intended for the creation and maintenance of laboratory animals in sanitary conditions, within strictly established standards, respecting ethical standards and the laws of manipulation and vivisection”.

Even though, in most cases, physical facilities and equipment intended for animals do not meet the necessary safety requirements in Brazil, the requirement for known sanitary standards has been stimulating the improvement of Brazilian facilities, with the adoption of appropriate sanitary barriers, ensuring the reduction of contamination risks and contributing to the well-being and health of these animals (GUILLEN, 2012). Without a doubt, the standardization and maintenance of an adequate vivarium are essential factors to guarantee the reliability and control of the results obtained in an experiment (HUBRECH; CARTER, 2019).

However, the use of animals in research and teaching encounters inherent problems related to issues of conduct in bioethics, considering that any use of animals in research or teaching, essentially, will always result in impacts on their well-being. Whether due to the natural behavioral and habit changes of these animals, enclosure, and placement in standardized environments or due to manipulations and genetic alterations (BRASIL, 2016).

The way these animals are used has been the source of great discussion in several countries, including Brazil. To prevent the use of these animals from being neglected, ethical principles, codes, and legislation on the subject have been created in activities that may compromise their well-being. Currently, Federal Law 11,794/08, which in its chapter II, article 4, when creating *Concea*, the National Council for the Control of Animal Experimentation, enables regulation, as well as the application of guidelines for the practice of using animals belonging to the phylum Chordata, subphylum Vertebrata (BRASIL, 2008).

It is also seeking to minimize such damage that research has been focusing on the area, aiming to replace the use of animals with alternative methods. Currently, the development of computerized simulators, especially those aimed at studying physiology and pharmacology, for example, in addition to models and virtual reality with 3D software, is becoming a reality

in European educational institutions (PEREIRA *et al.*, 2017). However, the high cost of implementing these materials in Brazilian educational institutions becomes a financial impediment to adding these tools to Brazilian curricular matrices, which end up using animals as their only resource.

In parallel, legislation regulating the use of animals in laboratories has implemented biosafety standards aimed at preventing, minimizing, or eliminating risks exposed to teaching and research activities. Biosafety, in turn, presents itself as a set of actions that aim to prevent, control, reduce, or eliminate risks inherent to activities that compromise human, animal, and plant health (POLITI *et al.*, 2008).

The awareness of most researchers and teachers regarding the adoption of some principles considered basic and rules for promoting a safe work environment in vivariums. In the opinion of professionals in the field of laboratory animal science, biosafety training should be a requirement for practice in these spaces, preferably on an ongoing basis rather than as a one-off training (STEELMAN; ALEXANDER, 2016). Biosafety, through these means, is now considered a learning experience whose practice and training must constantly be reinforced.

In this context, the inclusion of a curricular matrix on the contents of the area of laboratory animal science (biosafety and bioethics) for agricultural, biological, and health sciences courses ends up being able to offer students the necessary scientific knowledge in the use of animals in practical classes, with the use of animals and research projects.

This makes it possible to reduce risks, abuses, and controversy regarding the use of animals without harming techno-scientific advancement, as both are concerned with the quality of life of the individuals who handle them, as well as the well-being of the guinea pig animals. (SILVA; SANTORI; MIRANDA, 2016).

Given the above, it is necessary to understand students' perceptions regarding including the Biosafety and Bioethics discipline in the curriculum. It is estimated through this, in addition to identifying deficiencies and previous knowledge on the subject, such as impressions about the area of laboratory animal science and its ramifications, the opportunity to find ways for a practical introduction of the discipline to meet students' desires and expectations.

Methodology

The preparation of the work refers to the research of a qualitative nature, about the opinion on issues related to the practice of animal experimentation in scientific research and the importance of the disciplines of Bioethics and Biosafety in the Major's and Bachelor's Degree Biological Sciences course, offered by the Rural Federal University of Pernambuco.

According to Demo (2000), theoretical research results in significant argumentative resourcefulness, but data and concrete information from empirical work add significant value to theories and favor competent intervention. Furthermore, for Lankshear and Knobel (2008), well-structured and grounded research can point out interesting educational trends and patterns.

In this sense, a questionnaire was prepared containing 12 objective questions, in which it was possible to choose between the three alternatives present: yes, no, or never thought. The questions sought to identify scientific knowledge on the topic, the student's opinion on using animals in research and practical classes, and the interest in implementing said discipline in the course's curricular matrix.

Considering the total number of students enrolled in the course, a representative group was defined for the sample of students distributed between the first (CB1), second (CB2), third (CB3), and fourth (CB4) year, in the morning, afternoon, and night shifts for the application of the questionnaire. The interviewees were previously introduced to the project and agreed to participate. Subsequently, the computed data were analyzed and applied to statistical tests when necessary.

Table 1 – Questionnaire applied to Bachelor and Major students in Biological Sciences

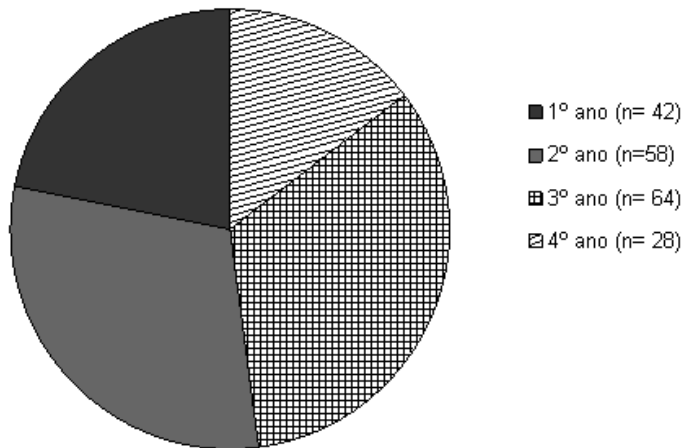
Item	Questions
1	Do you have any knowledge about bioethics and biosafety?
2	Do you know what a vivarium is and its importance in the areas of teaching biological sciences and health?
3	Are you aware of the levels of sentience among animals?
4	Do you agree with the use of animals in scientific research and practical classes in higher education institutions?
5	Do you work or have you worked with research that uses animals?
6	In a survey, would you consider the number of animals used in the project?
7	In a survey, would you consider the welfare of animals?
8	Do you think it is correct to use animals in testing cosmetic products?
9	Would you attend a class where animals were subjected to pain and suffering?
10	Have you ever participated in a practical class where animals were used?
11	Could animals be replaced by alternative methods in practical classes and research projects?
12	What do you think about including Bioethics and Biosafety in the Bachelor and Major courses in Biological Sciences on a mandatory basis?

Source: Own authorship (2023)

Results and Discussions

The questionnaire was answered by 192 university students, divided between 1st (n= 42), 2nd (n= 58), 3rd (n=64), and 4th year (n=28) of the Biological Sciences course (Figure 1).

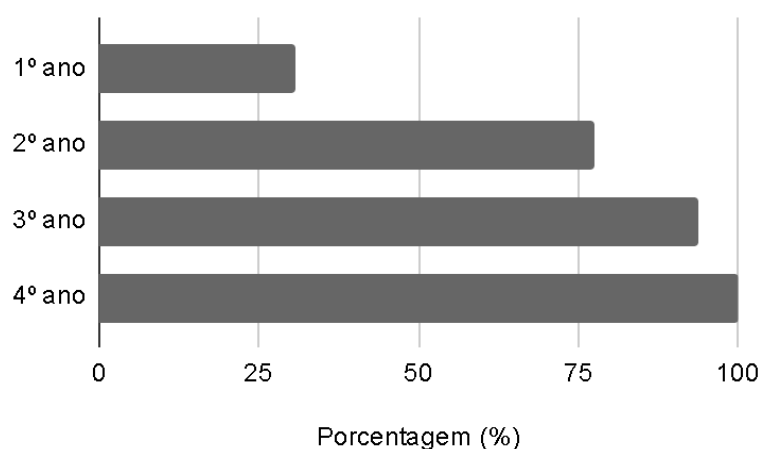
Figure 1 – Number of respondents in each Biological Sciences course stream



Source: Own authorship (2023)

According to the responses obtained among 1st-year students (CB1) of the Major's and Bachelor's Degree in Biological Sciences, it was observed that only 30.9% of students stated that they had prior knowledge on the topic "bioethics and biosafety". However, a significant growth in academic expertise could be observed as the second, third, and fourth year of graduation progressed (77.5%, 93.7%, and 100%, respectively), as shown in Figure 2. It is worth highlighting that, even though there is a natural development of knowledge during graduation, it is prudent to reaffirm the importance of training as it encourages a reduction in the false sense of invulnerability that arises with everyday practice.

Figure 2 – Evolution of knowledge of Bachelor and Major students in Biological Sciences about bioethics and biosafety according to years of experience in the courses



Source: Own authorship (2023)

In a study developed by Pinto and Paixão (2018), 350 pedagogical course projects (PCP) from 261 public Higher Education Institutions with a Biological Sciences course in academic degrees of bachelor's degree, full degree, or both were analyzed. It was observed that 69% of the PCP did not have the Bioethics discipline in the projects' curriculum matrix, and no discipline entitled Animal Ethics or Environmental Ethics was found in the curriculum analyzed in the research in question.

Despite this, Lima *et al.* (2021) found that 78% of students who started the veterinary medicine course stated that they were very interested in issues of ethics and well-being in their relationships with animals and that the vast majority (92.9%) believed that the discipline of ethics and animal welfare should be mandatory in the curriculum. The same could be verified in research with university professors in the biomedical field, who agreed that it is essential and necessary for the topic of bioethics to be addressed in a transversal way in undergraduate courses that use animals in practical classes (MELGAÇO; MEIRELLES; CASTRO, 2011).

According to data collected in the present study, the students showed a sensitivity to animal pain and suffering, constituting a fundamental feeling for developing a perception of animal ethics valuing their well-being. A significant percentage of students demonstrated awareness regarding well-being, the number of animals used, and the non-use for cosmetic purposes (98.9%, 92.7%, and 96.3%, respectively). In these values, it is possible to observe an awareness of animal ethics, in which students begin to worry about an abusive number of

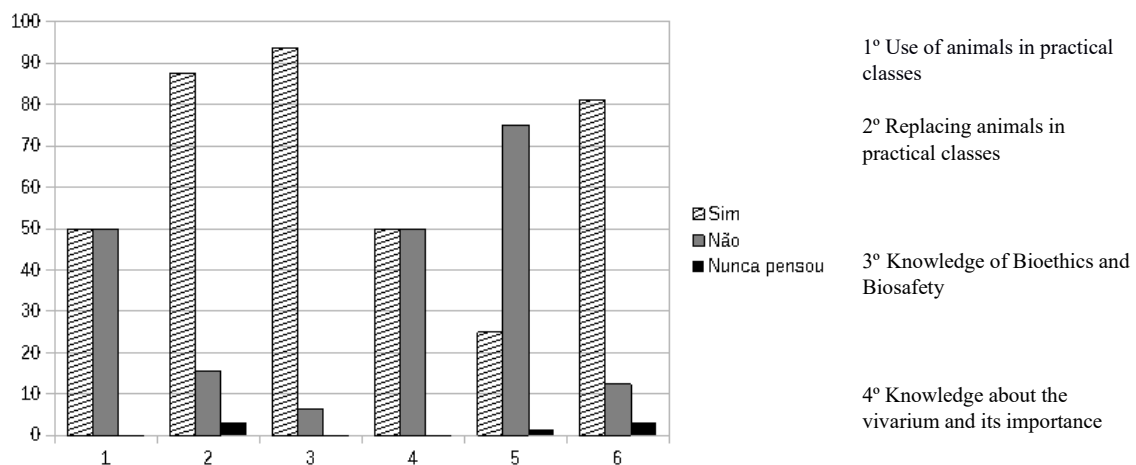
animals used unnecessarily, in addition to the pain and suffering that can be caused to them, considering their well-being.

Given the proximity of such issues to the theory of the three “Rs” proposed by Russel and Burch, where animals should only be used in essential situations, it is up to scientists to always look for alternatives, not only in the development of their experiments but also in teaching (PEREIRA *et al.*, 2017).

However, few students throughout the four years of the course responded that they knew the levels of animal sentience, since only 7.1% (CB1), 17.2% (CB2), 25% (CB3), and 28, 5% (CB4) demonstrated that they had extensive knowledge on the topic (Figure 3). As stated, it is alarming that only 19.8% of those interviewed indicate that they know the levels of consciousness. This lag can be justified by the fact that “sentience”, as a study, still encounters skepticism in some sectors of the scientific environment.

When considering the emotional life of animals, some are very critical, claiming that irrefutable scientific proof is necessary. On the other hand, fortunately, several scientists have been looking into the issue of animal sentience and claim that we rarely have complete knowledge of the problems. Involved in any matter. Therefore, nothing prevents us from making correct predictions about animal sentience (GREEK; GREEK, 2010).

Figure 3 – Positioning of students in the second year of Biological Sciences regarding the use of animals in practical classes



Source: Own authorship (2023)

Regarding participation in using animals in practical activities, 56.2% of the course students stated that they had already used animals in these classes. This fact demands attention, considering the little experience of these students in the management and care

required in these activities, in addition to questions in the scientific community regarding the validity of using animals in practical teaching activities (SILVA; SANTORI; MIRANDA, 2016).

According to the data obtained, around 52.3% of students in the first year of the course were in favor of the use of animals in research and practical classes, and even though they were still in the first year, 19% said they had already worked with animal research, while 30.9% had already participated in practical classes that use animals as guinea pigs.

In the second year, around 53.4% had already participated in activities that used guinea pigs, in the third and fourth years, 56.2% and 100%, respectively, had already attended in practical classes with animals. Despite this, when it comes to replacing animals with alternative methods, 69% of first-year students were in favor. In subsequent years, a significant number of students supported substitutive methods could also be observed, as seen in 56.8% of second-year students, 87.9% of third-year students, and 67.8% of fourth-year students.

In general, a large portion of students favored replacing animals with alternative teaching methods (73.4%), contrasting with around 25% who disagreed that alternative methods could be applied to replace the number of test subjects used in universities.

Similar results were obtained in several studies, such as the one developed by Lima *et al.* (2021), with students from the Veterinary Medicine course, of which 72.3% stated that alternatives should always be used as far as possible and in the work of Tréz and Nakada (2008), who observed, through reports, that a large some biology students considered that animals should not be used if there were substitute alternatives.

Although certain areas find it difficult to replace the use of animal models, the tendency is that, as research and technology development advances, new replacement models will be found to provide impressive opportunities to promote the Three Rs. (HUBRECHT; CARTER, 2019). However, it is necessary to know that applying these methods has a very high initial cost, but in the long term, it becomes viable, considering that, once implemented, they can be reused countless times.

Regarding knowledge about what would become a vivarium, a few students knew about the topic in question in the initial years of the course, as seen in 21.4% of those interviewed in the first year and 18.9% in the second year. However, an increasing trend in knowledge acquisition was noticeable, reaching 50% in the third year and 100% in the fourth year.

Despite this, analyzing in general, only 56.5% of the students interviewed knew what a vivarium was and its importance for courses in the health area, highlighting a deficiency in both administrative and operational information observed in the questions that they concern the vivarium and its functions within the university since the initial periods of the course.

Furthermore, the lack of knowledge about these spaces and their routines can compromise the standardization and maintenance of these spaces appropriately, which is essential to guarantee the reliability and control of the results obtained in an experiment (POLITI *et al.*, 2008).

A good part of the students (71.8%) responded that they were in favor of the integration of a discipline focused on the study of bioethics and animal welfare, a need not met during professional training since Bioethics, as well as Biosafety, are areas that are undergoing great expansion and directly contribute to the correct and safe development of scientific and technological research. Of these, 61.9% were in the first year, 67.2% in the second, 81.25% in the third, and 60.7% in the fourth year of the Biological Sciences course.

A fact that draws attention is that a considerable number of students at the end of the course exhibited a position contrary to the implementation. However, in an interview conducted by Bastos, Da Silva, and Soares (2021), when asked about the ability of the Bioethics and Biosafety discipline to increase interest in the subject, only 18.8% of respondents from the biological sciences course stated the statement negatively at the end of the discipline.

Thus, even though the constant contact in research projects, for example, has possibly caused a sense of knowledge of the area in students in the fourth year of the course, the implementation of the discipline is still relevant as it arouses the interest of students in the laboratory animal science theme.

Final considerations

The experience with animal use during the professional training process is constant, with research conducted with biological students elucidating how the subject of laboratory animal science, bioethics, and well-being is exposed during the undergraduate period. It is noticeable, therefore, how familiarization with the subject is gradual, even though it is of great importance in the academic world and, consequently, in professional development, given that the use of animals in experimentation and teaching is a need that is only partially resolved by

current alternative methods. For this reason, it is mandatory to introduce courses on teaching bioethics and biosafety to minimize damage caused to these animals in such practices.

In this context, the addition of a discipline capable of covering the themes of bioethics and well-being would have the responsibility of training and encouraging these students to seek to reduce abuse committed with experimental animals without harming techno-scientific advances.

Implementing the discipline in the first year of the course will clarify the moral conflicts inherent to the use of animals in research and teaching with a theory based on bioethics concepts, thus training conscious professionals and opinion-makers.

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