A Combinatorial Program on Biosafety and Ethics for Veterinary Students

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Abstract

Biosecurity and ethics topics should be a priority in the teaching of veterinary medicine, in order for the students to achieve the basic skills of ethics and the knowledge of universal measures to promote and safeguard animal welfare. Humans’ health like that of animals' and the environment's is interconnected. Therefore, the students must receive an education with an ecosystemic approach.

For this study, the non-formal environmental education program which was designed, implemented and assessed was aimed for first-semester university students of veterinary medicine, with the purpose of generating knowledge and determining the possibility of integrating ethics and biosafety subjects in the curriculum.

A total of 142 students participated in this study; meaningful improvements in knowledge of biosecurity and ethics were observed between the pre-test and post-test. 96.8% considered that the activities were accordingly to the topics explained.

This local research allows us to suggest the need to review the veterinarian’s career curriculum, and the urgency of introducing the axes of ethics and biosafety transversally.

Key words: education, knowledge, veterinary, skills, curricula
INTRODUCTION

Biosecurity and ethics topics should be a priority in the teaching of veterinary medicine, in order for the students to achieve the basic skills of ethics and the knowledge of universal measures to promote and safeguard animal welfare [1]. The World Organization for Animal Health (2013), developed the guidelines for the creation of a model of a basic curriculum for the training of veterinarians, with the aim of improving the quality of medical education in this area, under an integrative-thinking approach in which the topics of biosafety and ethics should be a priority for the students’ proper managing of the species [1, 3]. Like that of humans’, animals and the environment's health are interconnected. Therefore, the students must receive an education with an ecosystemic, biosecurity and ethical approach [4, 5].

These topics are relevant for the future veterinarian. They must be taught in a formal and transversal manner, with ethical and occupational health competencies, and the moral capacity to detect problems and become aware of these in their daily practice [6, 7, 8, 9]. In 2016 Magalhães-Sant'Ana proposed the teaching of veterinary medical ethics and the transmission of professional values by using normative documents, fostering desirable behaviors, ethical aptitudes and moral reasoning skills.

The occupational safety of veterinarians is a fundamental issue in the teaching of the student [11] due to exposure to physical, chemical and psychological risks in daily practice they are subjected to [12]. The knowledge on biological risks is scarce and there is a passive attitude from the veterinarians before this problem [13].

In Mexico, reviews of the different public veterinary schools’ curricula have been made, in which the lack of integration of ethics and biosafety in the veterinarian's curriculum has been observed [14]. There are no research projects where the training of these competences in the area of veterinary medicine is designed and implemented. Considering this problem, a non-formal environmental education program (NFEEP) was designed, implemented and evaluated for first-semester university students of veterinary medicine, with the purpose of generating knowledge and determining the possibility of integrating ethics and biosafety in the curriculum.

MATERIALS AND METHODS

Type and design

The design of the NFEEP was structured by workshops that lasted 15hrs. Each session lasted three hours of in-class work with the facilitator. The NFEEP was distributed in five sessions, considered the following biosafety topics: personal hygiene habits, safety equipment, use and handling of chemical, biological and disinfection products, use and management of municipal solid waste, hazardous waste and biohazard infectious hazardous waste; and the ethics issues: definition of ethics and bioethics, national and international legal standards, code of ethics, professional oath, rights, duties and responsibilities for the professional practice, examination of case studies. A total of nine group activities were carried out, with the aim of enabling
students to develop communication skills and five individual activities for them to become reflective and participatory and to demonstrate through their attitudes, their ethical values in a competent manner and to make them achieve respect awareness.

Population of study

We worked with first and second semester students from the Escuela Superior de Medicina Veterinaria y Zootecnia número 3 (School of Veterinary Medicine and Zootechnics, number 3, in English) (ESMVZ-3, for its name in Spanish) of the Universidad Autónoma de Guerrero (Autonomous University of Guerrero, in English), in the Municipality of Técpán de Galeana, in the State of Guerrero, located on the Acapulco - Zihuatanejo Federal Highway, Km 106 + 900. This program was implemented in two editions, in the months of June to July and November, 2017.

Definition of the sample

We worked with four groups (Table 1). The target population was integrated by a total of 142 students. A diagnostic assessment test was applied to 100% of the sample. The diagnostic tool applied was a questionnaire of 23 items of Likert-type scale with four response options, on ethics, bioethics, biosafety, informed consent, code of ethics, professional oath, Mexican official standards of animal welfare, universal protection standards, consequences of malpractice, veterinarian’s rights and duties.

Table 1. Application of the Non-formal Environmental Education Program by groups

<table>
<thead>
<tr>
<th>Target population by school grade</th>
<th>Group</th>
<th>Generation</th>
<th>Total of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>101 - First semester</td>
<td>1</td>
<td>2017-2022</td>
<td>46</td>
</tr>
<tr>
<td>102 - First semester</td>
<td></td>
<td>2017-2022</td>
<td>43</td>
</tr>
<tr>
<td>201 - Second semester</td>
<td>2</td>
<td>2016-2021</td>
<td>29</td>
</tr>
<tr>
<td>202 - Second semester</td>
<td></td>
<td>2016-2021</td>
<td>24</td>
</tr>
</tbody>
</table>

At the end of the workshops, a final assessment test was administered with the aim of measuring the changes of the target population derived from their learning achievement during the workshops. The test included 19 closed questions of Likert-type scale with four response options.

The content and the organization of the workshops were also assessed (to measure knowledge improvement, understanding of the topics, topics of interest and the structure of the workshops), the appropriateness and sufficiency of the didactic material used for the activities, how updated bibliographic material was and the development of the NFESEP, by pondering how easy to understand the activities had been, the timeliness of the topics, how much the dynamics encouraged learning and motivation to participate as a team or individual; also the participation of the
facilitator was pondered, taking into account her domain of the topic, respect, punctuality and dynamism. This tool used 30 items of a Likert scale with four response options.

**Analysis of data**

The data obtained through the assessment tests were captured in a Microsoft Excel version 2011 program and analyzed in the Statistical Package for the Social Sciences (SPSS) version 23.0. In order to analyze and interpret the outcomes of these assessments, the quantitative data analysis method was chosen, using descriptive statistics by frequency distribution and the differences were determined with the Chi-Square Test.

**RESULTS AND DISCUSSION**

First semester (94%) and second semester students (78%) knew the concept of ethics; group 1 (46%) and group 2 (67%) knew the bioethics concept, and 69% and 74% respectively knew the Biosecurity concept (Figure 1). The final assessment showed a significant increase in both groups in the learning of the concepts of ethics, bioethics and biosafety.

![Figure 1](image_url)

**Figure 1.** Diagnostic and final achievement assessment scores upon the knowledge of the concepts of ethics, bioethics and biosafety of Veterinary Medicine and Zootechnics students, Guerrero, Mexico, 2017.

54% of the students lacked knowledge on the code of ethics, informed consent, professional oath, consequences of malpractice, rights and duties of the professional. At the end of the workshops, on average, only 27% of the students still did not have
knowledge of these topics, which can be attributed to irregular attendance, disinterest in the topic or because they still do not have a vision about the importance of being a veterinarian.

Table 2 compares the diagnosis and the final assessments results of both groups on topics such as: the code of ethics, professional oath, malpractice, informed consent, rights and duties. There was a significant difference between both assessments in both groups, since p values are less than 0.05, so the hypothesis that the NFEEP is necessary to increase knowledge about ethical issues is accepted. Only in group 1, on the rights and duties issue, p is greater than 0.05 and the results may be influenced by chance.

**Table 2.** Results of the diagnostic and final assessments, on ethics issues seen in the NFEEP for students of Veterinary Medicine and Zootechnics, Guerrero, Mexico, 2017.

<table>
<thead>
<tr>
<th>Assessment by group</th>
<th>Code of ethics</th>
<th>Professional Oath</th>
<th>Malpractice</th>
<th>Informed consent</th>
<th>Rights and duties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>P</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>1-initial</td>
<td>16</td>
<td>17.9%</td>
<td>p=0.0004</td>
<td>9</td>
<td>10.1%</td>
</tr>
<tr>
<td>2-initial</td>
<td>11</td>
<td>20.7%</td>
<td>p=0.01</td>
<td>17</td>
<td>32%</td>
</tr>
<tr>
<td>1-final</td>
<td>49</td>
<td>69%</td>
<td>34</td>
<td>76%</td>
<td>55</td>
</tr>
<tr>
<td>2-final</td>
<td>34</td>
<td>68%</td>
<td>36</td>
<td>72%</td>
<td>38</td>
</tr>
</tbody>
</table>

95% of the target population was aware of the biosecurity measures that must be observed in the laboratory and for the treatment of domestic animals. As a protective measure in the laboratory, 99% said they wore a cotton gown, latex gloves and face masks. Only 62% identified occupational or professional risks that can occur to a Veterinarian, and 51% did not know which biohazard hazardous waste was generated and how it should be handled for its final disposal.

Table 3 shows the results of the assessment that the target population made upon the facilitator’s performance and the contents of the NFEEP. 97% of them considered that: the topics were of interest, the references were updated, the didactic material favored learning and that the organization was good. About the activities performed in the workshops, such as team or individual mental maps, games, brainstorming and socio dramas upon case studies, they mentioned that the activities were clear, dynamic and encouraging and that motivated learning, individual and team work. 98.5% considered that the facilitator had a good command of the subject and was a motivator who encouraged them to participate in the in-class activities. They recognized that the facilitator was respectful of the participants.
Table 3. Assessment of the facilitator and the content of the NFEEP made by the students of Veterinary Medicine and Zootechnics, Guerrero, Mexico, 2017.

<table>
<thead>
<tr>
<th>NFEED</th>
<th>Results</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of workshops</td>
<td>97%</td>
<td>Logistics, content and didactic material were very good.</td>
</tr>
<tr>
<td>Assessment of activities performed during the workshops</td>
<td>96.8%</td>
<td>The activities were good according to the topics explained.</td>
</tr>
<tr>
<td>Assessment of didactic material</td>
<td>97.8%</td>
<td>The didactic and bibliographic material was adequate for the activities.</td>
</tr>
<tr>
<td>Assessment of the facilitator</td>
<td>98.5%</td>
<td>The facilitator was on time, respectful of and dynamic with the students.</td>
</tr>
</tbody>
</table>

To 44% of group 1, the topic they liked better was ethics, to 23% of them it was biosafety, and to 20% it was waste; but to 13% of them were biosafety and ethics. In group 2, 42% chose biosafety and 22% ethics, 20% chose both issues and to 12% waste was the topic they liked better. About the facilitator’s participation, to 55% of the total population of students rated it as good, concerning the development of the workshops; and they rated her explanations, preparation and performance, very good. Regarding the content and development of workshops, 28% of the students mentioned that the workshops were interesting, clear and necessary for their training. 8% wanted more days of activities on these topics and more of this kind of workshops to be implemented. Both groups said to be willing to participate with the facilitator in further workshops.

According to various authors [6, 13, 15], the professional training of a veterinarian must be integral, for veterinarians cover diverse activities which expose them to physical, chemical and biological risks. The authors point out that the biosafety training for veterinary students is limited. As it was observed in the diagnosis’ outcomes, 38% did not identify the traumatic injuries, the zoonotic diseases and the chemical risks in the laboratory or the surgery room. Not knowing and not adequately application of biosecurity measures and norms on a daily basis makes veterinarians a vulnerable group [16, 17, 18].

In Australia, the United States, Canada, India, Colombia and Argentina, cross-sectional, cohort and literature review studies, analyzing the main risk factors of the veterinary profession they have been conducted. These authors concluded the lack of culture of good practices among veterinarians when working with chemical, biological and puncturing material and with animals [4, 6, 12, 13, 16, 17, 18, 19]. In this study, it is shown that the only protection for all kinds of activities that are performed in the laboratory is the use of the hospital gown, latex gloves and face
masks. 51% of the students were unaware of the classification of biohazard hazardous waste, when they are considered as a factor that can affect the occupational health of the veterinarian. These results agree with Cediel and Villamil who in 2004 [13] observed that knowledge about biological risks is scarce and that veterinarians show a passive attitude before this problem.

Although the target population had notions about the concepts of biosecurity, ethics and bioethics, it was important to strengthen their moral reasoning skills, including values and virtues to develop desirable behaviors, as recommended by Magalhães-Sant'Ana [10]. The diagnostic assessment results showed that the target population ignored about the code of ethics, informed consent, professional oath, consequences of malpractice, rights and duties; Espinosa et al. [20] found similar results in a study conducted in students of human medicine.

The NFEEP was designed according to Nieto-Caraveo’s proposal [21], a program with the environmental modality incorporated into the school system, considering ethics and biosafety priority issues for the training of veterinarians [10, 22]. The traditional method of teaching ethics is through the discussion of clinical cases, but teachers, usually veterinarians, who were not trained in these issues during their schooling, show serious deficiencies when it comes to the transmission of ethical knowledge to their students or if they do, it is not done adequately [23]. The teaching methods used in the NFEEP were considered by the target population as very good (96.8%), for workshops included ethical dilemmas that were subject to discussion, allowing the participants to develop ethical thinking and their autonomy in their future as veterinarians, as proposed by Parker [24] in his review of problem-based learning. The case studies presented by the students through the socio dramas were a useful educational method to get the individuals to know and analyze the possible ethical problems that can be faced by a veterinarian. The combinatorial methods that were used in this NFEEP compare with the successful work done by Beigy and collaborators [25], who used a combination of educational methods for the teaching of medical ethics.

The proposal of several authors on the teaching of ethics, bioethics or deontology has to be since the beginning of those careers related to the area of health, for ensuring that the knowledge achieved is integrated into the daily acting of the students and fostering human values, recognizing the deficiencies of the curricula, should be the start (10, 26, 27, 20, 28, 22, 29). The students of the two groups that participated in the NFEEP showed that their knowledge of ethics and biosafety had increased, so it could be used in the veterinary curriculum, as it is at the University of Bristol where they offer a program focused on animal welfare with ethics modules and veterinary legislation to encourage students to undertake critical thinking and to develop it throughout their university education (30).

The incorporation of topics on values and knowledge about ethics and biosafety to the curricula, as mentioned by Bermúdez [27] and Irribarra [7], will enable each individual to become aware of each risk in order to avoid accidents, since he or she is obliged to observe biosafety measures at work. Our results, in terms of knowledge
about protection measures, are good. However, it is necessary to deepen on the issues on hazardous waste and occupational hazards, particularly.

DuBois and Burkemper [31] determined the need to include formal ethical components in the curricula in the United States, as it is proposed in this work. In 2013, the World Organization for Animal Health developed guidelines for the creation of a basic curriculum, which includes animal welfare, ethics and biosafety. In Mexico, the curricula are not homogeneous and only a few universities have incorporated an ethics learning unit, but their course’s aims and teaching and assessment methods must be evaluated. This program could be considered in the veterinary medicine curriculum as an effective method for teaching ethics and biosafety, for its advantage of being a teaching model different from the traditional one.

CONCLUSIONS

It is a non-formal environmental education program to strengthen the veterinarian’s knowledge and skills on biosafety and ethics. It is innovative for its combination of methodologies, because integrative activities, socio dramas (case studies), individual and group activities were used. Significant differences were found in the results of the pre-test and post-test. They showed an improvement in knowledge of ethics and biosafety among the participants.

Although this was a local research, it allows us to suggest the need to review the veterinary medicine’s curricula and the urgency to introduce the axes of ethics and biosafety, transversally, at a national level.

ACKNOWLEDGEMENTS

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