

TECHNOLOGICAL INNOVATION: CONSTRUCTION OF DIDACTIC SIMULATORS SUBSTITUTES FOR ANIMALS FOR TEACHING THE GENITOURINARY SYSTEM EXAM OF THE CANINE AND FELINE SPECIES - TECHNICAL REPORT



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ABSTRACT

The use of live animals in higher education practices is being discouraged. For this, alternatives in the use of animal substitutes are motivated by the National Council for the

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Control of Animal Experimentation for the Production, Maintenance or Use of Animals and Teaching or Scientific Research Activities. In this scenario, teaching practices become challenging in the professional disciplines of the undergraduate veterinary medicine course. With technological innovation and advanced research resources, the profile of today's university students differs from previous decades. In addition, the demand of the labor market, professional qualification and the ability to solve problems are also important factors in the training of veterinarians. Considering the above, the objective was to present a technical report of the use of the Keller teaching methodology in the proposal of technological innovation in the construction of didactic simulators of the genitourinary system of the canine and feline species for the purposes of higher education and extension practices. For this, five undergraduate students of a veterinary medicine course were invited to build models of the aforementioned simulators, using the Keller methodology, under the supervision of a professor. As final products, for the teaching of the urogenital system of the feline and canine species, the following were built: a bitch simulator with mammary glands; a cat simulator for evaluation of the mammary glands; a fertile male dog simulator; a neutered male dog simulator and a fertile cat simulator. The aforementioned simulators allowed the learning of urethral probing of dogs, cats and, as well as the evaluation of the mammary glands. In higher education practices, the simulators were used by 229 students in the professional disciplines of a veterinary medicine course and 440 popular visitors to exhibitions appreciated the direction in tumor prevention in the Pink October Pet and Blue November Pet campaigns. The Keller teaching methodology used proved to be satisfactory and motivating to the studies of the students involved. The commitment and enthusiasm of the students who participated in the proposal was notorious. The contemplation and satisfaction of the students in the use of the simulators they created, in extension practices in the community, was also evident.

Keywords: Animal Welfare. Ethics. Teaching.

INTRODUCTION

The construction of scientific knowledge occurs through research, which follows different paths in order to achieve its objectives (Teixeira, 2015). In this context, veterinary medicine courses have always adopted the use of live animals in the training of future veterinarians, however this practice has been discouraged by the National Council for the Control of Animal Experimentation for the Production, Maintenance or Use of Animals and Teaching or Scientific Research Activities (Concea) (Concea, 2023). Thus, Veterinary Medicine schools are adopting conducts and means that prioritize the quality of teaching with ethical respect and animal welfare (Rodrigues et al., 2013). For this, it is necessary to search for alternative resources that provide efficient and satisfactory learning for undergraduate students of the veterinary medicine course (Magalhães; Ortêncio-Filho (2006). In addition, the alternatives implemented to replace live animals must be economically viable, resistant and durable in adequate time (Magalhães; Ortêncio-Filho (2006).

Considering the above, according to Magalhães; Ortêncio-Filho (2006), for the replacement of live animals for teaching purposes, there are options that include cadavers, videos, models, mannequins and simulators. In addition, the profile of university academics has undergone transformations, and educational institutions have been adopting new forms of teaching-learning (Marques et al., 2021).

The passive and observant mode of teaching, where the student usually attends lectures, does not currently correspond to a functional and motivating method (Marques et al., 2021). In this context, different types of learning process can be employed, with emphasis on active teaching methodologies, which allow a form of education with quality in a collaborative, engaging and encouraging way, as described by Misseyanni et al., (2008).

In addition, the active teaching methodology focuses on a multiplicity of instruments used to cognitively engage students, accumulating knowledge and creating schemes in a way that they, the students themselves, have greater belonging and autonomy over their learning (Marques et al., 2021). Additionally, active teaching strategies invite students to use their creativity, critical thinking, and build their own knowledge (Marques et al., 2021). In active methodologies, technological means can be used and allow for the optimization of available time, aiming at greater student satisfaction with the topic proposed to them (Marques et al., 2021).

In this context, the Keller teaching methodology deserves attention, which allows the student to progress at his own pace of time, respecting his limitations and capacities, without being forced to advance. In this methodology, the role of the teacher is to support and direct the students, as well as the teacher has the function of facilitating and motivating the acquisition of knowledge by the students, with positive reinforcement (Keller, 1968).

Considering the above, the objective was to address a technical report on the use of Keller's teaching methodology in the construction of didactic simulators of the genitourinary system of the canine and feline species for the purposes of teaching, learning and training of undergraduate students of a veterinary medicine course and for extension practices in the community, in the awareness of the October Pink Pet and Blue November Pet campaigns.

METHODOLOGY

With the proposal based on problem solving, five undergraduate students of the veterinary medicine course, in the fifth semester, were invited to create substitute didactic simulators for dogs, cats, and cats, to evaluate the genitourinary system. For this, the teaching methodology of Fred Keller (Keller, 1968) was used. The replacement of live animals for teaching purposes followed the form of incentive and recommendations of Conceia (Conceia, 2023).

In this context, under the supervision and direction of a professor with a PhD in Veterinary Medicine, the five undergraduates, at their own pace and availability of time, began the elaboration of the proposal to solve the problem: "Creation of substitute didactic simulators for dogs, cats, and cats for teaching purposes in veterinary practices involving the urogenital system".

Subsequently, the following stages were carried out: (1) – training of students of the Veterinary Medicine course in the context of research through a database in books and journals in physical form and online, with a virtual library and research platforms; (2) – bibliographic research on the use of animal substitutes in higher education practices (Conceia, 2023); (3) – research on the knowledge and anatomical and physiological particularities of the genitourinary system of the feline and canine species (Reece, 2020); (4) – bibliographic study of the examination of the genitourinary system in dogs, cats and (Feitosa, 2022); (5) – literary survey of the means for collecting urine by the probing method in dogs, cats and bitches (Taylor, 2011; Saints; Fragata, 2008); (6) – study of

diseases present in the mammary glands of and of prostate and testicular diseases in dogs (Nelson; Couto, 2023); (7) – research on diseases of the genitourinary system of cats (Nelson; Couto, 2023; Jericho; Kogika; Andrade, 2015).

Considering the data and knowledge obtained, based on the aforementioned researches, the undergraduates searched for several elements for the elaboration of the simulators, which corresponded to: realistic mannequins to allow the identification of species and sex; latex tubes of different sizes and thicknesses; sewing thread; felt fabric; cork and cylindrical and elliptical structures of coloured boracha corresponding to the organs of the genitourinary system. Equipped with the appropriate materials and/or elements, the proposed simulators were created during the period from July to December 2022.

The didactic simulators, when ready, were used in the undergraduate teaching of a Veterinary Medicine Course, during the years 2023 and 2024, in the disciplines of Veterinary Medical Semiology, Veterinary Clinical Pathology and Small Animal Medical Clinic.

In addition, the didactic simulators were also used in exhibitions made for the community in the years 2023 and 2024, in awareness campaigns for the early diagnosis of breast tumors in and prostatic diseases in dogs, corresponding to the actions aimed at the Pink October and Blue November Campaigns aimed at canine and feline species.

In 2025, the simulators were used in training for the different semesters of a Veterinary Medicine Course, for the application of learning in the physical examination of the genitourinary system of, cats and cats, as well as for the examination of the dog's urogenital system, considering prostate affections.

RESULTS AND DISCUSSION

Active teaching-learning methodologies make it possible to bring the student to the center of his learning, corresponding to him being the actor responsible for the construction of his knowledge (Melo; Sant'Ana, 2012). In this context, an invitation was then proposed and made to five students of a veterinary medicine course, to create didactic simulators for teaching purposes and extension practices. The proposal consisted of the elaboration of animal substitutes that would allow the knowledge of the urogenital system of dogs,, cats and cats; for the purpose of contributing to the learning of the students themselves, as well as with the ready-made simulators, the use in higher education and in extension practices

in the community. According to Berbel (1998), learning based on problem solving should be carried out with concrete, concise and distraction-free terms, promoting a restricted targeting of items. The invitation and proposal presented to the five students of a veterinary medicine course corroborated the instructions of the author previously cited.

The elaboration of the conduction in the construction of the simulators carried out by the five students of the veterinary medicine course, started from the search for learning in search of reflection, understanding and problem solving, considering the daily routine of professional practice, corroborating as described by Morais and Manzini (2006).

Additionally, considering the above, the five undergraduate students were guided to solve the problem, which consisted of the creation of simulators of the feline and canine species for the purpose of evaluating the genitourinary system. The functionality of the simulators consisted of the possibility of performing the evaluation of the genitourinary system, with the possibility of learning the urethral probing methodology for feline and canine species. It was also proposed that the simulators allow the evaluation of the mammary glands for the dog and for the cat and, for the fertile dog simulator, the evaluation of the prostate gland.

Subsequently, the five students participated in various activities, such as research, reading, discussion, writing and skill development, which allowed evaluation, reflection, analysis and synthesis of the problem in question, corroborating those described by (Daouk. Bahous; Bacha, 2016).

The final products created corresponded to five simulators, which were: (1) - a simulator of a bitch, which allowed the examination of the urogenital system and evaluation of the mammary glands. This simulator is equipped with a vulva and vagina, which allowed the learning of urethral probing and evaluation of normal mammary glands (Figure 1). In order to better establish the technique for evaluating the mammary glands, two additional sets of breasts were elaborated, one with nodules and the other with tumors (Figure 2); (2) - a cat simulator, which allowed the learning of the mammary gland exam (Figure 3); (3) - a simulator of a fertile male dog, which allowed the examination of the urogenital system, with identification of the foreskin, penis, urethra, scrotal pouch and testicles (Figure 4). This simulator also allowed the simulation of the evaluation of the prostate by means of renal palpation. In addition, the fertile male dog simulator allowed the learning of urethral probing for urine collection purposes (Figure 5); (4) - a neutered male dog simulator, with identification of the foreskin, penis, urethra and with absence of the scrotum and testicles, this simulator also allowed the teaching of urethral probing for urine collection purposes; (5)

- a simulator of a fertile male cat, which allowed the examination of the urogenital system, with identification of the penis and testicle, which allows the teaching of the practice of urethral probing (Figure 6).

Figure 1. Simulator of a bitch, which allowed the examination of the urogenital system and evaluation of the mammary glands, as well as urethral probing for urine collection.



Image source: author's file.

Figure 2. Simulators of the dog's mammary glands were designed so that it was possible to evaluate normal breasts, with nodules and other tumors.



Image source: author's file.

Figure 3. Simulator of a cat, which allowed the learning of the examination of the mammary glands.



Image source: author's file.

Figure 4. Fertile male dog simulator, which allowed the examination of the urogenital system, with identification of the foreskin, penis, urethra, scrotum and testicles, as well as urethral probing for urine collection. This simulator allowed the evaluation of the prostate by palpation.



Image source: author's file.

Figure 5. Castrated male dog simulator, which allowed the examination of the urogenital system, with identification of the foreskin, penis and urethra, as well as urethral probing for urine collection.



Image source: author's file.

Figure 6. Fertile male cat simulator, which allowed the examination of the urogenital system, with identification of the penis and testicle, as well as enabled the teaching of the practice of urethral probing.

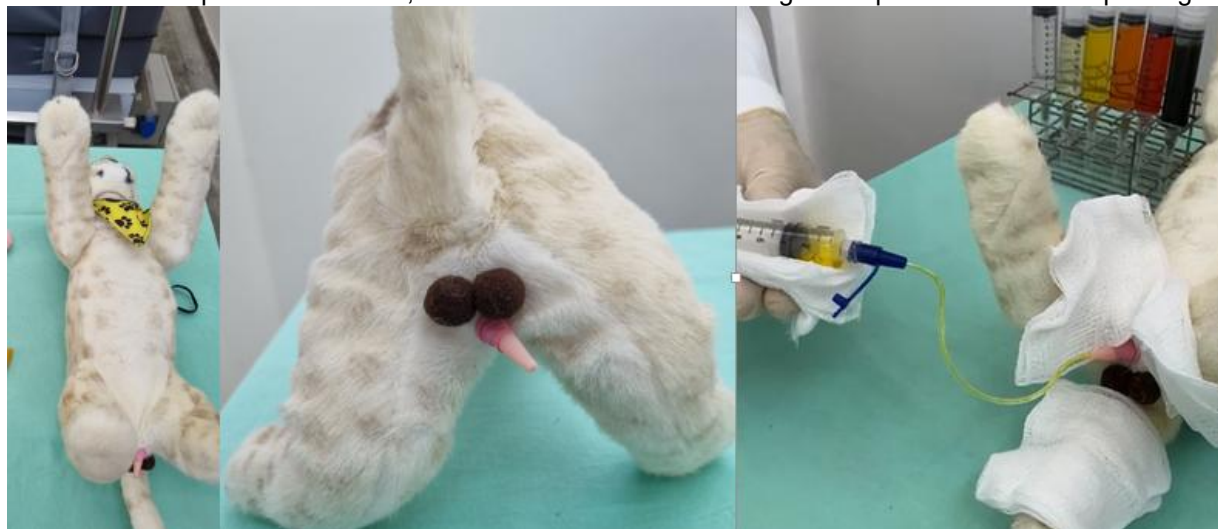


Image source: author's file.

Additionally, in the years 2023 and 2024, the aforementioned simulators were used by 212 students of a Veterinary Medicine Course for the purpose of learning urogenital examination and urine sample collection, in the disciplines of Veterinary Medical Semiology, Veterinary Clinical Pathology and Small Animal Medical Clinic, as shown in figure 7.

The simulators were used in four extension actions used to the community, in the years 2023 and 2024, with the participation of 440 visitors, who enjoyed learning how to search for breast tumors in dogs and cats and testicular/prostatic changes in the canine species.

Figure 7. Use of different simulators in practical class activities in the different professional disciplines of a Veterinary Medicine Course.



Image source: author's file.

In the year 2025, in a training workshop with the objective of teaching the urogenital examination of, cats, cats and dogs, 17 students from the different semesters of a Veterinary Medicine Course, had the opportunity to learn with the use of the simulators created.

In view of the above, the simulators developed allowed the instruction of the evaluation of the urogenital system of, cats, cats and dogs, for 229 students of a Veterinary Medicine Course and 440 popular visitors at scientific fairs and exhibitions for the purpose of directing the investigation of nodules and/or breast tumors and testicular alterations in canine and feline species.

Additionally, Melo and Sant'Ana (2012), in their study with nursing students using active methodologies, showed that 86% of the students adapted well to the methodologies used, as advantages the researchers noted the stimulus to reflection and appreciation of teamwork. With the proposal made, the five students performed the tasks as a team, from bibliographic research on the subject to the final preparation of the simulators. Clearly, teamwork and satisfaction in the completion of the simulators were clearly evidenced as an incentive means. In addition, the criteria of the Keller teaching methodology were followed, the students studied at their own pace of time, respecting their limitations and exploring the potential of their capacities (Keller, 1968). The participation of the five students with the simulators they created, in science fairs and exhibitions held in the community, provided a contemplation and satisfaction that were notorious. These findings corroborate those described by Misseyanni et al., (2008), which characterize that active learning is a form of offering quality, engaging and motivating education, with the ability to solve challenges.

CONCLUSION

The use of the Keller teaching methodology was perceptibly shown to be an intelligent way for specific and well-established tasks. The commitment and involvement of the five undergraduates in the realization of the proposal was evident. The satisfaction was clear from the five students in the use of the simulators they created in practices in undergraduate teaching classes and in extension activities carried out in the community.

In the extension practices, the simulators were a way to attract attention to the public interested in knowledge in the Pink October Pet and Blue November Pet campaigns.

In addition, simulators were an important didactic tool for teaching purposes, as they replaced live animals.

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