

# Improvement of experimental animal handling skills for higher education laboratory technicians in Semarang Region Indonesia

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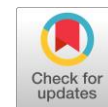
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## ABSTRACT

Laboratory technician skills in handling experimental animals are needed, by the study program, which in the lecture and research process uses experimental animals. The Biology Laboratory of FMIPA UNNES has the resources to practice these skills. As the realization of the 3rd Dharma of the Tri Dharma of Higher Education, community service is carried out to improve the skills of PTN/PTS laboratory technicians in the city of Semarang in handling experimental animals. The method used is training in the form of hands-on practice. The animals used were mice and white rats. The practices that were trained were bioethics, maintenance techniques, handling, gavage, drawing blood, and vaginal smears of experimental animals. The participants consisted of 29 laboratory technicians from general medicine, dentistry, biology, biology education, pharmacy, and animal husbandry study programs. The training instructors consist of lecturers, technicians, and student assistants. The training was held for 2 days by implementing health protocols. As a result, the participants improved their skills. From the beginning, only 29,26% of participants had the knowledge and skills to handle experimental animals at the end of the training, increasing to 86.84%. The concludes that the participants have increased their knowledge and skills in handling experimental animals.



## KEYWORDS

Laboratory technicians  
Training  
Experimental animals



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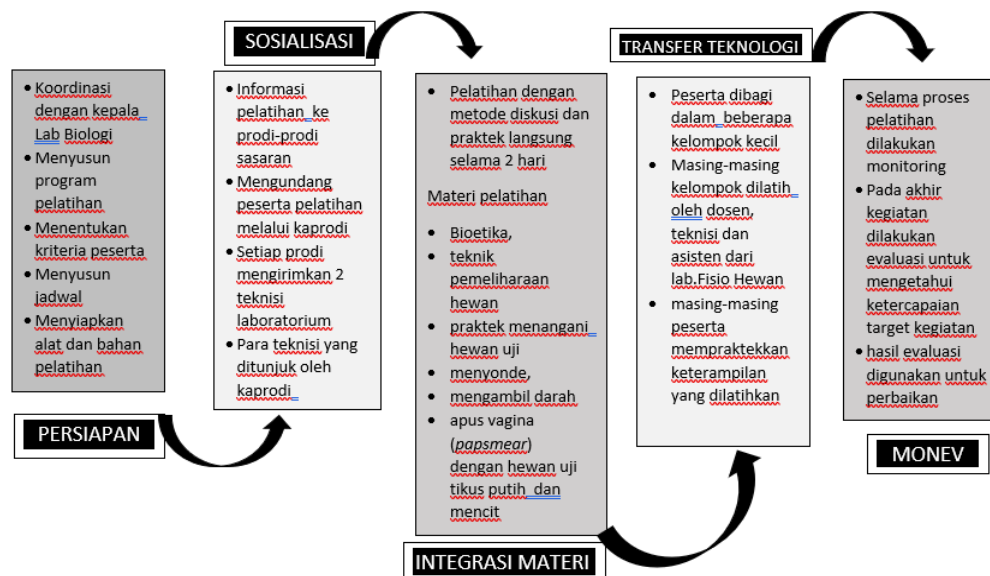
## 1. Introduction

Research and learning using experimental animals are indispensable to support the acquisition of science, development of knowledge, and improvement of community welfare. It needs to require in-depth knowledge of experimental animals to optimize that activity. One of the most necessary knowledge is knowledge about the welfare of test animals. The welfare of tested animals is have related to each other things such as to the process of caring for and handling test animals, when used both in the research and learning process. The application of animal welfare is further regulated in Peraturan Pemerintah No 95 of 2012 concerning Kesehatan Masyarakat Veteriner dan Kesejahteraan Hewan, especially in the articles 97 and 98. One of the personalities who have a lot of contact with experimental animals is laboratory technicians, especially laboratories in study programs (Prodi) who use experimental animals for both practicum and research activities, including Biology, Medicine, Pharmacy, Nutrition, Animal Husbandry, and others. Laboratory technicians in the study program are educational personnel. Education Personnel is members of society who are devoted and appointed to support the implementation of higher education. Education personnel who require special expertise are required to have a competency certificate in accordance with their field of work and expertise [1]. Laboratory technicians who work in laboratories that use experimental animals are included in this category, so they need to be equipped with the skills to care for and handle experimental animals so they can achieve their proper competence. To find out the skills required by laboratory technicians, the first stage that needed is to conduct the initial survey. The

survey was conducted online with a purposive sampling technique to 25 laboratory technicians. The survey results showed that only about 10.53% of technicians stated that they were skilled in handling experimental animals. 78.95% of technicians stated that they had done research or practicum using experimental animals. 94.74% stated that they had a strong desire to be skilled in handling experimental animals and 94.74% stated that laboratory technicians needed to have the skills to handle experimental animals. Based on the survey results, it needed more effort to improve experimental animal handling skills for laboratory technicians. The Biology Laboratory of FMIPA UNNES has the main function as an educational laboratory for Biology Department students, but, this place also possible to be used as a place of research for both students and lecturers. The Biology Laboratory is supported by 6 laboratory technicians, 3 of them have PLP functional positions. Service to students and lecturers majoring in Biology is a top priority, however, there is also service a section to the community that must exist as part of the 3rd Tridharma of Perguruan Tinggi. One form of service to the community is services in the field of research. The Animal Psychology Laboratory as one of the laboratories under the coordination of the biological laboratory has carried out both functions. The services that have been provided are serving research using experimental animals, including the provision of experimental animals, giving treatment to animals, taking research samples, and analyzing several research parameters, which have been carried out starting in 2008. This activity can be conduct because the Animal Physiology laboratory has facilities for maintenance and treatment of experimental animals. Moreover, there are lecturers and technicians who are competent in maintaining and handling experimental animals. As part of the Faculty of Mathematics and Natural Sciences, which has the aim of providing modern professional services in the field of Mathematics and Natural Sciences and education to the community, Tim Pengabdian Masyarakat(PKM) consisting of lecturers, staff, and students majoring in Biology, FMIPA UNNES organizes experimental animal handling training for laboratory technicians at PTS and PTN in the city of Semarang. The main objective of this activity is to improve the skills of laboratory technicians in maintaining and handling experimental animals, especially white rats (*Rattus norvegicus*) and mice (*Mus musculus*). This activity also has a function as a promotion for biological laboratory service products to potential customers.

## 2. Method

The activity plan is jointly prepared by the service team. The stages of PPM activities are carried out through socialization, material integration, technology transfer, monitoring, and evaluation. Details can be seen in Figure 1.



**Fig. 1.** Methods of training for the maintenance and handling of experimental animals for PTN and PTS laboratory technicians in Semarang

### 3. Results and Discussion

The practical animal handling training for laboratory technicians was attended by 29 participants from 9 PTN and PTS university in Semarang, those are UIN Walisongo, UNDIP, UNIKA, UNISSULA, UPGRIS, UNIMUS, UNWAHAS, Poltekkes Kemenkes, and Ngudi Waluyo University, with lecturer instructors, educator and assisted by student assistants who are included in the Pengabdian Masyarakat team (PKM). Technicians who take part in the training come from the laboratories of various study programs, such as General Medicine, Dentistry, Pharmacy, Biology, Biology Education, Nutrition, Nutrition, and Animal Production study programs. These study programs are the study that in the lecture and research process mostly use rats and mice as test animals. This activity is also used for the promotion of products and services produced by the Animal Physiology laboratory to potential customers. The training is using the offline system in the Biology laboratory of FMIPA UNNES by implementing health protocols. When viewed from the point of view of the number of laboratory technicians and the number of study programs at the participating PTN and PTS, this activity has met the set target that was planned. The training material consists of Bioethics delivered with an interactive lecture method. This material presents various matters related to the ethics of treating experimental animals. As we know, the use of animals in research or experimental activities is regulated by Undang-Undang No.18 of 2009, Article 74 paragraphs 1 and 2, which states that in order to increase the use of animals as laboratory animals (test animals) and research model animals and / or use of animal organs for human welfare, comparative medical science is applied under the supervision of a competent veterinarian, based on animal and veterinary ethics [2].

The next training material is experimental animal maintenance techniques. The delivery method uses an interactive lecture method. The material that delivered was related to how to raise experimental animals with a conventional holding system. According to Lesmana et al (2020), the rat rearing system in Indonesia is generally carried out with a conventional holding system. In general, rat care and maintenance include; (1) food and drink; (2) room temperature, room lighting and noise, (3) cage sanitation [3]. And the next material was the practice of handling experimental animals, *menyonde*, drawing blood, and vaginal smears (pap smears) of white rats and mice. The training method begins with a demonstration by the instructor. The demonstration is repeated several times, then each participant is asked to practice it under the guidance and supervision of the instructor. In the training activities, pretest and posttest were also carried out for the participants. The results of the participant questionnaire can be seen in Table 1.

**Table 1.** Results of participant questionnaires before and after the experimental animal handling training

Number	Statement	Before (%)	After (%)
1	understand the need for ethical clearance from the ethical commission, before giving treatment to experimental animals	56,35	94,74
2	understand the maintenance techniques of experimental animals	31,58	89,47
3	have the skills to handle experimental animals, especially rats and mice	10,53	89,47
4	already studied how to handle (handling) rats and/or mice	47,37	100
5	able to hold rats/mice properly	26,32	89,47
6	understand the purpose of " <i>menyonde</i> " rats/mice	52,63	89,47
7	able to <i>menyonde</i> rats/mice correctly	15,79	84,21
8	understand that there are several ways to take blood samples from rats/mice.	26,32	89,47
9	able to take blood samples from the bodies of rats/mice correctly	10,53	26,32
10	understand the definition of a rats/mice "vaginal smear"	31,58	100
11	understand the purpose of performing "vaginal smears" on rats/mice	31,58	94,74
12	able to do vaginal smear on rats/mice properly	10,53	94,74
	Average	29,26	86,84

Based on the answers to the questionnaire from the training participants, it appears that there has been a change in skills for handling experimental animals. This result can occur because during the training they are guided intensively by instructors and one by one the participants directly practice what they have

exemplified. Participants seem enthusiastic about doing the practice, if they are not skilled they will happily repeat it until they can handle the experimental animal correctly. The results of the questionnaire from the training participants showed that there was an increase in both the knowledge, courage, and skills of the participants in handling test animals, especially rats and mice. After join in the training, the participants increasingly understand that there are a number of ethics that must be met when using test animals for both research and learning activities. The 3R principle (replacement, reduction, and refinement) based on The Principles of Humane Experimental Techniques written by Russell and Burch (1959) is a concept that is generally accepted as an ethical principle in the use of experimental animals [3]. The training participants also increasingly understand that research proposals using test animals must be assessed and approved by the Ethics Committee for the use of test animals in the form of a letter of ethical clearance before they can carry out the research. The courage and confidence of the trainees also increased in handling experimental animals. The participants, who initially felt afraid or uncomfortable with rats and mice, began to practice holding correctly, after being given an example by the instructor. Skills in handling experimental animals are needed to carry out learning or research using model animal media. Technicians as people assigned to manage laboratory technical matters, especially in study programs that use experimental animals, really need to be masters the techniques of handling and caring for experimental animals. According to Sunardiyo (2014), laboratory technicians should have adequate hard skills and soft skills. Moreover, they also must have initiative, perseverance, creativity, skills and skills and knowledge [4]. This helps the efficiency and effectiveness as well as the productivity of laboratories managed by universities.

*Menyonde* skill is very important for technicians to master because many studies have used oral treatments. Hayes et al. (2019) stated, giving chemicals orally, allows these substances to be rapidly absorbed by the digestive tract [5]. Then these chemicals are carried by the bloodstream to the liver and metabolized according to the levels ingested. This is not the case with other routes of giving. Treatment orally with a sonde according to Eichenbaum et al. (2011), can have an impact on stress and potentially confuse experimental measurements, especially when blood pressure and heart rate are the main data to be captured [6]. This can happen if the unskilled process is carried out by those who are not skilled. To ensure that these substances actually enter the rat's body with the dose that has been determined, the only way to do is to brush. *Menyonde* is a way to put substances into the rat's body through the mice's mouth to stomach using Sonde. The oral sonde used is made from metal which has a rounded tip (cannula). This tool can take and distribute the substance to be condensed to the test animal after pairing it with an injection syringe. To make the substances actually enter the stomach and the rats still feel comfortable, special skills are needed in this step. The participants practiced the technique of *menyonde* after observing the technique of stroking that was demonstrated by the instructor, see Figure 2. Based on the results of the questionnaire, participants who initially did not understand the meaning of the word *menyonde* after the completion of the training became almost entirely understanding. Then, from the initial level, less than 16% of participants who were able to *menyonde* after the training increased to more than 84%. Figure 3 is the activity of participants in the training to test experimental animals.



**Fig. 2.** Skilled trainees handling experimental animals.



**Fig. 3.** The trainee is skilled at *menyonde* experimental animals

Another important skill that provided was the skill to draw blood. Blood is drawn because in certain studies researchers need to collect blood samples of the tested animals for further analysis. Blood collection procedures should be performed by trained personnel. There are several techniques for collecting blood, those are (1) using the lateral tail vein and (2) through the retro-orbital plexus (blood vessels near the eye), (3) saphenous veins, (4) cranial vena cavae, (4) jugular veins, (5) heart. In this training, techniques 1 and 2 are trained. Participants received an example from the instructor on how to draw blood from the tail vein and through the retroorbital plexus. Then for those who are brave are welcome to try. This bold requirement was given because this blood collection technique required high skill and was relatively difficult for those who had just practiced handling experimental animals. After completing the training, only about 26% of the participants managed to practice drawing blood. However, these results have shown an increase because initially, only about 10% stated that they could take blood samples from the retroorbital plexus of rats/mice. And for the information, this activity of drawing blood under the supervision of a veterinarian and still applying bioethics. The next training material is the vaginal smear technique (Pap smear). The pap smear technique is needed for research that aims to detect the stages of the estrous cycle in female rats/mice. As is known, rats or mice in their reproductive system experience an estrous cycle. Estrus is the phase of the period of heat. According to Turner & Bagnara in Effendi et al (2015), the estrous cycle is divided into four phases, those are proestrus, estrous, metestrus, and diestrus phases [7]. Rats and mice experienced estrus for about 9-20 hours and the estrous cycle lasted from four to six days. To determine the estrous cycle, it was done by observing the cells found in the vaginal smear microscopically. Skills to detect estrous and induction cycles according to Ajayi are useful in teaching and research and in the evaluation of the effects of drugs/chemicals on reproductive function [8].

Participants were given a brief explanation of the definition and purpose of performing vaginal smears. They showed microscopic images of the stages of the estrous cycle in rats/mice. Then the instructor gave an example of how to do vaginal smears on mice using cotton buds. Cotton buds that have been moistened with saline solution are slowly inserted into the vagina of the rats. Then the smear results are applied to the glass object. Because the preparations are made not to be preserved, they are not fixed with methanol, but enough dye is given to facilitate observation under a microscope with a magnification of 100x. Based on the results of the questionnaire answers, after the training, the participants understood the definition and purpose of doing vaginal smears on mice. In the beginning, only about 10% of participants were able to do vaginal smears after training, more than 90% of participants stated that they could do vaginal smears.

#### 4. Conclusion

The implementation of community service activities with the aim of improving the skills of experimental animal handlers for laboratory technicians has been as planned. The number of laboratory technicians and the number of study programs at PTN / PTS that are the target of the activity have been met. The entire series of activities have also been successfully carried out as planned. After participating in training activities, laboratory technicians have increased their knowledge and skills in caring for and handling experimental animals.

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