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Virtual reality-based animal anatomy model: a new possible approach for veterinary education in Indonesia

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ABSTRACT: Cadaveric dissection method is classical learning method as well as the gold standard for veterinary students to learn anatomy. However, development of alternative methods is needed since ethical issues of animal use has become challenge in veterinary anatomy education. The need for innovation is increasingly relevant to the COVID-19 pandemic situation. Implementation of the cutting-edge virtual reality (VR) technology can provide positive impacts in distance education. Therefore, establishment of VR-based animal anatomy learning system could answer the need, not only in this physical distancing-required situation but also for future veterinary education in Indonesia. In addition, understanding the key concerns and interdisciplinary collaboration will be needed in the establishment of the comprehensive VR-based veterinary anatomy learning system.

Keywords:
learning, model, veterinary anatomy, virtual reality

■ INTRODUCTION

Veterinary anatomy is commonly studied in detail and systematically using cadavers, with the explanation from the instructor. Although cadaveric dissection method with direct instruction is thought to be the gold standard and considered better for veterinary anatomy learning (Theoret *et al*. 2007), this method continues to be studied due to ethical issues of animal use, the development of alternative methods is important (Hackmann *et al*. 2019).

Innovative methods and supporting materials have been developed for the study of animal anatomy, such as three-dimensional (3D) printing animal model and 3D graphics with interactive touch screens (Hackmann *et al*. 2019; Little *et al*. 2019). Utilization of two-dimensional (2D) and 3D digital graphics as an alternative veterinary anatomy learning method can reduce the use of animals as well as the formaldehyde (Ozkadif & Eken 2012). However, these methods have limitation on the accessibility of students or even veterinarian, especially in conditions that require anatomical review other than in school, or in a situation requires physical distancing.

■ THE NEED FOR DISTANCE LEARNING

It is necessary to develop an alternative method that is more accessible and affordable for veterinary students, but still meet the achievement target of learning veterinary anatomy. Innovation of veterinary anatomy learning methods is one of the demands to establish a high-quality veterinary anatomy education, while still prioritizing animal welfare principles or minimizing the use of animals in the provision of cadaveric dissection. Currently, the need for innovation in veterinary anatomy education is increasingly relevant to the situation of the COVID-19 pandemic worldwide, including Indonesia, which urges the physical distancing in learning activities. A prospective-innovative idea that can provide a solution to distance learning, especially in veterinary anatomy, is the implementation of virtual reality (VR) in veterinary anatomy learning system. The VR-based materials can provide convenience for veterinary students and veterinarians to learn veterinary anatomy virtually.

■ PEDAGOGICAL ASPECTS OF VR

The VR potential in education has been studied in veterinary education (Kamińska *et al*. 2019). Before the pandemic, Hunt *et al*. (2020) provided VR material for student's first live canine surgeries. The research was limited by various factors and didn't show more superior. However, Hunt *et al*. (2020) and Farrell (2020) noted that the failure might not be in the VR technologies but instead on how the learning theory and learning outcomes are not designed to use VR capabilities. DeBose (2020) noted that students could construct their conceptual knowledge of anatomical.

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Table 1. Implementation of VR technology key elements in the veterinary anatomy learning system

Key elements	Implementation in the VR-based animal anatomy model
Virtual world	Provides a virtual environment resemble an animal dissection room with high precision animal anatomy model.
Immersion	Provides users the sensation and feeling of being part of the virtual environment.
Sensory feedback	Provides a close-to-real feeling being presence in the generated virtual environment as in animal dissection room.
Interactivity	Allows users to control and communicate with the scene using 3D devices with an effective real time reaction.

features through VR-based applications. McCaw *et al.* (2021) reported a positive impact on course content engagement, information retention, radiographic interpretation, and clinical reasoning skills. From previous attempts, we can summarize key concerns on implementing VR in veterinary education: importance of learning theory, utilization of suitable VR capabilities, and cost.

■ CONCEPTUAL DESIGN

The conceptual design of the VR-based anatomy model we have presented consists of the feline internal organ, derived from Pixelbeaker (2019) works. We add anatomical information and description (Figure 1). This technique is called annotation, which embeds information in 3D objects. Learners can interact with 3D objects, pressing the annotation and accessing the information embedded to learn about the part of an internal organ. The essential elements of VR technology implemented in the animal anatomy learning systems are shown in Table 1.

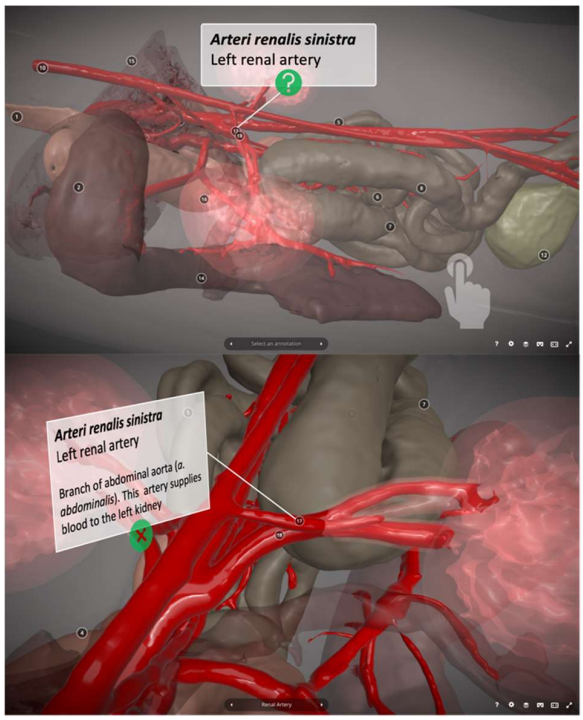

Figure 1. Illustration of VR-based animal anatomy learning system.

In the current perspective, VR-based animal anatomy model possibly gives a new alternative method in veterinary anatomy education, especially in Indonesia. Scientific and technical as well as financial aspects should be considered in the establishment of this VR-based veterinary anatomy learning materials. Thus, we highlight that to establish a comprehensive VR-based animal anatomy model, interdisciplinary collaboration will be needed.

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Author Contributions

All authors have given approval to the final version of the manuscript.

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