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Perspective

Educational Technology Use in Veterinary Medical Education

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Abstract

Human medical education is already utilizing educational technology tools for clinical skills training and assessment. However, there are very few veterinary programs that utilize educational technology tools to teach and assess clinical skills whereas these tools are being progressively incorporated into human programs. A major obstacle to more flexible online learning in this field is the requirement for a concurrent physical presence at a clinical veterinary site in which to accomplish required learning and assessment of hands-on clinical skills. Any educational technology tools that would be utilized as a replacement must therefore be efficient and proficient at assessing student achievement, as well as increase student engagement and academic success, to both entice current educators to use them and to attract students to academic programs incorporating the tools. In addition, the accreditation body for these programs would need to approve the use of educational technology tools in addition to or in lieu of live animal use. Telehealth and telelearning are changing the world in which we live, demonstrating the necessity for veterinary professionals to transition into using technology to assist with educating and assessing students. Therefore, instructors need to meet those changes head-on in education to prepare students to work in this new environment.

Keywords: Clinical Skills Assessment; Educational Technology; Veterinary Medical Education; Hands-On Skills; Educational Technology Tools

Abbreviations

AVMA: American Veterinary Medical Association

Introduction

Every day, much of the developed world connects to a global society using digital devices. These devices can be found both in our personal and professional lives - in our homes, our workplaces, and our schools. Society is changing as the use of technology increases; students are adapting to these changes [9]. Since digital technology is ubiquitous, traditional methods of course delivery, such as lecture and textbook reading, are rapidly being replaced by digital technology and online learning [13]. Many students, especially non-traditional adult students, are looking for innovative, flexible educational programs that incorporate online learning [13].

In contrast to human medical education, teaching practices in veterinary medical education do not tend to change quickly with innovations in the field. For example, there are very few veterinary programs that utilize educational technology tools to teach and assess clinical skills whereas these tools are being progressively incorporated into human programs [18]. Educational technology is the use of technology products, applications, and tools to enhance teaching and learning. Examples include lecture capture software, online discussion boards, and virtual simulations. Several technology products and applications are already in use for teaching and assessing knowledge-based skills in some veterinary medical programs, but it is rare to find tools such as virtual simulators and digital devices being used for hands-on clinical skills [2,5].

While students can learn something from an instructor or a textbook, a true test of what they know is being able to apply what they learned through praxis [15]. In veterinary medical education, praxis is the performance of hands-on clinical skills. A major obstacle to more flexible online learning in this field is the requirement for a concurrent physical presence at a clinical veterinary site in which to accomplish required hands-on learning and assessment of clinical skills [4]. This requirement restricts the ability of educators to utilize other assessment methods and tools that are not face-to-face and perhaps better at assessing students. The inability to use digital technology to assess hands-on clinical skills limits the flexibility and ease at which students can complete skills assessments.

Veterinary medical education includes both veterinary education for future veterinarians and veterinary technology education. In traditional veterinary technology programs, which is the level of veterinary medical education equivalent to human nursing, students perform hands-on clinical skills on live animals in front of instructors. This standard of practice is resource-consuming in that live animals and instructors must be available for use while also toeing the line of being inhumane, at worst, and considered animal research, at best, if a patient does not require a particular procedure. Currently, students enrolled in online learning programs in veterinary technology must videotape their skills on live animals. Thus, the student is required to intern or work in a clinical veterinary setting. The videotaping process is both time-consuming in that the owner of the pet must first consent to the recording and resource-consuming because another person is typically needed to control the video camera. In addition, students can only perform skills when the patient requires them, and not all required skills are frequently performed in general practice. Then, students send the videos to an instructor in their program who will assess their techniques. Perhaps it would be more efficient if an educational technology tool could both capture and assess the student's performance with instant feedback.

The use of educational technology tools with feedback can allow students to continue perfecting their techniques, even after the minimal level of proficiency is reached. Digital haptic simulation tools for training and assessment of certain hands-on skills are available in both human and veterinary medical education, though their use in the latter is much less common [6]. Haptic simulators are computerized tools that mimic the touch sensation experienced when performing an actual clinical procedure. Users can virtually feel how the patient and/or instruments would respond while they practice on an inanimate device. What is typically missing from these tools is a feedback loop to assist students in improving their techniques [17]. This feedback loop is part of the in-person learning and assessment process in traditional veterinary technology programs. It is not enough for educational technology tools to return merely a pass/fail assessment of specific steps in the process of the medical procedure. Students need and deserve instruction on how to get better. It is through both formative and summative assessment that they learn and grow. Danielson., *et al*. stress that instructors' feedback aids students in learning and retaining knowledge [3]. Students can learn from a failure, but they learn more easily when they receive specific and timely guidance that reinforces the correct skill.

Tradition versus technology

Any educational technology tools that would be utilized to address hands-on clinical skills as a replacement to the requirement of a physical clinical site must therefore be efficient and proficient at assessing student achievement. They must be at least equivalent to an in-person instructor in their ability to uncover problems with student performance and provide feedback for future improvement and/or reinforce correct performance. The educational technology tools would also need to increase student engagement and academic success to both entice current educators to use them and to attract students to what would be considered innovative, yet untested, veterinary technology programs. Finally, the accreditation body for these programs would need to approve the use of educational technology tools in addition to or in lieu of live animal use.

To remain relevant and maintain desired learning experiences, educators must work with educational trends, even if they failed to anticipate them [9]. Veterinary professionals are focused on and empathetic toward living animals; to encourage the use of non-living educational technology tools is contradictory to this role, but experience changes the expectations of reality [10]. There is a necessity, now, for veterinary professionals to transition into using technology to assist with educating and assessing students. Telehealth and telelearning are changing the world in which we live. Therefore, instructors need to meet those changes head-on in education so that students are prepared to work in this new environment.

Educational technology availability, advantages, and concerns

Institutions of higher education worldwide are incorporating technology into teaching and learning as a result of the widespread technology use among current university students [13]. E-learning tools are commonly used in human medical education, whereas veterinary medical education has not embraced this trend [18]. Raffan., *et al*. analyzed the veterinary curriculum and determined it lacked the use of modern technology that is present and commonly used in the human medical curriculum, yet the accrediting bodies for veterinary medical education suggest increased use of online technologies as one method for improving veterinary curricula [7,12]. The bottom line is that traditional course delivery methods are being challenged, and veterinary medical education must learn to adapt [6].

Student engagement is one factor that impacts academic success. Rashid & Asghar found a direct positive relationship between the use of technology and student engagement and self-directed learning [13]. Virtual learning can provide the same level of training and assessment of hands-on skills as traditional methods [6,8,11,14]. Lamb., *et al*. determined that serious educational games and virtual reality provide opportunities for interactions that may be comparable to hands-on activities [8]. El Sharaby., *et al*. reported that "interactive computer-based instruction was associated with improved learning" [5] - specifically of equine anatomy. If delivery through digital tools is equivalent to traditional methods of education, as Nilsson., *et al*. found to be true for video training for postpartum hemorrhage management, institutions may be able to reduce their reliance on certain resources like brick-and-mortar campuses and increase their reach for enrollment across the world [11]. One thing holding back the move to delivering all coursework online and/or using virtual tools is that students seem to be more satisfied with hands-on laboratories versus technology-enabled formats and tended to have higher outcomes on them as well [1]. It remains to be seen whether student engagement could be improved with the use of tools that utilize educational technology for hands-on skill assessment, thus increasing academic success.

Multiple methods of educational technology tools are being used in human medicine to teach and assess hands-on skills [11,14,17]. Despite the availability of educational technologies in human medical education, the existence of these virtual assessment tools has not translated to widespread use in the veterinary field [18]. There is an apparent lack of digital resources in veterinary medical education [12]. The main problem with employing educational technology tools in veterinary technology education is the need to assess hands-on clinical skills. Currently available e-learning and digitals tools may assist with determining what general kind of digital tool would work best to assess hands-on skills in veterinary medicine. The use of educational games, virtual reality, and simulators could provide opportunities for interactions that may be comparable to hands-on activities [8]. An innovative and unique training program utilizing educational technology would likely enhance veterinary students' understanding of course material through an engaging, and hopefully simple, format [12]. Simulators and virtual reality may be of greater benefit to less experienced students because they provide additional time with hands-on training [14]. However, while students and educators may find educational technology tools useful, there may be specific reasons why a particular tool should not serve as a complete replacement for hands-on learning. For example, students and staff found a digital anatomy application to be useful for obtaining knowledge, but they felt that it should not be a replacement for laboratory dissection because of the loss of appreciating three-dimensional spatial relationships [5]. This "loss of spatial information…can present problems when translating [anatomy] to the patient" [12]. Some tools, though, such as the Problem List Generator, a computer-based tool for learning diagnostic problem-solving in veterinary clinical pathology, might lead to statistically significant increases in final exam scores [3]. One thing is for sure, an application that supplies "immediate and detailed feedback promotes learning and retention" [3].

Examples of educational technology tools

There are both human and veterinary medical education examples of digital tools being used for learning [6,12]. Recent endeavors to bring veterinary medical education into the e-learning arena include some incorporation of virtual learning tools for anatomy [5,12,18]. Determining how to assess hands-on skills is probably the most important issue facing the incorporation of educational technology tools into veterinary medical education. Accredited veterinary technology programs currently require students to either perform a hands-on clinical skill for an instructor within an accredited program academic course or videotape their performance in a clinical setting and submit it for review by an instructor within the program [16]. There is a limitation to how many times a single student can practice a clinical skill on a live veterinary patient in

either the academic teaching environment or the clinical setting for a variety of logistical and ethical reasons. In addition, cadaver models are becoming more expensive and problematic to source [6]. As a result, there has been a move toward reducing, replacing, and refining the use of live animals in veterinary medical education, as already occurs in laboratory animal research. However, it is not enough for educational technology tools to return merely a pass/fail assessment of specific steps in the process of the medical procedure [17]. While this could be helpful to assess hands-on skills in veterinary medical education, it leaves a lot to be desired in terms of feedback to the student. A technology tool that assesses hands-on veterinary clinical skills must be at least equivalent to an in-person instructor in their ability to uncover problems with student performance.

Virtual quiz assessments for knowledge-based learning already exist for veterinary medical education [12]. There are several options available for the assessment of hands-on skills, though they are not widely used. Virtual microscopy is one alternative way to perform a hands-on skill using a technology-based tool [7]. Kogan., *et al*. noted that using virtual microscopy had "no perceived impact on student performance" [7] at the University of Iowa Medical School where it was first used. Haptic simulators - technology tools that allow users to have touch sensations similar or equivalent to what they would feel while performing a hands-on skill in real life - are becoming more common in human medical education [14]. According to Sikder., *et al*. surgeons who were assessed on a haptic simulator for a hands-on skill involved in human cataract surgery had statistically significant improvement from their baseline evaluation after performing surgery for six months in the operating room [14]. Thus, these simulators can function as assessment tools for certain hands-on skills. Teaching and assessment using validated haptic simulators are already occurring in some veterinary schools in Europe [6]. Kinnison., *et al*. reported that most students found a haptic simulator for bovine abdominal anatomy helpful for learning the location of anatomical structures through touch, as opposed to using cadavers [6]. Any educational technology tools that would be utilized to address hands-on clinical skills assessment in veterinary medical education must be efficient and proficient at examining student achievement. For example, objective structured assessment of technical skill-derived rating scales could be used to validate virtual-based error scoring against live procedures [17].

Challenges in implementing educational technology tools

The use of educational technology tools should be shown to improve student engagement and success as well as the success of graduates in the field; otherwise, there is no reason to change what is already working. More research is needed to determine if the use of these educational technology tools equates with improved proficiency in the field after graduation, whether skill scores from educational technology tools determine performance in the 'real world.' An additional consideration is whether the use of these tools would pose a barrier to learning for students who are not tech-savvy. If these tools indeed could positively impact the learning process, the reactions of current educators to new methods of teaching and assessment would greatly impact the use of any innovative and unique virtual training programs for hands-on veterinary skills, not only in veterinary technology education but in veterinary medical education as a whole. It remains to be seen if the veterinary field will adopt these tools or stick to traditional methods of hands-on skill assessment regardless of their availability. If educational technologies are adopted in veterinary medical education in the future, it will be pertinent to know how this can be done successfully. The future of technology use in veterinary medical education may be unknown, but there is little doubt that we will need to incorporate some form of educational technology if we want our programs to remain relevant and appeal to new prospective students.

Conclusions

Instructor and student buy-in to the use of educational technology tools would be essential to the implementation phase of these tools. To create buy-in, development of new tools should include the involvement of both educators and students. These individuals have user needs that must be met to convince them to deviate from the traditional methods of assessment. Educators and students can be useful to build a list of characteristics and features for developing the ideal educational technology tools for veterinary medical education. Once instructors and students are utilizing these kinds of tools and the tools are validated against the traditional method of assessment, accrediting bodies will need to examine whether they would be an appropriate alternative for assessing hands-on clinical skills.

Conflict of Interest

The author reports no conflict of interest.

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