

Transformation of Veterinary Education through the Flipped Classroom Model: Advantages, Challenges, and Future Implications

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ABSTRACT

Veterinary education is undergoing a significant transformation, with the adoption of the flipped classroom model at its forefront. This innovative pedagogical approach challenges the traditional teaching method by reversing the sequence of instruction. In the flipped classroom, students engage with pre-recorded lectures and readings independently before attending in-person class sessions, which are now dedicated to active learning, group discussions, problem-solving, and practical application. The model's adoption aligns seamlessly with the broader shift towards student-centered, outcome-based education, equipping veterinary students with essential skills and knowledge for their dynamic profession. While the flipped classroom presents numerous advantages, it is not without challenges, including technology requirements, instructor time investment, and the need to address resistance to change. Nevertheless, the transformative potential of the flipped classroom in veterinary education is promising, emphasizing lifelong learning and adaptability in an ever-evolving field. This shift, enabled by technology and innovative teaching strategies, prepares veterinary graduates to excel in their profession's dynamic landscape.

Key words: Active learning, Flipped classroom, Technology in education, Transformative teaching, Veterinary education

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INTRODUCTION

Veterinary education is a field of paramount importance, shaping the future of animal healthcare and advancing human well-being. Traditionally, it has relied on didactic lectures as the primary mode of instruction. However, a profound transformation is underway in the realm of veterinary education, driven by the innovative "flipped classroom" approach. This pedagogical paradigm shift, known to enhance student engagement, critical thinking, and problem-solving skills, has the potential to redefine how future veterinarians are trained. As we embark on this exploration, it's imperative to understand the foundations of the flipped classroom model and its impact on veterinary education. In this article, we delve into the concept and application of the flipped classroom within the context of veterinary education, shedding light on its potential to revolutionize the way veterinarians are prepared for the challenges of their profession.

The flipped classroom model's effectiveness in increasing student engagement and promoting active learning has been highlighted in various educational contexts (Hemmings *et al.*, 2012). By reversing the traditional teaching method, the flipped classroom aims to empower students to take a more proactive role in their education (De Jong *et al.*, 2013). This approach has been reported to be implemented in a variety of disciplines, including medical education (Moffett, 2014; Moffett and Mill, 2014; McLaughlin *et al.*, 2014; Hew

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and Lo, 2018; Matthew *et al.*, 2019a; Londgren *et al.*, 2021), physics (Deslauriers *et al.*, 2011), and engineering (Cone *et al.*, 2017). Further, it has also been reported that flipped classroom approach has also been explored in clinical subjects in veterinary medicine (Cuello, 2020; Dooley *et al.*, 2018; Matthew *et al.*, 2019b; Uribe *et al.*, 2020; Londgren *et al.*, 2021). However, the reports on the evaluation of flipped classroom in veterinary education is scarce (Dooley *et al.*, 2018). It offers a potential solution to the challenges of large enrolment classes and has been shown to enhance student learning, cooperation, innovation, and task orientation

(Strayer, 2012). As we move forward, we aim to explore how this transformative methodology can be harnessed to better prepare the veterinarians of tomorrow, equipping them with the knowledge, skills, and critical thinking abilities essential for the complexities of the field.

UNDERSTANDING THE FLIPPED CLASSROOM

At the heart of the flipped classroom model lies a pivotal role reversal. Traditionally, students attend lectures where instructors serve as the primary information providers. They passively consume the content, often with limited opportunity for active participation. The application of knowledge is typically reserved for assignments and homework conducted outside of class hours. In contrast, the flipped classroom presents an alternate sequence and approach. Students are introduced to new content outside of the physical classroom environment. This exposure occurs through pre-recorded video lectures or assigned readings, leveraging various technological resources (Strayer, 2012). This “out-of-class phase” encourages self-paced learning and empowers students to take charge of their educational journey (Abeysekera and Dawson, 2015).

The core innovation of the flipped classroom unfolds within the classroom itself. Classroom time is no longer devoted primarily to passive listening; instead, it transforms into a dynamic hub of active, student-centered learning (Anderson and Krathwohl, 2001). This shift involves a diverse range of activities, including but not limited to group discussions, collaborative problem-solving, practical applications of knowledge, case studies, and hands-on

experiments (Garrison and Kanuka, 2004). These in-class experiences, sometimes facilitated by instructors but more often driven by students themselves, enable the application, analysis, and synthesis of knowledge (Herreid and Schiller, 2013).

The flipped classroom, with its focus on fostering student engagement and critical thinking, has shown promise in various educational contexts beyond veterinary education (Zappe *et al.*, 2009). By leveraging technology and redefining the learning environment, it has the potential to revolutionize the way knowledge is acquired, leading to more effective and interactive educational experiences (Tucker, 2012).

A schematic representation that captures the essence of the flipped classroom model, a dynamic pedagogical approach transforming traditional teaching paradigms is depicted in Figure 1 (Created with www.biorender.com). At its core, the model revolves around two distinct phases: Out-of-Class and In-Class: where learning takes on a multifaceted and interactive form. The Out-of-Class Phase places students in the driver’s seat, engaging with pre-recorded lectures and readings independently, fostering self-paced learning. As the transition unfolds into the In-Class Phase, collaborative discussions, problem-solving, and practical applications come to the forefront, creating an environment where knowledge is not just received but actively applied. A crucial Feedback Loop ensures a seamless connection between these phases, allowing for continuous interaction, while the teacher’s role transforms into that of a facilitator, guiding students through active engagements. Technology permeates every aspect, from at-home learning to in-class collaboration, underlining its pivotal role. This schematic unravels the intricacies of the

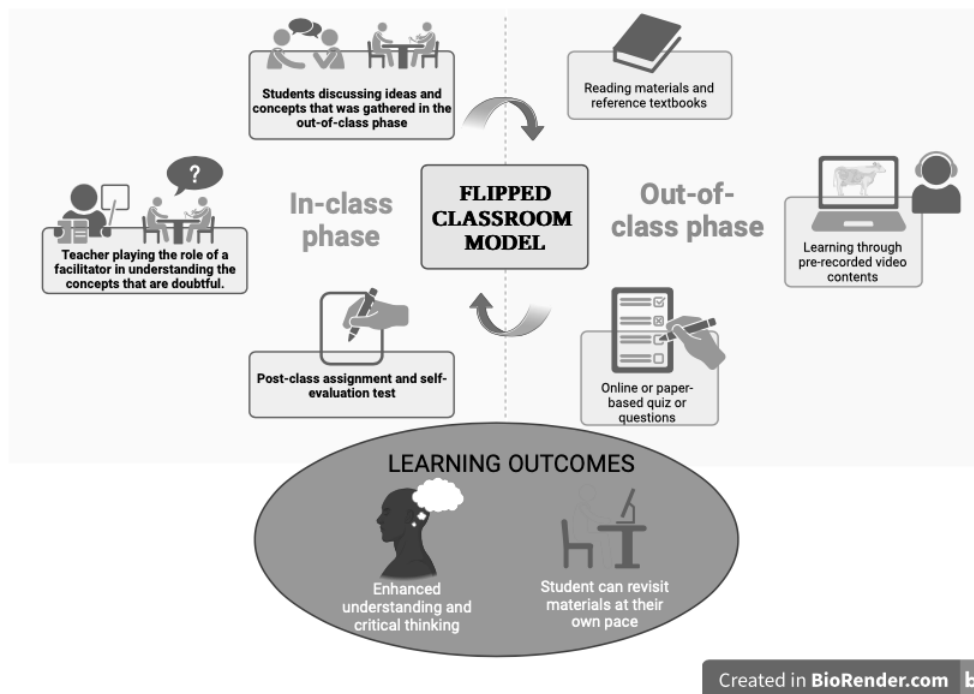


Fig. 1: Dynamic flow of the flipped classroom: A visual exploration

flipped classroom, emphasizing customization, self-pacing, and the ultimate goal - enhanced learning outcomes through an innovative educational journey.

ADVANTAGES OF FLIPPED CLASSROOM APPROACH IN VETERINARY EDUCATION

Active Learning (Hemmings *et al.*, 2012): The flipped classroom model, known for its emphasis on student engagement and active participation, brings a transformative dimension to veterinary education. This approach encourages students to take a proactive role in their learning. Instead of being passive recipients of information, they become actively engaged in exploring and comprehending complex subject matter. In veterinary education, this active learning fosters a deeper understanding of the material, which is essential for the development of critical thinking and problem-solving skills.

Customized Learning (McLaughlin *et al.*, 2014): The field of veterinary medicine is characterized by its intricacy and diversity. The flipped classroom model provides students the flexibility to progress at their own pace, ensuring that they grasp the challenging topics thoroughly. This adaptability is invaluable, allowing students to revisit difficult concepts as needed, tailoring their learning experience to match their individual needs and preferences.

Enhanced Retention (De Jong *et al.*, 2013): Retention of knowledge is paramount in veterinary education, as future veterinarians must apply their learning in real-world scenarios. The interactive and hands-on activities that are central to the in-person class sessions in a flipped classroom significantly enhance knowledge retention. This practical approach ensures that the information is not only stored but also readily applicable, preparing students for the rigors of their profession.

Better Preparedness (Garrison and Kanuka, 2004): When students enter the classroom with a foundational understanding of the topic, class time becomes a hub of meaningful and productive interactions. In the context of veterinary education, students' prior exposure to pre-recorded lectures or readings equips them with a basic comprehension of the subject matter. This pre-class preparation sets the stage for in-depth discussions, practical exercises, and case studies, enabling students to delve deeper into the complexities of veterinary science.

Improved Communication Skills (Roehl *et al.*, 2013): Communication skills are integral to the work of future veterinarians who often collaborate with teams and interact with clients. The flipped classroom model, with its emphasis on collaborative learning and group discussions, provides a fertile ground for honing these essential skills. Students engage in meaningful dialogues, learn to articulate their thoughts effectively, and build the interpersonal skills required for successful veterinary practice.

CHALLENGES AND CONSIDERATIONS IN IMPLEMENTING THE FLIPPED CLASSROOM

While the flipped classroom model offers a multitude of advantages, it is not exempt from certain challenges and considerations that must be addressed to ensure its effective implementation in veterinary education.

Technology Requirements (Bonwell and Eison, 1991): The success of the flipped classroom is intricately linked to technology. Students are expected to have access to the necessary digital tools and resources for engaging with pre-class materials, such as video lectures and online readings. Ensuring equitable access to technology can be a significant challenge, particularly in regions with varying degrees of digital infrastructure and socioeconomic disparities. Instructors need to be mindful of these disparities and offer alternatives to students who may face technology barriers.

Time-Intensive for Instructors (Lakhal *et al.*, 2017): The development of high-quality video lectures, interactive online resources, and active learning materials can be a time-consuming endeavour for instructors. Course design, which involves structuring the content for effective out-of-class engagement and in-class activities, demands a substantial upfront investment of time and effort. Instructors must not only be content experts but also skilled in instructional design and technology integration (Baker, 2000).

Resistance to Change (Smith *et al.*, 2013): The adoption of the flipped classroom model may face resistance from both instructors and students who are accustomed to traditional teaching methods. Faculty members may be hesitant to change their established teaching practices, while students might initially find the shift unsettling. Overcoming this resistance requires comprehensive training and support for both instructors and students, with a focus on the rationale behind the change and the potential benefits it offers (Tucker, 2012).

Classroom Space (Zappe *et al.*, 2009): Active learning sessions, a hallmark of the flipped classroom, often demands different classroom setups. Collaborative group work, discussions, and practical exercises necessitate flexible and interactive learning environments. Some institutions may face logistical challenges in adapting their physical classrooms to accommodate these dynamic activities. Addressing this consideration involves reconfiguring learning spaces and ensuring they are conducive to the interactive nature of the flipped classroom (McLaughlin *et al.*, 2014).

KEY DIFFERENCES BETWEEN TRADITIONAL AND FLIPPED CLASSROOMS

In our journey to explore the innovative approach of the flipped classroom within the realm of veterinary education, it is essential to understand the stark differences that set this model apart from the traditional classroom. The core distinctions between these two teaching methodologies,

shedding light on how the flipped classroom challenges convention by reshaping the dynamics of learning (Garrison and Kanuka, 2004, Hemmings *et al.*, 2012, McLaughlin *et al.*, 2014) is tabulated in Table 1. By examining these differences, we gain valuable insights into the transformative potential of the flipped classroom model and its impact on the future of veterinary education.

BENEFITS AND CHALLENGES OF THE FLIPPED CLASSROOM

In exploring the transformative power of the flipped classroom model in veterinary education, it is essential to understand the numerous advantages it offers, as well as the challenges it presents (Garrison and Kanuka, 2004, Hemmings *et al.*, 2012, McLaughlin *et al.*, 2014). The key benefits and challenges associated with this innovative approach, providing a comprehensive overview of what educators and students can expect when embracing the flipped classroom model is summarized in Table 2.

TYPICAL IN-CLASS ACTIVITIES IN A FLIPPED CLASSROOM

One of the cornerstones of the flipped classroom is its ability to create a dynamic and engaging in-class learning environment. The typical in-class activities that students partake in during the flipped classroom sessions are outlined in Table 3. These activities go beyond traditional passive learning, fostering collaborative discussions, problem-solving, and hands-on experiences, ultimately equipping veterinary students with the skills and knowledge needed for their future careers (Garrison and Kanuka, 2004, Hemmings *et al.*, 2012, McLaughlin *et al.*, 2014).

TECHNOLOGY UTILIZATION IN A FLIPPED CLASSROOM

The successful implementation of a flipped classroom heavily relies on the strategic use of technology. The various technologies that play a pivotal role in the flipped classroom

Table 1: Key differences between traditional and flipped classrooms

Aspect	Traditional classroom	Flipped classroom
Lecture Delivery	In-person lectures by instructors	Pre-recorded lectures or readings
Class Time Usage	Passive listening to lectures	Active discussions and activities
Student Engagement	Passive reception of information	Active engagement, critical thinking
Homework and Assignments	Homework assigned after class	In-class activities related to pre-work
Pace of Learning	Fixed pace for all students	Self-paced learning and revision
Teacher's Role	Primary information provider	Facilitator of discussions and tasks
Resource Requirements	Traditional teaching aids (e.g., boards)	Technology for video lectures, online resources
Classroom Space	Lecture-style seating	Flexible seating for collaboration
Preparation Time	Less time needed for lecture preparation	Time invested in creating quality video lectures
Retention and Application	Lower retention due to passive learning	Higher retention and better application of knowledge

Table 2: Benefits and challenges of flipped classrooms

Aspect	Benefits	Challenges
Active Learning	Encourages critical thinking and problem-solving	Requires the creation of high-quality pre-class materials
Customized Learning	Allows students to progress at their own pace	Ensuring equitable technology access for all students
Enhanced Retention	Promotes higher knowledge retention and application	Resistance to change from both instructors and students
Better Preparedness	Students come to class with a basic understanding of the topic	Logistical challenges in setting up flexible classrooms
Improved Communication Skills	Enhances communication and interpersonal skills	Instructor time required for course design and support

Table 3: Typical in-class activities in a flipped classroom

Activity	Description
Group Discussions	Students engage in open dialogues about pre-class materials
Problem-Solving	Collaborative efforts to solve real-world veterinary issues
Hands-On Activities	Practical, skill-building exercises and experiments
Case Studies	Analysis of veterinary cases, fostering critical thinking
Peer Teaching	Students explain concepts to each other, reinforcing understanding



model, highlighting their purposes in enhancing the learning experience are identified in the Table 4. From pre-recorded video lectures to online discussion forums and learning analytics, these tools are instrumental in making the flipped classroom a dynamic and interactive educational framework (Baker, 2000; Abeysekera and Dawson, 2015; Raffaghelli and Cucchiara, 2018).

Table 4: Technology utilization in a flipped classroom

Technology	Purpose
Pre-Recorded Video Lectures	Delivering content for out-of-class phase
Learning Management Systems	Hosting course materials, assignments, and assessments
Online Discussion Forums	Facilitating student interactions and questions
Web Conferencing Tools	Conducting virtual office hours and discussions
Learning Analytics	Tracking student progress and performance

FUTURE OF VETERINARY EDUCATION

The future of veterinary education is undergoing a transformative shift, prominently marked by the increasing adoption of the flipped classroom model. This innovative approach aligns seamlessly with the overarching trend towards student-centered, outcome-based education, emphasizing critical thinking and practical application. By reversing the traditional teaching method and leveraging technology, the flipped classroom equips veterinary students with the skills, knowledge, and collaborative abilities vital for success in the dynamic field of veterinary medicine. It prepares graduates to navigate the complexities of their profession, promoting lifelong learning and adaptability, essential attributes in the ever-evolving landscape of veterinary practice (Deslauriers *et al.*, 2011; Hemmings *et al.*, 2012; McLaughlin *et al.*, 2014).

CONCLUSION

In conclusion, the flipped classroom model is not just a trend; it's a dynamic and transformative force in the realm of veterinary education. By challenging the conventional wisdom of teaching and learning, this innovative approach empowers students to take an active role in their education, fostering critical thinking, collaborative skills, and problem-solving abilities. As veterinary medicine continues to evolve, the flipped classroom equips future veterinarians with the adaptability and expertise required to meet the profession's ever-changing demands. While it is not without its challenges, the potential benefits for both educators and students are profound. By embracing technology, reimagining traditional pedagogy, and aligning with the shift towards student-centered education, the flipped

classroom paves the way for a promising future in veterinary education.

REFERENCES

- Abeysekera, L., & Dawson, P. (2015). Motivation and cognitive load in the flipped classroom: definition, rationale and a call for research. *Higher Education Research & Development*, 34(1), 1-14.
- Anderson, L.W., & Krathwohl, D.R. (2001). A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives: complete edition. Addison Wesley Longman, Inc.
- Baker, J.W. (2000). The "classroom flip": Using web course management tools to become the guide on the side. In: *Proceedings of the 11th International Conference on college teaching and learning*, Vol. 7, No. 1, pp. 9-17.
- Bonwell, C.C., & Eison, J.A. (1991). Active learning: Creating excitement in the classroom (ASHE-ERIC higher education report No. 1). ERIC Clearing house on Higher Education.
- Cone, C., Davies, R., McGarvey, B., & Ramos, R. (2017). A systematic review of flipped learning in engineering education. *Computers & Education*, 112, 243-259.
- Cuello, D. (2020). Exploring the flipped classroom model in veterinary clinical skills teaching. *Veterinary Sciences*, 7(1), 12.
- De Jong, T., Linn, M.C., & Zacharia, Z.C. (2013). Physical and virtual laboratories in science and engineering education. *Science*, 340(6130), 305-308.
- Deslauriers, L., Schelew, E., & Wieman, C. (2011). Improved learning in a large-enrolment physics class. *Science*, 332(6031), 862-864.
- Dooley, L.M., Frankland, S., Boller, E., & Tudor, E. (2018). Implementing the flipped classroom in a veterinary pre-clinical science course: Student engagement, performance, and satisfaction. *Journal of Veterinary Medical Education*, 45(2), 195-203.
- Garrison, D.R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education*, 7(2), 95-105.
- Hemmings, A., Green, M., & Robson, D. (2012). Twelve tips for enhancing the effectiveness of the flipped classroom. *Medical Teacher*, 34(4), 317-321.
- Herreid, C.F., & Schiller, N.A. (2013). Case studies and the flipped classroom. *Journal of College Science Teaching*, 42(5), 62-66.
- Hew, K.F., & Lo, C.K. (2018). Flipped classroom improves student learning in health professions education: a meta-analysis. *BMC Medical Education*, 18(1), 1-13.
- Lakhal, S., Khechine, H., & Pascot, D. (2017). New approach for teaching fundamental computer science courses: A study on the effectiveness of the flipped classroom. *Education and Information Technologies*, 22(6), 2989-3011.
- Londgren, L.M., Wininger, A.E., & Leady, S.E. (2021). A systematic review of the effectiveness of the flipped classroom model in the health professions. *Journal of Dental Education*, 85(4), 449-474.
- Matthew, S.M., Pope, A.L., Matthews, N.S., & Lutz, C.M. (2019a). A systematic review of the effects of the flipped classroom on learning outcomes. *The Journal of Chiropractic Education*, 33(2), 87-100.
- Matthew, S.M., Schoenfeld-Tacher, R.M., Danielson, J.A., & Warman, S.M. (2019b). Flipped classroom use in veterinary education:

- A multinational survey of faculty experiences. *Journal of Veterinary Medical Education*, 46(1), 97-107.
- McLaughlin, J.E., Roth, M.T., Glatt, D.M., Gharkholonarehe, N., Davidson, C.A., Griffin, L.M., Esserman, D.A., & Mumper, R.J. (2014). The flipped classroom: A course redesign to foster learning and engagement in a health professions school. *Academic Medicine*, 89(2), 236-243.
- Moffett, J. (2014). Twelve tips for "flipping" the classroom. *Medical Teacher*, 37(4), 331-336.
- Moffett, J., & Mill, A.C. (2014). Evaluation of the flipped classroom approach in a veterinary professional skills course. *Advances in Medical Education and Practice*, 5, 415-425.
- Raffaghelli, J.E., & Cucchiara, S. (2018). Digital competence: The flip side of digital literacy. *European Journal of Open, Distance and E-Learning*, 21(2), 45-63.
- Roehl, A., Reddy, S.L., & Shannon, G.J. (2013). The flipped classroom: An opportunity to engage millennial students through active learning strategies. *Journal of Family & Consumer Sciences*, 105(2), 44-49.
- Smith, M.K., Jones, F.H., Gilbert, S.L., & Wieman, C.E. (2013). The classroom observation protocol for undergraduate STEM (COPUS): A new instrument to characterize university STEM classroom practices. *CBE-Life Sciences Education*, 12(4), 618-627.
- Strayer, J.F. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environments Research*, 15(2), 171-193.
- Tucker, B. (2012). The flipped classroom: Online instruction at home frees class time for learning. *Education Next*, 12(1), 82-83.
- Uribe, L.A., Benegas, J., & Sánchez, R. (2020). The flipped classroom model at the university: Analysis of the research in higher education. *Journal of Computer Assisted Learning*, 36(4), 487-507.
- Zappe, S., Leicht, R., Messner, J., Litzinger, T., & Lee, H.W. (2009). Flipping the classroom to explore active learning in a large lecture course. In: *Proceedings of 39th IEEE Frontiers in Education Conference*, p. 1-6.

