

Adapted model of flipped classroom in Veterinary Medical Pathology teaching: students' perception

**Jose-Ramiro González Montaña, Angel-Javier Alonso-Diez, Juan-Carlos Domínguez,
Felipe Martínez-Pastor, Marta-Elena Alonso de la Varga**

Grupo de Innovación Docente INNOVAVET. Universidad de León, Campus de Vegana s/n.
24007. León, España.

Abstract

The European Higher Education Area (EHEA) has restructured university faculty to reduce classroom time dedicated to theoretical teaching. For this reason, we have resorted to the inverted—or flipped—classroom, where students acquired complimentary instruction prior to classroom instruction. Our objective was to evaluate the usefulness of online tests to evaluate students' knowledge prior to theoretical classroom instruction, the degree of student satisfaction, and student performance.

During the last academic year, we implemented online tests requiring students to review information prior to in-person classroom instruction. We carried out an anonymous survey evaluating student perception related to the flipped classroom method and how it affected acquiring medical-veterinary knowledge and skills. We collected the final evaluation results in recent years.

Students took this assessment online, with mixed results, although the majority obtained high scores. The modified inverted class was favorably perceived by students and demonstrated a high degree of satisfaction with the knowledge and skills they acquired. For these reasons, we can affirm that students favorably accept the inverted classroom model.

Keywords: *flipped classroom; on line tests; veterinary; clinical subjects; motivation.*

1. Introduction

The European Higher Education Area (EHEA) is a project promoted by the majority of European countries to facilitate the mobility and employability of European citizens by aligning institutions of higher education between European Union (EU) countries. Historically, the process began with The Bologna Declaration (1999), which restructured the university system to promote coordination between the different countries.

In 2012, professors within the University of León Veterinary Faculty implemented a new study plan adapted to address the EHEA purpose. Medical Pathology (MP, similar Internal Medicine) curriculum for fourth-year students was subdivided into two semesters (I and II). The plan reduced the credits for theoretical masters classes so it was not possible to address all the Theoretical Program of Medical Pathology (MP II) in the limited time available. Therefore, we reorganized the program and considered alternatives before deciding on the inverted classroom (or flipped classroom), whereby students may acquire theoretical knowledge that will be reinforced with the practical classes, directly on animals, and laboratories.

The origin of the inverted classroom, or flipped classroom, dates back to the United States almost a decade. Professors Bergmann and Sams (2012) began recording their classes on video to support their students' learning experiences. In the flipped classroom, the cycle of knowledge acquisition and its application is reversed. Thus, students must acquire knowledge prior to in-person instruction class while the teacher guides students to interact with both the teacher and with other students. It has the aim of clarifying and applying the knowledge obtained (López-Olvera & Prandi, 2019). The flipped classroom also represents a fundamental change in class time, which becomes a time dedicated to active learning. This pedagogical method assumes that students prepare and learn different concepts or skills prior to the class session (Cuello, 2020; McDonald & Smith, 2013).

While the flipped classroom is used in multiple teachings, ranging from secondary to university education, it has been used in health professions in recent years (Hew & Lo, 2018; Londgren et al., 2021; Moffett, 2014; Moffett & Mill, 2014). Recently, it was used to teach clinical subjects in Veterinary Medicine (Cuello, 2020; Dooley et al., 2018; López-Olvera & Prandi, 2019; Matthew et al., 2019; Uribe et al., 2020; Londgren et al., 2021).

Therefore, in our opinion, the basic idea inherent in this educational model would be to provide students with learning autonomy. In particular, to encourage students to work on theoretical concepts on their own, outside the classroom, using various learning resources provided by the instructor. Examples of such resources include informative text and specialized publications or videos (although not exclusively). Class time is used to resolve doubts related to the material provided, carry out practices, and open content-related dialogue (Berenguer-Albaladejo, 2016).

In this way, the MPIO faculty provided informative material for students to visualize, read, process and study basic material prior to theoretical classroom instruction. Specifically, it was implemented to ensure students were familiar with the material provided. While in principle we tried to implement an exam at the onset of classes, we found that it was too difficult to carryout the tests within the classroom. A combination of large class size, 100 to 125 students, and limited classroom time led us to implement online tests to encourage prior learning with the intention of promoting the aforementioned attitudes.

For all these reasons, our objective was to assess the usefulness of a series of online tests prior to the theoretical masters classes, and to assess the degree of student satisfaction with this flipped learning method.

2. Methodology

To evaluate the first objective during the last six academic years (2014-15 to 2020-21), we used the Moodle platform to carryout a type of test that "encourages" the students of the MP II subject to study, or at least to read carefully, information provided by the instructors.

Periodically, and always at the beginning of each thematic block, we implemented a multiple choice exam (choice type) through the Moodle platform. The platform is an online system that remains open for 36-48 hours and limits the amount of time students have to take the exam to 10-12 minutes. This test randomly presents 20 questions with four options and only one correct answer. The scores obtained, together with other activities (clinical, tutorials and discussion groups), consist of 35% of the overall evaluation model. The opinions expressed both individually by the students and through their representatives, invite us to think that the approach was appropriate. For this reason, and with the intention of assessing the second objective, we considered it appropriate to carryout an anonymous survey —prior to the final written exam— where a series of items request the students' opinion and degree of satisfaction with this teaching methodology and the repercussion of this flipped classroom model in their acquisition of medical-veterinary knowledge and skills. Students were asked to rate the following items on a Likert scale (1: poorly or a little, 2: regular, 3: acceptable, 4: good, 5: very good or a lot).

- Usefulness of online resources (notes, clinical cases, previous tests, etc.) in the acquisition of theoretical knowledge
- Would you recommend limiting the use of online tests?
- Degree of satisfaction with the teaching and methodology used
- Degree of satisfaction with the competences, knowledge and skills acquired during this subject

To better visualize the results obtained, we have grouped them as follows: 1+2: indicating an unfavorable evaluation or perception, 3: as acceptable, and 4+5: as a positive or very positive perception (Figure 1). Likewise, we have raised a series of questions where the students could identify both the didactic resource that they found most interesting and most innovative. The students could also freely express other opinions with comments. Finally, we took into account the results of the final evaluation of MPII (success rate), in the two options (June and July) as proposed by the Teaching Plan at the University of León. We differentiated between the students who passed the subject and those who did not. Results are expressed as a percentage of the students present and of the students enrolled (Figure 2).

3. Results and Discussion

Nearly all students completed the online evaluation test, which favours the first of the objectives. Specifically, the objective highlighted that students become familiar with classroom instruction before in-person classroom instruction. The learning serves as the basis for the teacher's explanations and furthers understanding of course-related pictures, videos, ultrasounds, as well as any interactions.

The students commented that they perform these online tests both individually and in groups. In our opinion as teachers, it is indifferent whether the students answer the questions individually or in groups, since our main objective is to introduce the students to the subject and expose them to the activities carried out in the classroom (Uribe et al., 2020). The grades obtained on these online tests show very different results that range between 4.0 and 10/10 points. Most of the students obtain scores between 8.5 and 9.5 points, which demonstrates that they review the material available, or at least discuss differing opinions among themselves within the limited time they have to take the test.

Survey results are shown in figure 1. Our data illustrate how this flipped classroom model is perceived positively by the majority of students with 75 to 79% of the students indicating the online resources provided were very useful. These data are in agreement with multiple authors (Hew & Lo, 2018; Londgren et al., 2021; Moffett & Mill, 2014).

Up to 84% of those surveyed do not agree with the possibility of discontinuing the use of online tests, and only between 3.6% and 6.6% are in favor of eliminating them. When asked about the degree of satisfaction with the teaching and the methodology used, only between 2.3 and 5% of the students are dissatisfied and up to 95% either consider it acceptable or are clearly in favor of it. Also up to 96% express a high degree of satisfaction with the skills, knowledge and abilities acquired during this subject, and only 4% disagree with it.

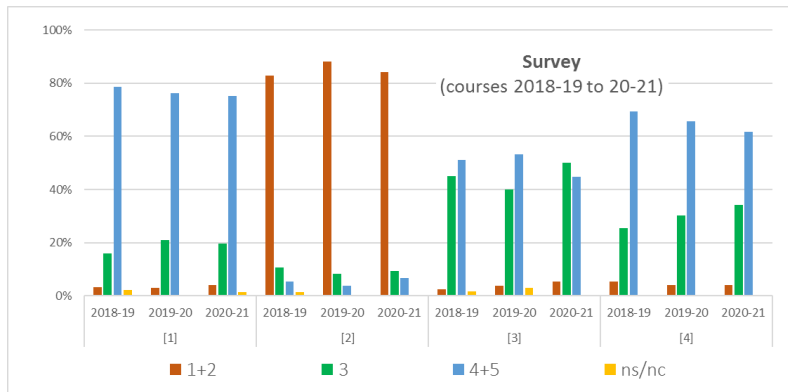


Figure 1. Results of some of the items in the survey carried out. Footnotes: the numbers indicated between [] refer to the following items: [1]: Usefulness of online resources (notes, clinical cases, previous tests, etc.) in the acquisition of theoretical knowledge; [2]: Would you recommend suppressing the use of online tests? [3]: Degree of satisfaction with the teaching and methodology used; [4]: Degree of satisfaction with the skills, knowledge and abilities acquired during this course.

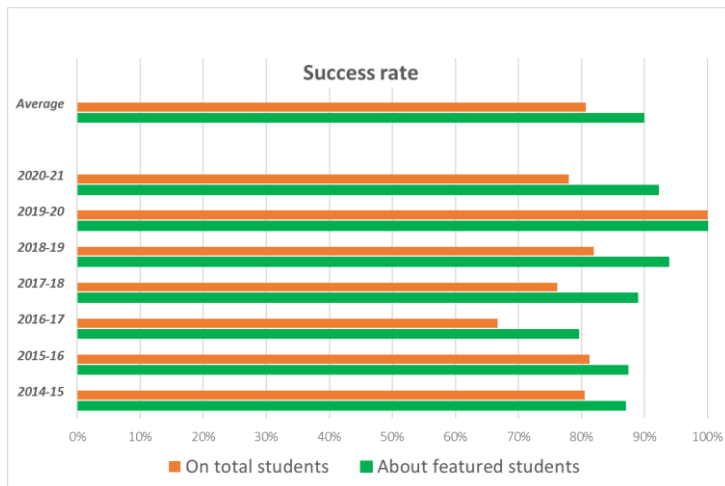


Figure 2. Results of the final evaluation of the subject Medical Pathology (II) in the different years that the flipped classroom model has been used. Foot notes: The results are expressed based on the students who have taken the final test, although the grades obtained in the different activities carried out have been taken into account, as well as based on the students enrolled.

We agree with several authors that the flipped classroom is a pedagogical model that frees up the time of the presentation, which allows us, as teachers, to highlight the most important aspects, clarify the most complex concepts, individually help students with difficulties and encourage learning. Students' are commitment to their own learning instead of focusing on theoretical exposition (Olaizola, 2014). However it is possible that more content can be

covered in a simple and didactic lecture, compared to a workshop of similar time, focused on active learning (Moffett & Mill, 2014).

As Bergmann et al. (2012) indicated, the inverted class is not synonymous with the use of specific videos. For this reason, the teaching resource we used for our inverted class could vary (Gálvez & García, 2015). Since it can be used from the subject manual, different notes, videos, audios, or even scientific publications of specialized reviews or clinical cases, which are usually highly accepted by students. According to Uribe et al. (2020) it is essential that the teacher is resolute in not reteaching the material previously provided in the classroom, in order to shape the culture of the students in the operation of the new dynamic. In our case, the teaching staff reproduced different videos and graphical material that support and complement the previous students' work and the comments, as well as classroom interactions between teachers and students. The previous line tests are also used as one of the activities developed to verify how well students understand the topics (Olaizola, 2014).

The flipped classroom approach has become increasingly popular within medical health instruction (Hew & Lo, 2018; Moffett, 2014; Moffett & Mill, 2014), and while literature on the flipped classroom in veterinary science is scarce (Dooley et al., 2018; Londgren et al., 2021; Matthew et al., 2019; Moffett & Mill, 2014), the positive results in student satisfaction and involvement encourage the use of this methodology (Cuello, 2020; Dooley et al., 2018; Londgren et al., 2021; López-Olvera & Prandi, 2019; Matthew et al., 2019; Uribe et al., 2020).

There are hardly any reports evaluating the implementation of the flipped classroom in veterinary education (Dooley et al., 2018), and even fewer in clinical subjects (Londgren et al., 2021; Matthew et al., 2019) or even postgraduate (Moffett & Mill, 2014), so it is difficult to compare our results. Matthew et al. (2019) conducted a study focused on establishing baseline information on the use of the flipped classroom technique in veterinary education, but focused on the familiarity of the participants—along with the activities used—the perceived benefits and the barriers to implementation. Dooley et al. (2018) demonstrated that a transition to online learning resources in a flipped classroom format improved aspects of student academic performance, satisfaction, and engagement in a pre-clinical sciences course. The activity closest to our experience was carried out by Londgren et al. (2021) when they investigated the potential of the flipped classroom approach to prepare students for internships in a clinical skills laboratory.

Several students explicitly pointed out the performance of online tests as the most innovative didactic resource and just as interesting as other teaching resources used in this subject, such as practices carried out with sick animals, resolution of virtual or real clinical cases, visits to farms and group discussion of clinical. They agree with Londgren et al. (2021) that the

flipped classroom was an investment of time and resources, but in general, it was worth it in terms of results—especially if the students had done the previous homework.

Although the percentage of students who pass the subject in the final evaluation (success rate) varies in the different courses, it is around 90% of the students within the classroom and over 80% of the students enrolled (Figure 2). We must point out that in Course 2019-2020 (confinement due to the Covid-19 pandemic) 100% of the students presented passed the subject. There is consensus that students seem to prefer the flipped classroom approach over the traditional classroom approach (Dooley et al., 2018; Moffett & Mill, 2014), although this preference did not always translate into better academic performance. McLaughlin et al. (2014) found that cumulative final exam performance increased and overall grades increased from 80% to 82.5% when a flipped classroom approach was adopted in a first-year pharmacy foundation course (Moffett & Mill, 2014).

A significant beneficial effect was also found for the flipped classroom cohort, which achieved significantly higher scores on the written response section of the final exam, while this difference was not seen for the multiple choice section, which was identical for both cohorts (Dooley et al., 2018). However, and although students preferred flipped classroom teaching over traditional teaching, traditional classroom students outperformed flipped classroom students on multiple-choice items (Moffett & Mill, 2014). For this reason, and given that studies of the implementation of the flipped classroom have shown variable impacts on the academic performance of students, it is possible that some of the benefits of this design are not adequately evaluated with traditional methods (Dooley et al., 2018).

We consider that the best results in this aspect may be due to the fact that this methodology is perceived positively by the students, increasing their motivation towards the "active learning" experience of this subject. It is reinforced by the high attendance within non-mandatory theoretical classes. This is consistent with a study, in which students who participated in the flipped classroom rated the teaching staff better than those who participated in the traditional classroom course, although the teaching staff remained the same (Moffett & Mill, 2014).

4. Conclusion

As conclusion, the favorable student acceptance from surveys results, combined with marks obtained in the final evaluation, invite us to believe that adaptating the flipped classroom facilitates the learning process in Medical Pathology (Clinical Veterinary) and that it may directly transfer to other subjects in the Veterinary degree curricula.

References

- Berenguer-Albaladejo, C. (2016). Acerca de la utilidad del aula invertida o flipped classroom. *XIV Jornadas de Redes de Investigación en Docencia Universitaria*, 1466.
- Bergmann, J., Overmyer, J., & Wilie, B. (2012). *The flipped class: Myths versus reality*. The Daily Riff. <http://www.thedailyriff.com/articles/the-flipped-class-conversation-689.php>.
- Cuello, C. (2020). El aula invertida como herramienta para la docencia no presencial en Veterinaria. *CIVINEDU 2020*, 480.
- 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. <https://doi.org/10.3138/jvme.1116-173r>
- Gálvez, A., & García, A. (2015). *Uso del vídeo docente para la clase invertida: Evaluación, ventajas e inconvenientes* (1.ª ed.). ACCI (Asoc. Cultural y Científica Iberoameric.).
- Hew, K. F., & Lo, C. K. (2018). Flipped classroom improves student learning in health professions education: A meta-analysis. *BMC Medical Education*, 18(1), 1-12. <https://doi.org/10.1186/s12909-018-1144-z>
- Londgren, M. F., Baillie, S., Roberts, J. N., & Sonea, I. M. (2021). A survey to establish the extent of flipped classroom use prior to clinical skills laboratory teaching and determine potential benefits, challenges, and possibilities. *Journal of Veterinary Medical Education*, 48(4), 463-469. <https://doi.org/10.3138/jvme-2019-0137>
- López-Olvera, J. R., & Prandi, D. (2019). Nuevos métodos docentes para una nueva asignatura: Clase invertida y aprendizaje en grupos en Métodos Exploratorios del Grado de Veterinaria. *VetDoc. Revista de Docencia Veterinaria*, 3, Extraord., 58-59.
- Matthew, S. M., Schoenfeld-Tacher, R. M., Danielson, J. A., & Warman, S. M. (2019). Flipped classroom use in veterinary education: A multinational survey of faculty experiences. *Journal of Veterinary Medical Education*, 46(1), 97-107. <https://doi.org/doi:10.3138/jvme.0517-058r1>
- McDonald, K., & Smith, C. M. (2013). The flipped classroom for professional development: Part I. Benefits and strategies. *The Journal of Continuing Education in Nursing*, 44(10), 437-438.
- 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), 1-6. <https://doi.org/10.3109/0142159X.2014.943710>
- 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.
- Olaizola, A. (2014). La clase invertida: Usar las TIC para “dar vuelta” a la clase. *Actas X Jornadas de Material Didáctico y Experiencias Innovadoras en Educación Superior*, 1-10.

Uribe, A. A., Jimenez, G. D., & Troncoso, M. F. (2020). Flipped Classroom: Una experiencia para fortalecer el aprendizaje en Medicina Veterinaria. *Educação e Pesquisa, São Paulo*, 46(e214200), 1-16.