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## **Analysis of teaching methods in anaesthesia in the undergraduate curriculum of 4 veterinary universities**

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### **Running Head**

Teaching anesthesia for undergraduates

### **Authors' contributions**

OA: study design, data collection, data management, data analysis, data interpretation and  
preparation of manuscript.

LP: data collection, data management, data analysis, data interpretation and preparation of  
manuscript.

KVN: data collection, data management, data analysis, data interpretation and preparation of manuscript.

AZ: study design, data collection, data management.

LZ: study design, data collection, data management, and preparation of manuscript.

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### **Conflict of interest statement**

The authors declare no conflict of interest.

## **Abstract**

1 **Objectives** To design a holistic audit tool to assess the effectiveness of anaesthesia  
2 teaching strategies, and thereby to study veterinary undergraduate teaching methods in  
3 different geographical areas.

4 **Study design** Qualitative study using interviews of university staff and students to  
5 identify common themes and differences in teaching veterinary anaesthesia.

6 **Methods** An audit was carried out using an audit tool in four veterinary universities  
7 (ENVA-France, RVC-UK, UBA-Argentina, UNIBO-Italy). First, an open-question  
8 interview of anaesthesia head of service (60 to 90 minutes) identified the pedagogical  
9 strategies in order to conceive a subsequent semi-directive interview formulated as a  
10 SWOT analysis (Strength/Weaknesses/Opportunity/Threats). Secondly, the SWOT  
11 reflection was carried out by a second staff member and focussed on i) general  
12 organisation, ii) topics for pre-rotation teaching, iii) teaching methods for clinical  
13 rotation and iv) assessment methods. Qualitative analysis of the interview responses  
14 was performed with semi-structured interviews. Finally, the students evaluated their  
15 teaching through a student questionnaire generated from the output of both interviews.

16 **Results** A group of nine lecturers and 106 students participated in the study at four  
17 different sites. Pre-clinical teaching ranged from 13 to 24 hours (median 15 hours).  
18 Clinical teaching ranged from 4 to 80 hours (median 60 hours). Overall, all faculties  
19 perceived time as a limitation and attempted to design strategies to achieve the  
20 curriculum expectations and optimize teaching using more time-efficient exercises.  
21 Large animal anaesthesia teaching was found to be a common area of weakness.  
22 Internal feedback was delivered to each university, while generalised results were  
23 shared globally.

24 **Conclusions** This preliminary study proved the generalisability of the protocol used.  
25 Recruiting a larger pool of universities would help to identify and promote efficient  
26 teaching strategies and innovations for training competent new graduates in an ever-  
27 expanding curriculum.  
28  
29 **Keywords** andragogy, anaesthesiology, competences, questionnaire, skills, SWOT.

30 **Introduction**

31 In our society of increasing expectations and technological advances, universities face a  
32 challenge of educating students in order to meet these expectations. On one side, we are  
33 dealing with increasing number of students per year and on the other side, universities  
34 deliver an ever-expanding curriculum content in response to scientific advances in  
35 medicine.

36 “The missions of a teacher are not limited to the transmission of updated information, or  
37 gestures and techniques to meet a regulatory framework. The teacher must clarify his  
38 intentions, define strategies, and choose environments with the aim of developing skills  
39 in the face of the complexity of our care situations” (Jaffrelot et al. 2012)

40 Teaching veterinary medicine is predominantly university-specific and includes  
41 a wide range of teaching methods. Unlike medical education, where anaesthesia is a  
42 postgraduate skill, it is essential for new veterinary graduates to master anaesthesia in  
43 order to work as a competent clinician. In human medicine, anaesthesia is mainly  
44 associated with a surgical operation, whereas, in veterinary medicine, anaesthesia is  
45 needed for the majority of procedures that a general practitioner has to perform (not  
46 only surgery but diagnostic imaging for example).

47 There are no standardized, worldwide-accepted pedagogical methods for  
48 veterinary universities to utilise when anaesthesia is taught. In this study, we focused on  
49 undergraduate anaesthesia teaching. The AVMA (American Veterinary Medical  
50 Association), the RCVS (Royal College of Veterinary Surgeons), EAEVE (European  
51 Association of Establishments for Veterinary Education) and the AVBC (Australian  
52 Veterinary Boards Council) proposed a set of aims and learning objectives required for  
53 their accreditation (“Day one skills”, see Appendix A). However, there is no  
54 information about what methods are currently used to secure these “Day 1 skills” and

55 their effectiveness in producing competent practitioners, ready to perform anaesthesia  
56 on their first day in practice under the auspices of the same professional body. This  
57 could lead to differences in teaching methods between schools overseen by the same  
58 regulatory body. Our aim was to study the andragogy in veterinary anaesthesia, which is  
59 the method and practice of teaching adult learners. This required the use of qualitative  
60 research methods, which are applied when factors are subjective or difficult to quantify  
61 or measure. The purpose of qualitative research is to collect data allowing an  
62 interpretative approach. This method has been applied for the last two decades in  
63 general medicine (Pope & Mays 2006; Aubin-Auger et al. 2008). It relies on the use of  
64 audit tools, which is a generic term for any instrument that collects data and provides  
65 feedback on the performance of the subject studied. Medical education studies have  
66 used audit tools in an effort to improve theoretical teaching. In a study by Mercier-  
67 Coubris (2013), medical students evaluated teaching methods and provided feedback to  
68 the teaching team, which subsequently contributed to the improvement in the  
69 competencies of the students. This led us to investigate the different veterinary  
70 anaesthesia curricula, with regard to the teaching organisation (number of hours,  
71 balance practical *versus* theoretical) and assessment. We wanted to know if teaching  
72 methods were standardized and if there were differences in how anaesthesia was taught  
73 between universities. To answer these questions, we created an audit tool that we  
74 applied to four veterinary universities. Our hypotheses were: 1) the volume of teaching  
75 and methods used differ between veterinary universities; 2) veterinary universities  
76 confront common issues and limitations in anaesthesia teaching; and 3) students'  
77 assessment/perception of anaesthesia teaching differs between veterinary universities.

78         This preliminary study is the first of its kind in the field of veterinary education.  
79 Our aims were to i) design a holistic audit tool to assess the effectiveness of anaesthesia

80 teaching strategies and to ii) study teaching methods of anaesthesia to veterinary  
81 undergraduates in different geographical areas.

82

### 83 **Materials and methods**

84 In order to study this wide-ranging topic, we focussed on anaesthesia teaching methods  
85 of four universities (ENVA-France, RVC-UK, UBA-Argentina, UNIBO-Italy). We  
86 used a qualitative approach; universities were considered as entities on their own  
87 (Denzin & Lincoln 2000; Mucchielli 2009; Berg & Lune 2010). The study was  
88 approved by the Ethical Committee of the RVC (URN SR2017-1384) and the analysis  
89 of the data collected was authorized by the participating universities.

90 The study, based on our audit tool, was divided into successive stages, which  
91 were applied to each participating university (Fig. 1). It consisted of 1) interview of the  
92 head of service to establish an overview of the curriculum and teaching methods, 2) a  
93 SWOT (Strength/Weaknesses/Opportunity/Threats) analysis of the anaesthesia course,  
94 3) collection of students' impressions of the course and 4) the report back to the  
95 individual school.

96 The participants were: the heads of the anaesthesia service at each university; a  
97 senior anaesthetist at the four university teaching hospitals and the students, who had  
98 completed their theoretical courses and clinical rotation.

99 For this study, three types of questionnaires were developed in this order.

100

101 General interview of the head of service (see Appendix B)

102 This open-question interview provided an opportunity for the heads of service to discuss  
103 in broad terms the teaching methods used in their service (Miller & Crabtree 1999;  
104 Harris 2002). The interviews were conducted face-to-face and took between 1 hour and  
105 1 hour 30 minutes to complete. They were audio-recorded with the consent of

106 participants. The goal was to highlight the andragogical strategies in teaching veterinary  
107 anaesthesia.

108

109 Interview of a member of the teaching team (see Appendix C)

110 The second questionnaire was an interview of a different member of the teaching team.

111 The responses to this semi-structured interview lead to the delivery of a SWOT analysis

112 (Fig. 2) (Dicicco-Bloom & Crabtree 2006; Imbert 2010).

113 The SWOT reflection was applied to:

114 i) general organisation of the anaesthesia teaching,

115 ii) topics for pre-rotation teaching,

116 iii) pedagogical methods for clinical rotation,

117 iv) assessment methods.

118

119 Students Questionnaire (see Appendix D)

120 The outputs of both interviews as outlined in appendices B and C were used to generate

121 a student questionnaire. The same questionnaire (paper based or administered using the

122 university's virtual platform) was used for all the students, with one or two different

123 questions dependent upon specific aspects of each university's teaching. The

124 questionnaire was given to the students at the end of their anaesthesia learning

125 experience (after rotation and lectures had been completed) in order to enable a

126 complete evaluation of their perception of the teaching. A short verbal introduction was

127 made to the students to explain the aim of the study. The analysis of this survey served

128 as feedback to the teachers on their pedagogical methods.

129 The questionnaire included 12 Likert scale (Bishop & Herron 2015) questions to

130 evaluate:

- 131 i) general organisation,  
132 ii) theoretical component of teaching,  
133 iii) practical component of teaching,  
134 iv) number of contact hours,  
135 v) assessment process,  
136 vi) their clinical rotation overall,  
137 vii) two or three open questions about positive and negative aspects of teaching.

138 It required no more than 5 minutes to complete in order to maximise the  
139 response rate from the polled students.

140

#### 141 **Analysis**

142 Both interviews were conducted as far possible in the native language of the teachers in  
143 order to obtain the necessary information. If it was not possible to conduct the interview  
144 in the instructor's native language, the interviews were conducted in English.

145 The data analysis was based on the following steps (Lingard & Kennedy 2010):

- 146 1) The teachers' interviews were audio-taped and fully transcribed by the  
147 investigator and the transcript checked by the interviewee.
- 148 2) Themes/specific aspects/teaching methods used from the interviews of the  
149 head of service were selected. This allowed us to obtain an overview of the  
150 andragogical strategies used.
- 151 3) The SWOT matrix was elaborated from the interview with the teaching staff.
- 152 4) Students' questionnaires were analysed. Percentages were calculated for each  
153 question; comments and suggestions were categorized. To analyse a possible  
154 correlation between the amount of anaesthesia contact hours and the students'  
155 ratings, a chi-square test was performed using a commercial statistical software

156 (IBM SPSS Statistics 22; IBM Corp, NY, USA). Statistical significance was set  
157 at  $p < 0.05$ .

158 From this data analysis, each participating university received a confidential  
159 report summarizing the result of their field study (Appendix E: structure of the feedback  
160 report).

161

## 162 **Results**

163 Results relate to our three main hypotheses, specifically the inter-university  
164 commonalities/differences in 1) teaching time and methods, 2) issues and limitations in  
165 anaesthesia teaching, and 3) students' assessment/perception of anaesthesia teaching.

166

167 The volumes of teaching and methods differ between universities – hypothesis 1 (Fig.3  
168 and Table 1)

169 Figure 3 represents an overview of the curriculum at each of the participating  
170 institutions. Table 1 describes more precisely how anaesthesia teaching is organised and  
171 timetabled in the curriculum of each participating university.

172 Results from the initial interview of the head of service suggested that  
173 theoretical anaesthesia concepts were taught prior to clinical rotations. The length of  
174 theoretical teaching, consisting of didactic lectures and practicals, ranged from 13 to 24  
175 hours (median 15 hours). Clinical teaching consisted of an immersive experience in an  
176 anaesthesia rotation where students were assigned clinical cases under supervision. Its  
177 duration ranged from 4 to 80 hours (median 60 hours).

178

179 Universities confront common issues and limitations in teaching anaesthesia –  
180 hypothesis 2.

181 The results of the teaching teams' interviews (SWOT analysis included) highlighted  
182 common points between the participating universities:

183         At all four institutions time was perceived to be a limitation. With respect to  
184 anaesthesia of large animals: anaesthesia teaching is small animal-oriented, at the  
185 expense of large animals. With respect to the simulation laboratory: a simulation  
186 platform provides training on mannequins and models that enhances clinical skills. It  
187 also provides additional teaching that complements the theoretical classes. Teachers  
188 using this support identified a reduction in student stress, which was associated with the  
189 start of their clinical rotation and noted that students seemed more comfortable in taking  
190 care of the animal and completing clinical tasks.

191         Small group tutorial classes provide an interactive and stimulating learning  
192 environment for students. With a small number of students, these classes facilitate the  
193 assimilation of clinical skills. This format of teaching coupled with theoretical sessions  
194 allows the students to put theory into practice.

195         Clinical rotations within the university hospital: taking part in a clinical rotation  
196 at the university hospital of the institution is a strong advantage by the teaching team. It  
197 provides access to a wide and diverse range of clinical material. The clinical rotation  
198 appears to be one of the best strategies of applying theoretical knowledge to clinical  
199 practice, since it empowers the students. With regard to the clinical cases allocated to  
200 the students, the clinicians try to favour basic cases, such as orchidectomies. Teaching  
201 rounds at the end of the day is an additional feature that promotes learning. It is an  
202 opportunity for students to discuss anaesthesia protocols and clinical cases. The  
203 teaching teams consider that oral presentation of cases during rotation enhances  
204 knowledge and trains the students in verbal communication.

205 All of the anaesthesia teachers at the four participating universities, considered  
206 a rotation of 2-weeks to be the ideal duration of time. The first week provided an  
207 adjustment period for the students. While the second week allowed an improvement in  
208 clinical skills and knowledge.

209 Constant guidance and supervision of the students is ideal during the rotation.  
210 However, the pressures of busy operating schedules can be a limitation and emergencies  
211 interfere with the teaching organisation and the availability of the teachers' time.

212 Teachers promoted continuous assessment. However, for a majority of  
213 universities, the organisation of the curriculum makes it difficult to provide this form of  
214 assessment; owing to limited time allowed and organisational constraints of the  
215 examinations for example. During the theoretical assessment, teaching teams considered  
216 multimedia support (such as photographs and videos of related material) to be beneficial  
217 to the provision of clinical scenarios to the students.

218 The ideal assessment of a clinical rotation would be successful completion of the  
219 rotation by the students with the teaching team verifying/evaluating whether students  
220 are able to anaesthetize an animal competently. Individual and personalised feedback to  
221 the students provides the opportunity for targeted discussion and an optimal learning  
222 outcome.

223

224 Students assessment/perception of anaesthesia teaching differs between the veterinary  
225 schools – hypothesis 3.

226 The students' questionnaire provided feedback of their perception of the teaching they  
227 received. There was a total of 104 student replies (range 20 to 43 per site) out of the 104  
228 students to whom the questionnaire was distributed in three universities. In the fourth  
229 participating university, the investigator was not on site and delegated the distribution

230 of the questionnaire to the attending clinician. Only two students replied to the  
231 questionnaire. We were not able to determine how many students had access to the  
232 survey in this university. Therefore, it was decided not to include those results in Fig. 4.  
233 Data were used to compare the inter-university teaching methods (Fig. 4).

234 Common trends were identified: greater than 80% of students in three of the  
235 universities considered the organisation of the clinical rotation to be adequate (80.5% in  
236 UBA, 87.5% in ENVA and 90% in RVC). General organisation of the anaesthesia  
237 curriculum was perceived as adequate or partially adequate by the students. While the  
238 number of contact hours of theoretical teaching was considered inadequate by 17% of  
239 students in UBA, 16% in ENVA and 30% in RVC.

240 For the methods of theoretical and clinical rotation assessment, the students'  
241 evaluation diverged between universities. In ENVA and UBA, 0% of the students  
242 evaluated as inadequate the methods of theoretical assessment, whereas at the RVC  
243 15% of the students considered it inadequate. In universities UBA and RVC, 2% and  
244 0% respectively of the students evaluated the methods of the clinical rotation  
245 assessment to be inadequate, while in ENVA 21% of the students reported the way they  
246 were assessed during their clinical rotation as inadequate.

247 This student questionnaire emphasized effective and weak pedagogical methods.  
248 Free-text comments and suggestions were used to identify new ways for improving and  
249 reinforcing the efficiency of anaesthesia teaching.

250 The analysis of the comments and suggestions identified three common aspects of  
251 the students' vision: specifically, large animal anaesthesia teaching was unsatisfactory;  
252 (18.8% of the comments in ENVA, 24% of the comments in UBA). Clinical anaesthesia  
253 rotations were judged as a superior technique to understand and strengthen theoretical  
254 knowledge; (100% in UBA, ENVA, and RVC). Finally, anaesthesia pharmacology was

255 perceived as a difficult topic necessitating much more teaching time. (67% in ENVA  
256 and 50% in RVC of the comments).

257           Students that received fewer contact hours were more likely to rate the course as  
258 less adequate than the students, who received more tuition ( $p = 0.004$ ) (Table 2).

259

## 260 **Discussion**

261 To the best of the authors' knowledge, this is the first study to evaluate methods of  
262 teaching anaesthesia to veterinary students. Between 2017 and 2018, we studied  
263 anaesthesia teaching strategies in several veterinary institutions (d'Anselme 2018)  
264 applying a qualitative research methodology. Qualitative research is based on collecting  
265 data and providing feedback to the participating institutions. This was used to elaborate  
266 the audit tool. We measured (with the SWOT analysis and the student survey) current  
267 performance in each of the participating universities and provided feedback to them.  
268 Thereby, we facilitated the identification of areas where performance met expectations  
269 or areas where improvement was needed. The qualitative approach and clinical audit  
270 tools have been used largely in medical disciplines, to improve the quality of care in  
271 nephrology for instance (Esposito & Dal Canton 2014).

272           With our audit tool, we obtained two types of results: a) andragogical strategies,  
273 and their status as defined by the teaching team of each university. b) The students'  
274 evaluation of the teaching strategies identified and used in the universities.

275           We verified two hypotheses. First, we demonstrated that teaching methods are  
276 not standardized between universities, as they follow the day 1 skills lists established by  
277 the relevant regulatory bodies. In the human medical field, there are no agreed methods  
278 for teaching anaesthesia to undergraduates, as stated by Sidhu: "the content and  
279 approach to undergraduate anaesthesia varies between institutions" (Sidhu et al. 2015).

280 Sidhu et al recommended that universities undertake similar exercises to optimise  
281 teaching and learning opportunities for undergraduate anaesthesia students. Sidhu and  
282 authors suggested that “there is potential for academic departments to align curricular  
283 goals with expectations of supervising clinicians in teaching hospitals in order to  
284 facilitate student involvement in patient care” (Sidhu et al. 2015). We thought it would  
285 be interesting to apply Sidhu’s suggestion to the context of our study: align curricular  
286 goals in undergraduate anaesthesia and harmonize the day 1 skills. This would help to  
287 ensure that students, at the end of their training, have the minimum requirements to be  
288 competent clinicians in anaesthesia.

289 We also verified that universities confront common issues and limitations in  
290 anaesthesia teaching. The results of the interviews from the teaching teams highlighted  
291 time as a common limiting factor. All the participating faculties attempted to design  
292 strategies to fulfil the curriculum requirements and optimize teaching in a time-efficient  
293 exercise. It would be useful to devise a system where the time is assigned based on  
294 pedagogical needs and objectives of this discipline. This organisation would optimize  
295 the achievement of the pedagogical objectives. The current system (fixed amount of  
296 time allocated per discipline and then adaptation of the teaching content) has limitations  
297 and the curriculum's objectives are sometimes only partially met. As such, veterinary  
298 anaesthesia teaching seems to face comparable challenges and similar opportunities to  
299 those encountered in the teaching of anaesthesia to trainee doctors (Sidhu et al. 2015).  
300 “The traits of the ideal teacher in anaesthesia have been previously described. A one-on-  
301 one teaching environment, as occurs during the anaesthesia attachment, is a rare  
302 experience during medical school training”. Drawing a parallel between teaching  
303 anaesthesia in human and veterinary medicine would be useful in order to identify a  
304 common set of solutions.

305           For the third hypothesis, we observed that the majority of the students shared the  
306 same vision between universities. The goal of this student survey was to obtain the most  
307 representative perception possible of the teaching they had received and to compare it  
308 with the teachers' perception. The two visions were actually in agreement most of the  
309 time. Students in our surveys seemed clearly aware of both good and poor teaching  
310 practices.

311           We designed an audit tool to assess anaesthesia teaching strategies in veterinary  
312 universities and applied it to four veterinary undergraduate curricula in different  
313 geographical areas. First, the design of the teachers' questionnaire was based on the  
314 principles of a semi-structured survey. This allowed for a more realistic and up-to-date  
315 view of the teaching methods used in the institutions and provided the participants'  
316 perspective via direct interaction with them (Merriam & Tisdell 2015). Then for the  
317 SWOT analysis "a framework identifying and analysing the internal and external factors  
318 that can have an impact on the viability of a project, product, place or person" (Leigh et  
319 al. 2010), the goal was to critically analyse the pedagogical strategies from the teachers'  
320 point of view. The field study required a physical on-campus attendance of the  
321 investigator at the university and favoured the application the semi-directive interviews.  
322 Indeed, to have an exchange allowing a collection of valid data, it was essential to  
323 establish a relationship of trust with the students during their rotation. Physically  
324 visiting the schools for an average of 2 weeks, was vital for undertaking this study. In  
325 fact, once there, it was much easier to collect data, to adapt to the organisation of each  
326 university and ultimately this allowed better analysis and interpretation of the  
327 information. In one university, the language barrier and the time limit did not allow this  
328 on-the-spot survey to be performed. The exchange with this university was in English  
329 and through e-mail. For the university where the interviews were conducted only by

330 video conference (Skype, Microsoft 2017, CA, USA), the implementation of the  
331 protocol as well as the evaluation of the teaching by the students were thereby  
332 compromised (yielding two responses only).

333 In conclusion, the presence on the site of the university allowed a much better  
334 application of the protocol and a rigorous collection of the data necessary for our study.  
335 This confirms that the "human factor" and the relation are fundamental in carrying out  
336 this type of study. The use of technology in communication is not yet able to replicate  
337 as effectively the information sharing that can be achieved with a face-to-face human  
338 presence. Moreover, as the study unfolded, it was easier to conduct the interviews with  
339 the teachers. For this reason, there is a significant development in the conduct of the two  
340 types of interviews (the interview with the head the service and the interview for the  
341 construction of the SWOT analysis): the latest interviews were richer in detailed  
342 information.

343 For the design of the students-questionnaires, we noticed that the section  
344 "comments and suggestion" placed at the beginning of the questionnaire resulted in a  
345 higher completion rate of this section. This configuration allowed students to express  
346 themselves more constructively and students were keener to leave more written  
347 comments. The opposite configuration (with the comments at the end of the test),  
348 exhausted the motivation of the candidates and their commitment to answer efficiently.  
349 The results then were less satisfactory.

350 A limitation of this study was the number of students recruited: a large number  
351 of participants would have been beneficial. There was a need to be physically at the  
352 university to present the study to the students. We noticed that an oral presentation of  
353 the project to the students was appreciated since it triggered their interest and  
354 involvement. We believe the oral presentation helped to increase students' participation:

355 during the field study, we were in contact with students during their clinical rotation. At  
356 the end of their clinical rotation in anaesthesia (in ENVA and RVC) or during their  
357 anaesthesia examination (in UBA) a short presentation was made. At these institutions  
358 100% of the recruited students completed the survey. However, in the university where  
359 the investigator was absent, only 2 students participated. Moreover, the semi-structured  
360 interview method has some limitations. The small sample size does not allow the results  
361 to be generalized or permit the recommendations to be drawn from them to be applied  
362 on a large scale. Being immersed in the cultures and experiences of the participants, the  
363 researcher may lack perspective. Furthermore, this immersion increases the chances of  
364 generating biases in the collection of information, in the generation of data and in their  
365 interpretation, known as the “Hawthorne effect” (which is the alteration of behaviour  
366 by the subjects of a study due to their awareness of being observed) (Holden 2001). The  
367 amount of information collected from participants can affect its quality and lead to  
368 unfounded conclusions (Reeves et al. 2006). Finally, this method of data collection and  
369 analysis is time-consuming and financially demanding (Denzin & Lincoln 2000;  
370 Anderson 2010; Merriam & Tisdell 2015).

371 In conclusion, we devised a prototype audit tool to identify common themes and  
372 differences in teaching veterinary anaesthesia. It was applied to four veterinary schools  
373 to support tool generalisability. The findings of this study suggest that anaesthesia  
374 teaching within the four participating veterinary teaching programs was similar. The  
375 universities shared many parallels such as a restricted amount of time for anaesthesia  
376 teaching and a sub-optimal exposure to large animal topics. The results showed an  
377 enthusiasm and a strong interest from the universities for improvements in and the  
378 development of veterinary anaesthesia teaching. This was enhanced by the commitment  
379 of the European and Argentinian students: their voluntary participation in the survey

380 and the quality of their comments and suggestions expressed their involvement and  
381 dedication to this study. However, we acknowledge that this work was labour-intensive  
382 but necessary in order to have a direct analysis of the universities. The investment of  
383 time and money cannot be neglected or underestimated if we want to re-apply properly  
384 this protocol and comply with reliable results on a larger scale.

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438

439 **Appendix A** The AVMA (American Veterinary Medical Association) Clinical  
440 Competencies/AVBC (Australian Veterinary Boards Council) Clinical  
441 Competencies/RCVS (Royal College of Veterinary Surgeons) Day One Skills table.  
442 <http://www.massey.ac.nz/massey/fms/Colleges/College%20of%20Sciences/IVABS/vet>  
443 [school/IVMA%20/AVMA-RCVS%20LO.pdf](http://www.massey.ac.nz/massey/fms/Colleges/College%20of%20Sciences/IVABS/vet/school/IVMA%20/AVMA-RCVS%20LO.pdf);

### AVMA Clinical Competencies/RCVS Day One Skills

1.1	Demonstrate a level of literacy and numeracy that enables them to competently undertake the functions expected of a veterinarian.	AVMA NL	AVBC 4.3, 4.8, 8.8, 8.10, 8.11	RCVS B1.1
1.2	Understand the basis of effective communication by verbal and non-verbal means.	AVMA 8	AVBC 1.9, 2.8, 8.13	RCVS A1.1
1.3	Be able to communicate effectively orally and in writing.	AVMA 8	AVBC 1.9, 2.5, 2.6, 8.13	RCVS A1.1
1.4	Possess interpersonal skills that will enable them to interact effectively and professionally with people with whom they come into contact in their personal and professional lives. This includes skills in listening and understanding, empathy and respect for others and an ability to handle interpersonal conflict.	AVMA 8	AVBC 2.1, 2.2, 2.3, 2.4, 7.1, 7.2, 8.13	RCVS A1.3
1.5	Demonstrate the ability to find, utilise and manage information, including the use of modern information technology.	AVMA 10	AVBC 4.3, 6.4, 8.11	RCVS A1.6
1.6	Demonstrate intellectual curiosity and a desire for lifelong learning.	AVMA 11	AVBC 4.1	RCVS A1.6
1.7	Demonstrate ability to reason logically and think critically and analytically.	AVMA 1	AVBC 8.9	RCVS B1.3
1.8	Demonstrate problem solving ability.	AVMA 1		
1.9	Make valid judgements and deductions on the basis of evidence and information available taking into account, as appropriate, ethical, moral and legal considerations.	AVMA 1	AVBC NL	
1.10	Demonstrate physical and mental health- and self-awareness and strategies to maintain them.	AVMA 2		RCVS A1.10, A1.11
1.11	Demonstrate understanding of the scientific method and the scientific basis of modern veterinary medicine, and the ability to utilise scientific principles in the practice of veterinary science and medicine.	AVMA NL		RCVS A1.6, B1.2
1.12	Have well developed observational skills.	AVMA 1	AVBC 8.6	
1.13	Demonstrate adaptability and the ability to work collaboratively with professional colleagues, support staff and clients.	AVMA 8	AVBC 3.6, 7.1	RCVS A1.3
1.14	Understand the principles and methodology of quality management and assurance.	AVMA NL	AVBC 3.5	RCVS A1.7
2.1	Recognise and comply with all legal and statutory requirements and obligations pertaining to veterinary activity.	AVMA 8	AVBC 1.5, 5, 6.4	RCVS A1.9, B1.7, C1.8, C1.10
2.2	Recognise and comply, in all areas of veterinary activity, with the ethical and professional standards expected of a veterinarian and in particular, those set down in the Code of Professional Conduct.	AVMA 8	AVBC 1.5, 5, 8.12	RCVS A1.9
2.3	Recognise the special responsibilities of veterinarians in safeguarding and promoting animal welfare.	AVMA 8	AVBC 1.2, 6.2	RCVS A1.4
2.4	Be knowledgeable about animal welfare and able to identify and deal with animal welfare issues.	AVMA 8	AVBC 6.2	RCVS A1.4
2.5	Recognise the special responsibilities and privileges of veterinarians in society and the need to maintain an appropriate standard of personal and professional behaviour.	AVMA 8	AVBC 1.3, 8.12	RCVS A1.1

2.6	Understand the basic principles involved in the running of veterinary businesses.	AVMA NL	AVBC 3.1, 3.2	RCVS A1.7
2.7	Recognise and accept their responsibility for maintaining their veterinary knowledge and skills, and for their own professional development and continuing veterinary education.	AVMA 12	AVBC 3.3, 4.9	RCVS A1.8
2.8	Use knowledge of the role of animals in the local and global societal context to provide appropriate veterinary treatment and advice.	AVMA 7	AVBC 1.3, 6.1	RCVS A1.5
3.1	Demonstrate knowledge and understanding of the preclinical and paraclinical subjects.	AVMA 1	AVBC 1.4, 7.3	RCVS B1.4
3.2	Obtain and record a relevant, accurate and detailed history of animals presented.	AVMA 1	AVBC 8.2	RCVS A1.2, C1.1
3.2	Provide first level advice on the public health implications of animal diseases.	AVMA 7	AVBC 1.6, 8.5, 9.2, 9.11	RCVS C1.2
3.3	Approach, handle and restrain animals in ways that are effective, safe, humane and ethical and appropriate to the circumstances.	AVMA 5	AVBC NL	RCVS A1.2, C1.3
3.4	Carry out and evaluate a thorough systematic physical and clinical examination of animals presented and be able to distinguish between the normal and the abnormal.	AVMA 1	AVBC 9.1, 9.3, 9.11	RCVS A1.2
3.5	Where appropriate carry out, or have carried out, such diagnostic tests and procedures (such as haematology, clinical pathology, radiology and imaging) as are needed to make a diagnosis, ensuring that all samples are properly identified, handled and accurate records kept.	AVMA 1	AVBC 9.5, 9.11	RCVS C1.6, C1.7
3.6	Know when to investigate and be able to evaluate the environment in which the animals under investigation are kept.	AVMA 1	AVBC 8.1	
3.7	Carry out a routine post mortem examination of common domestic animals including birds, record and report observations and initiate further diagnostic procedures where appropriate. Interpret post mortem findings and reach tenable conclusions concerning the changes observed.	AVMA 1	AVBC 9.6	RCVS C1.16
3.8	From the history, clinical and/or post-mortem examination and interpretation of diagnostic procedures arrive at a tenable diagnosis or diagnostic hypothesis and a list of differential diagnoses.	AVMA 1	AVBC 9.7	
3.9	Develop strategies that are appropriate to the circumstances for dealing effectively with commonly diagnosed conditions and diseases.	AVMA 2	AVBC NL	RCVS B1.5
3.10	Conduct common therapeutic procedures on animals with uncomplicated diseases in a manner that will maximise the likelihood of a satisfactory outcome, and minimise the risk of untoward effects with respect to the animals concerned, public health and safety, food safety and quality. Record, monitor and follow up therapeutic responses and modify where appropriate.	AVMA 2	AVBC 9.9, 9.11	RCVS A1.2, B1.7, C1.10, C1.14
3.11	Understand the importance of the unique disease status of New Zealand and recognise diseases that may be exotic to New Zealand or notifiable.	AVMA 2	AVBC 9.8	RCVS B1.5, C1.8
3.12	Understand the principles and practices involved in controlling the spread of diseases.	AVMA 7	AVBC 9.10	RCVS C1.20
3.13	Recognise when analgesia and/or anaesthesia are required and be able to safely induce, maintain and monitor analgesia and anaesthesia in uncomplicated cases, and take steps to ensure safe and humane recovery.	AVMA 3	AVBC NL	RCVS C1.13

3.14	Carry out common surgical procedures in uncomplicated cases using appropriate techniques and procedures before, during and after surgery that will minimise the risk to the animal and maximise the likelihood of a successful outcome.	AVMA 4	AVBC 9.9	RCVS C1.11, C1.12
3.15	Recognise personal limitations in dealing with unfamiliar, complicated or technically difficult cases and be prepared to seek further advice, assistance or to refer such cases to others.	AVMA 2	AVBC 4.10	RCVS A1.12, C1.19
3.16	Deal effectively with the immediate emergency needs of animals ensuring the relief of pain and suffering of the animal(s) while taking into account ethical and legal considerations.	AVMA 6	AVBC NL	RCVS C1.4
3.17	Evaluate the need for euthanasia and, where required, carry it out safely and humanely using procedures appropriate for the species concerned and the circumstances. In addition, recognise the sensitivity of the situation and the need for support of grieving clients and the requirement for the consent of the owner of the animal (where known).	AVMA 8	AVBC NL	RCVS C1.15
3.18	At all times communicate effectively with clients to keep them fully informed, ensuring that they are made aware of the rationale of any actions taken, therapeutic options, likely outcomes, costs and ethical and legal implications, so that they are able to make informed decisions.	AVMA 8	AVBC 9.12	RCVS A1.1
3.19	Assess the need for and advise on the implementation of programmes to promote the health, well being, productivity and performance of animals through such means as: dietary management and feeding; vaccination; preventive and curative treatments for common diseases; housing and general management; training and behavioural management and modification.	AVMA 7	AVBC 8.3, 8.4, 9.10, 9.12	RCVS B1.8, C1.5, C1.19
3.20	Provide first level advice on the public health implications of animal diseases.		AVBC 1.6	RCVS B1.9
3.21	Understand the procedures, and the animal welfare, ethical and statutory requirements involved in the transport and hygienic production and processing of animals for food and other animal products and the responsibilities of veterinarians in relation to these.	AVMA 7	AVBC 8.5	RCVS B1.6
3.22	Recognise the statutory and regulatory requirements for the inspection and certification of animals and animal products intended for human consumption, and the responsibilities of veterinarians in relation to these.	AVMA 7	AVBC 8.5	RCVS C1.9
3.23	Understand the basic requirements for the production of safe food and other products of animal origin including the compliance verification and quality assurance procedures involved	AVMA 7	AVBC 8.5	RCVS C1.16

447 **Appendix B** Open-question interview of the head of service

448 **Interview of the head of service at X University**

449 1. How do you organise the subject Anaesthesia? What was its evolution in the  
450 curriculum?

451 The purpose here, is to know the number of hours, the global organisation and how the  
452 teacher adapt his program.

453 2. How did you choose the subjects/themes for the theoretical part?

454 Is there a logical order/sequences of the topics?

455 The purpose is to find if there is a prioritization strategy of the topics in teaching  
456 anaesthesia.

457 3. Do you use the teaching by objectives for the theoretical part?

458 4. How and why did you pick those topics covered in workshops/project groups?

459 Find out how the teacher consider the purpose of a project group, and how he organizes  
460 it.

461 5. Do you use specific tools/equipment for workshops?

462 6. Is there a particularity of X University in teaching Anaesthesia? (for example:  
463 simulation/training with models before clinical rotations)?

464 7. What is your evaluation's strategy for the theoretical class?

465 Advantages and disadvantage.

466 8. What is your organisation and your evaluation's strategy for the clinical rotation?

467 9. Is there a pedagogical role of residents/teaching staff?

468

469

470 **Appendix C** Semi-structured interview of a second member of the teaching team

471 **SWOT ANALYSIS in X University**

472 Sequences of the interview:

- 473 1. Short thesis presentation in order to remind the purposes, the results and the  
474 benefits of the study.
- 475 2. Short explanation of a SWOT analysis and the interest of using it.
- 476 3. Interview starts. Audio recording would be used in order to preserve the entire  
477 meanings of the answers.

478

479 1. GENERAL ORGANISATION OF ANAESTHESIA:

480 -What are, for you, the benefits, strengths?

481 **STRENGTHS**

482 -What are the disadvantages?

483 **WEAKNESSES**

484 -What are the opportunities that could improve the organisation of teaching  
485 Anaesthesia?

486 **OPPORTUNITIES**

487 -What are the threats, external factors, potential problems that could harm the  
488 correct functioning of teaching Anaesthesia?

489 **THREATS**

490 2. TOPICS SELECTED FOR THEORITICAL COURSES AND WORKSHOP (if

491 applicable)

492 -What are the benefits, the strengths?

493 **STRENGTHS**

494 -What are the disadvantages?

495 **WEAKNESSES**

496 -What are the opportunities?

497 **OPPORTUNITIES**

498 -What are the threats, external factors, potential problems that could compromise  
499 theoretical courses/workshop?

500 **THREATS**

501 3. METHODS USED DURING CLINICAL ROTATIONS

502 -What are the benefits?

503 **STRENGTHS**

504 -What are the disadvantages?

505 **WEAKNESSES**

506 -What are the opportunities

507 **OPPORTUNITIES**

508 -What are the threats, external factors, potential problems that could compromise  
509 theoretical courses/workshop?

510 **THREATS**

511 4. X University PARTICULARITY (specific method identified used in the university)

512 -What are the strengths?

513 **STRENGTHS**

514 -What are the disadvantages?

515 **WEAKNESSES**

516 -What are the opportunities?

517 **OPPORTUNITIES**

518 -What are the threats, external factors, potential problems that could compromise  
519 theoretical courses/workshop?

520 **THREATS**

521 5. EVALUATION'S METHODS (THEORETICAL exam + ROTATIONS' evaluation)

522 -What are the benefits, the strengths?

523 **STRENGTHS**

524 -What are the disadvantages?

525 **WEAKNESSES**

526 -What are the opportunities?

527 **OPPORTUNITIES**

528 -What are the threats, external factors, potential problems that could compromise

529 theoretical courses/workshop?

530 **THREATS**

531 **Appendix D** Students' Questionnaire to evaluate the teaching in Anaesthesia example  
 532 of the Royal Veterinary College (RVC) (2 pages).

URN SR2017-1384  
**Feedback Form for Anaesthesia teaching  
 evaluation by RVC students**

This questionnaire is designed to seek a feedback from the student to strengthen the quality of teaching-learning environment. Thank you for providing honest and constructive feedback. Your responses are kept anonymous.

Please do choose only one answer for each question.

1. Give your general appreciation about the Anaesthesia education

- Satisfied
- Partially satisfied
- Unsatisfied
- Unable to answer

2. Since you started anaesthesia scholarship, did the teachers satisfied to all your questions/doubts?

- Absolutely
- Partially
- Barely
- Unable to answer

3. Did your teacher help you to apply the theory to practice?

- Absolutely
- Partially
- Barely
- Unable to answer

4. Were the numbers of anaesthesia lectures sufficient?

- Too long
- Too short
- Just about right
- Unable to answer

5. Were the anaesthesia teaching objectives clearly defined at the beginning of the lectures?

- Absolutely
- Partially
- Barely
- Unable to answer

6. Do you think that the computer-aided-learning session, helped you to gain Day-one practical skills?

- Absolutely
- Partially
- Barely
- Unable to answer

7. Do you think that the anaesthesia training in the clinical skill center (training for OSCE), helped you to gain Day-one practical skills?

- Absolutely
- Partially
- Barely
- Unable to answer

8. Was the length for clinical rotation in anaesthesia adequate?

- Too short
- Too long
- Just about right
- Unable to answer

9. Do you consider assessment of your practical skills/competencies adequate?

- Absolutely
- Partially
- Inadequate
- Unable to answer

534

535

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10. Do you consider the written assessment of your Anaesthesia teaching in the Principle of Sciences was adequate?

- Absolutely
- Partially
- Inadequate
- Unable to answer

11. Were your clinical rotations in line with anaesthesia theory from your earlier lectures?

- Absolutely
- Partially
- No I don't think so
- Unable to answer

12. Do you think that the clinical rotations were useful?

- Yes, it was useful
- I think it was partially useful
- No, it was not useful
- Unable to answer

13. Do you consider the way you are assessed in your clinical rotation at the end adequate?

- Absolutely
- Partially
- Inadequate
- Unable to answer

**COMMENTS**

14. What are the positive aspects of the lectures and the clinical rotations?

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15. What are the negative aspects of the lectures and the clinical rotations?

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16. Comments and suggestions:

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538 **Appendix E** Structure of the confidential feedback report gave to the participating  
539 university summarizing the result of their field study.

540 **STUDY FIELD'S REPORT OF THE PEDAGOGICAL**  
541 **METHODS IN TEACHING ANAESTHESIA AT X**

542 **Table of contents**

543 ACKNOWLEDGEMENTS

544 INTRODUCTION

545 ORGANISATION OF ANAESTHESIA AT X UNIVERSITY

546 1. General organisation of Anesthesia and its evolution

547 2. Choice of the topics for theoretical courses

548 3. Pedagogical methods used during theoretical courses

549 4. University's particularity teaching methods

550 5. Evaluation of the theoretical courses

551 6. Organisation and pedagogical strategies of the clinical rotation

552 7. Evaluation's strategy for the clinical rotations

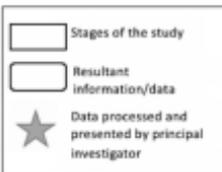
553 8. Pedagogical role of residents/teaching staff

554 9. Overview table of the pedagogical strategies in teaching Anaesthesia

555 RESULTS OF THE SWOT ANALYSIS

556 RESULTS OF THE TEACHING'S EVALUATION BY THE STUDENTS

557 APPENDIX (containing the transcription of the teaching team's interviews and the  
558 comments and suggestions of the students' survey)



Participating University

1

GENERAL INTERVIEW of the HEAD of ANAESTHESIA  
(1 hour - 1 hour 30 minute open-question interview, audio recording)

PRESENTATION of the GENERAL ORGANISATION in ANAESTHESIA  
IDENTIFICATION of the PEDAGOGICAL METHODS

2

INTERVIEW of a MEMBER of the TEACHING TEAM  
- SWOT ANALYSIS on the topics identified -

3

EVALUATION of the ANAESTHESIA TEACHING by the STUDENTS  
-QUESTIONNAIRE-

4

FEEDBACK of PEDAGOGICAL METHODS at University



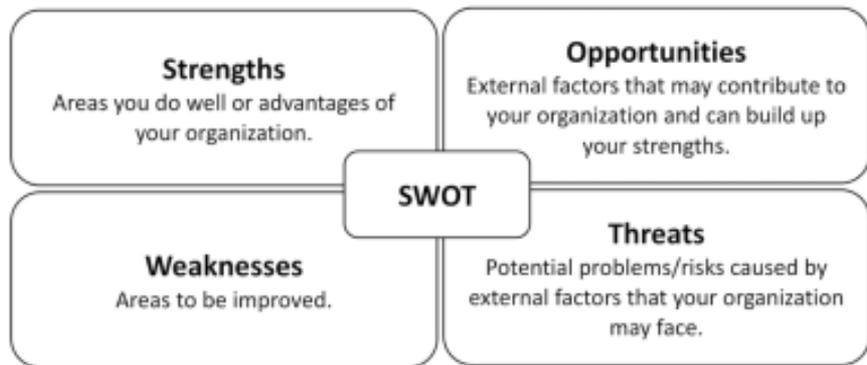
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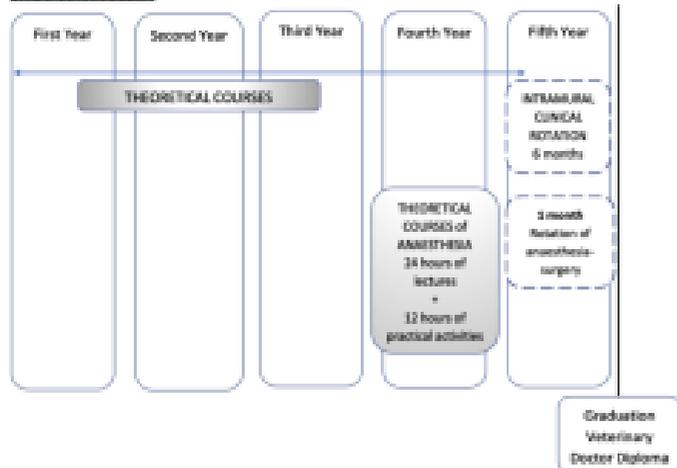
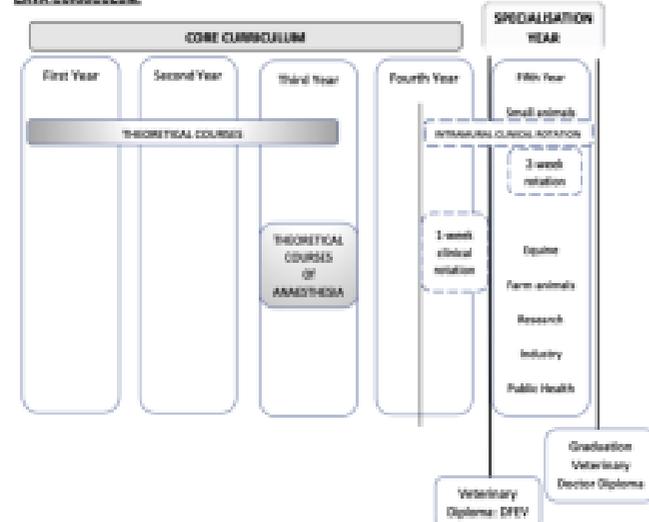
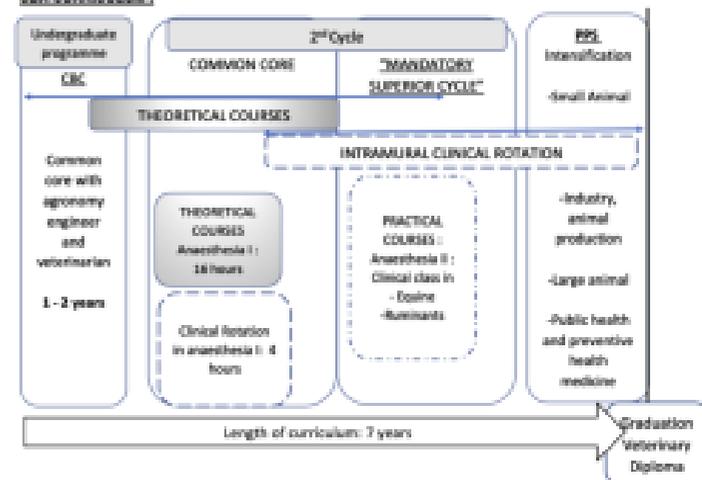
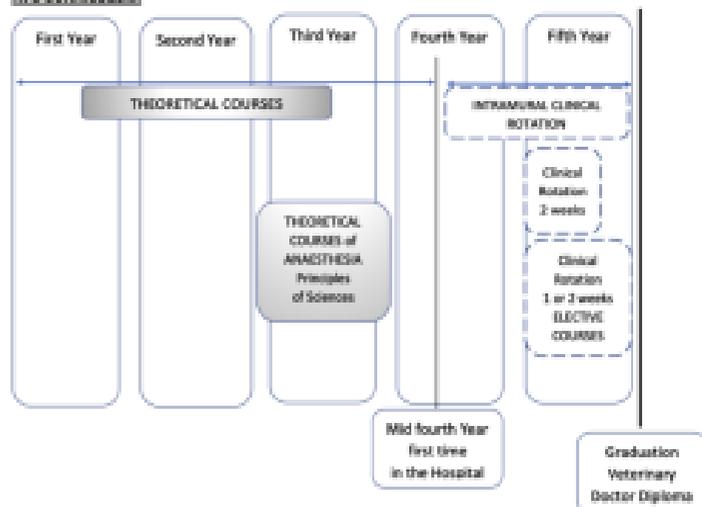
**POOLING:**  
SUMMARY TABLE of all the pedagogical elements collected from participating universities



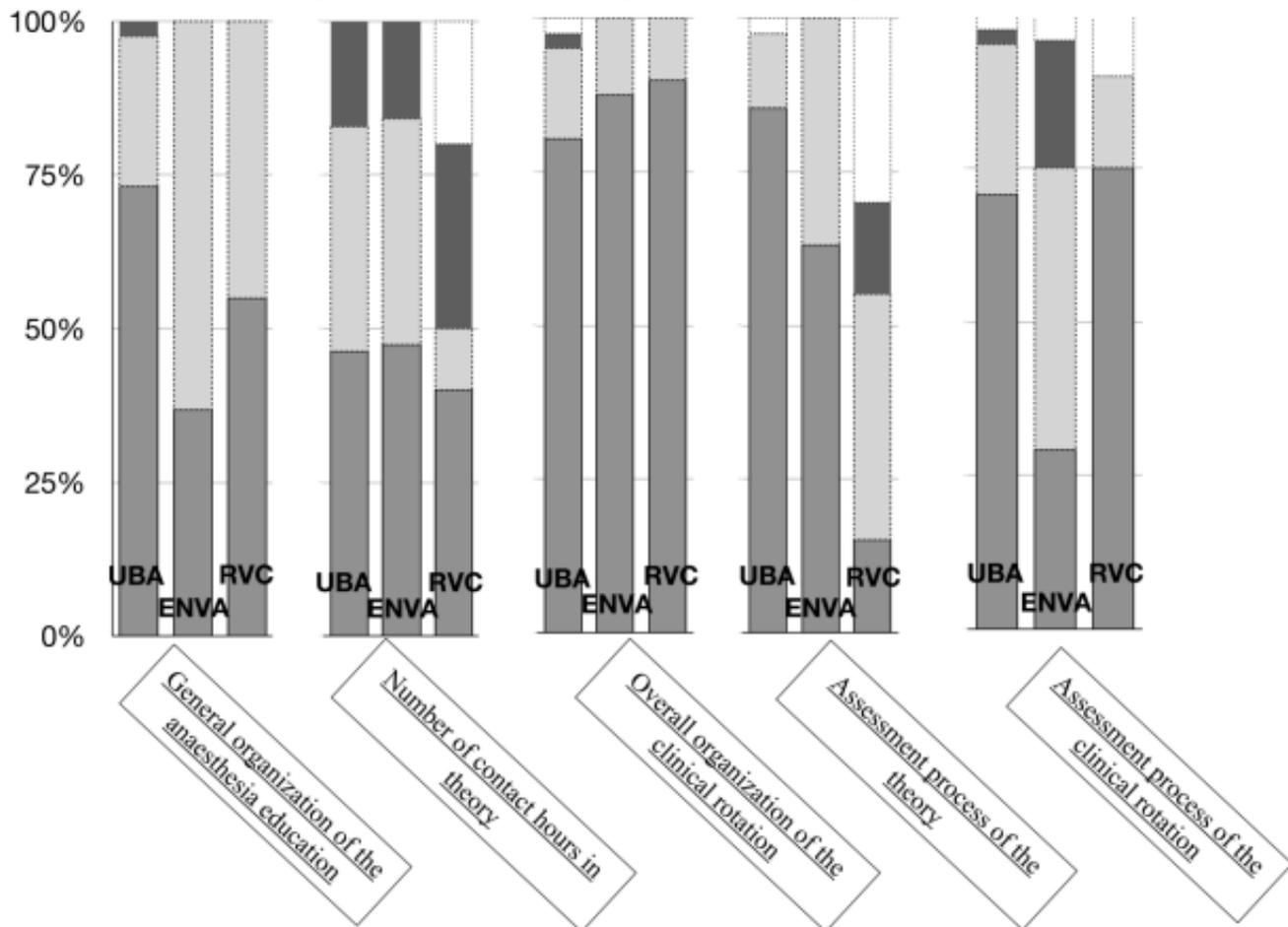
GENERAL SYNTHESIS of the PEDAGOGICAL METHODS:  
-STRENGTHS  
-WEAKNESSES





**MBBS CURRICULUM:****EMVA CURRICULUM:****MBA CURRICULUM:****BYC CURRICULUM:**

Students answer    ■ Adequate    ■ Partially adequate    ■ Inadequate    □ Unable to answer



**Table 1** Information describing curricula from the four participating universities.

	Curriculum's criteria based on	Length of curricula	Duration of theoretical teaching	Particularities in anaesthesia curriculum	Duration of clinical rotation	Intensification
ENVA	EAEVE, National criteria	5 years	14 hours and 12 hours of practical activities in 3 <sup>rd</sup> year	VetSims Simulation lab (Models/Mannequins)	40 hours in 4 <sup>th</sup> year	2 weeks in 5 <sup>th</sup> year, small animals
RVC	AVMA, EAEVE, RCVS	5 years	13 hours in 3 <sup>rd</sup> year	10 hours 30 minutes of computer-aided learning sessions LIVE Centre: simulation lab	80 hours in 4-5 <sup>th</sup> year (last 3 semesters)	1 to 2 elective weeks in 5 <sup>th</sup> year
UNIBO	EAEVE, National criteria	5 years	24 hours courses and 12 hours of practical activities in 4 <sup>th</sup> year	Practice on cadavers	80 hours in 5 <sup>th</sup> year	-
UBA	National criteria, MERCOSUR agreement	7 years	Practical activities included in the 16 hours theoretical courses in 4 <sup>th</sup> or 5 <sup>th</sup> year	Models/Mannequins for practical activities 6 hours minimum seminars (24 hours in total)	4 hours in 5 <sup>th</sup> year 10 hours in 6 <sup>th</sup> year	Minimum 1 week in 7 <sup>th</sup> year in small or large animals

Intensification is a period of time when the students have the opportunity to complete extra clinical weeks in anaesthesia

ENVA Ecole Nationale Vétérinaire d'Alfort

RVC Royal Veterinary College

UNIBO Università di Bologna

UBA Universidad de Buenos Aires

EAEVE European Association of Establishments for Veterinary Education

AVMA American Veterinary Medical Association

RCVS Royal College of Veterinary Surgeons

MERCOSUR Mercado Común del Sur

LIVE Lifelong Independent Veterinary Education

VetSims plateforme de simulation médicale vétérinaire

**Table 2** Anaesthesia course rating by students in relation to the number of contact hours. The question on the topic “General organisation of the anaesthesia education” was used to rate the course. “Partially adequate” and “inadequate” answers were gathered and considered as a “less adequate” rate.

	Adequate	Partially adequate + Inadequate = less adequate	Total numbers of students
UBA (16 hours)	30	11	41
ENVA (14 hours)	16	27	43
RVC (13 hours)	11	9	20
Totals of students	57*	47*	104

ENVA Ecole Nationale Vétérinaire d’Alfort

RVC Royal Veterinary College

UBA Universidad de Buenos Aires

\*  $p = 0.004$ , using the chi-square test.

$p < 0.05$  statistically significantly different