

Clinical teaching paradigms at the University of Minnesota College of Veterinary Medicine

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Abstract

Course coordinators were surveyed and course syllabi reviewed at the University of Minnesota College of Veterinary Medicine for types of teaching paradigms used for clinical training and extent of those varying types of teaching in large animal, small animal, and non-species-based rotations. Show-and-tell, or apprenticeship, was the most commonly used teaching paradigm. Other teaching paradigms, in decreasing order, included topic rounds, case rounds, critical scientific reading/evidence-based medicine, assignments and other assessments, games, and discussion of roles in society/ethics. Apprenticeship teaching was more common in small animal rotations and topic rounds was more common in large animal rotations; this may be a reflection of caseload. Specific teaching methods, tools, and unique learning opportunities are described.

Keyword: Clinical teaching

Introduction

Accreditation by the American Veterinary Medical Association Council on Education requires that students experience at least one year of clinical training. This generally is accepted to be the capstone experience for students, during which they integrate the basic science and clinical didactic training they have received and start to practice as a professional with clinical oversight. Kolb described learning as being driven by concrete experience, with reflection, abstract conceptualization, and an opportunity to try again being the path to deep understanding.¹ The Kolb model clearly describes learning in a clinical environment.

Historically, medical training has been accomplished through a show-and-tell, or apprenticeship, model. Apprenticeship learning includes the type practiced historically in the arts where a master worked with a group of students who strove to emulate his work, and the type common to artisans, where a product was manufactured under guidance of a master until the protégé demonstrated competence. Efficiency is one of the great advantages of the apprenticeship model since the clinician is already seeing cases and can readily take students along into the clinic. It uses client-owned animals for teaching purposes, minimizing the expense and animal welfare concerns of housing teaching animals. Finally, it is multi-faceted, permitting students to practice communications, technical skills, problem-solving, and other higher level competencies within one authentic experience. Students benefit from seeing cases with a variety of clinicians, with their varying backgrounds, knowledge, perspectives, and teaching styles.² Inconsistency is one of the disadvantages of the apprenticeship model since there is a potential for limited hands-on experience by students. This can be true if the caseload and subsequent demands on clinician time are high or if the caseload is very low, such that inadequate case material for teaching is present. Competition often exists for cases between students and other trainees (graduate students and house officers). Finally, the need to balance student learning opportunities with risk assessment may decrease student learning opportunities. Student:faculty ratios must be appropriate to permit students opportunities to interact directly with clinical instructors.

Clinical teaching is challenging. Clinicians are required to create a supportive learning environment for students of varying ability while seeing cases in a timely manner.³⁻⁵ Caseload may vary, requiring the instructor to be flexible in considering what information will be covered by seeing cases and what should be presented in more formalized rounds or seminars.⁴ In one survey, veterinary clinical instructors cited their greatest challenges as managing individual learners and groups of learners, and balancing their clinical workload and teaching responsibilities.³ Several studies have identified a common concern held by faculty that provision of clinical care often supersedes teaching.^{6,7} Increasingly complicated electronic medical record systems, and the time it takes to master them, are a further drain on clinical teaching time.

At the University of Minnesota, students enter clinics during the spring semester of their third year in the curriculum, such that they complete slightly more than one year of clinical training. All clinical rotations are two weeks in length. Required rotations vary by track (Table 1). The number of rotations available to students varies slightly annually, as not all rotations are offered every year, and as faculty members work with the collegiate curriculum committee to provide appropriate breadth and depth of clinical experiences in a wide variety of species. This study evaluated teaching paradigms used on clinical rotations at one point in time at this institution.

Materials and methods

Course coordinators of all clinical rotations were sent an electronic survey and solicited for input via repeated email messaging (Appendix 1). Those who did not respond initially also received a hard copy of the survey in their mailbox. Syllabi for all clinical rotations were evaluated for data by the primary author and those data verified by communications with the course coordinator or course instructors. Statistical analysis was not performed due to the subjective nature of the data.

Results

Response rate was 100%. Information for 43 rotations (78%) was gathered by completion of the survey of the course coordinator. Information for the other 12 rotations was taken from syllabi and verified by the course coordinator or instructors.

Teaching paradigms are as described in the survey in Appendix 1. Show-and-tell was the primary instructional paradigm overall (Figure 1). Rotations were split into large animal clinical rotations (n=27), small animal clinical rotations (n=23), and “other” rotations (n=5; Table 2). Show-and-tell was the primary instructional paradigm for large animal and small animal clinical rotations, while other teaching paradigms predominated for those rotations that were not strictly species-based. Variance in use of all teaching paradigms is demonstrated graphically in Figure 2.

Games described included card and board games, crossword puzzles and Jeopardy-type games, and the Poultry Olympics Quiz Bowl. A specific example is a board game used to help students think through thoracic anatomy, and to link radiographically visible abnormalities with that anatomy and relate it to disease conditions (http://www.cvm.umn.edu/prod/groups/cvm/@pub/@cvm/@education/documents/asset/adrthoraxposter_2015.pdf).

Assignments and assessments include open- or closed-book take-home examinations, review of instructional videos with an associated quiz, student-created examinations, practical examinations of technical skills, practical examinations by direct oversight of independent case management, case studies, and on-line quizzes or cases. Specific examples include the small animal theriogenology content covered on the Primary Care rotation. Students are required to assess vaginal cytology images and use their interpretation of those images to manage cases. On the second week of the rotation, students choose a case, are given the signalment, history, and physical examination findings, and are required to generate for later small-group discussion with an instructor a problem list, rule-outs, and diagnostic and treatment plans, with an estimate of cost (<https://sites.google.com/a/umn.edu/margaret-v-peggy-root-kustritz/home>).

Examples of “other” teaching paradigms included:

- Field trips
- Teaching laboratories or lectures
- Completion of on-line coursework created by the instructor or drawn from other institutions or from industry
- Student presentations
- Student attendance at collegiate or departmental rounds including Grand Rounds, Cytology Rounds, and Morbidity and Mortality Rounds
- Student review of unknowns
- Student and faculty attendance at outside venues, for example state- or industry-sponsored continuing education
- Language classes

Faculty also described experiences they believed to be unique and of great value to students. Students on one service act as primary clinicians with a peer as the secondary clinician and the house officer or faculty member providing oversight. On the biosecurity rotation, students complete a biosecurity audit of a production animal facility, with written report, as they would in practice. On the equine ambulatory service, students create a formulary; this helps them think through what medications they need to have on hand for ambulatory equine practice, including considering costs of medications, deciding which drugs from a given class they wish to use most often, learning inventory control, and managing controlled substances. Fourth-year students on the nutrition service assist in teaching a nutrition laboratory in the first-year preventive medicine course. Students on that service also act as peer reviewers for each other's discharge notes before final review by a faculty member. Students on the General Practice rotation are videotaped during a client encounter with client permission, and those tapes reviewed with the student by a faculty member for communications training. The Miracle of Birth rotation is a joint venture with the Minnesota Veterinary Medical Association where students provide veterinary care and educate the public about cattle, sheep, and pigs as those animals give birth in a supervised facility during the state fair. The Dairy Education Center is a public-private partnership providing students from Minnesota and other schools with extensive hands-on training in dairy herd management. Finally, the College has partnered with a large local animal humane society to provide students with surgical training and experience in small animal population medicine.

The primary barrier described by course coordinators in developing new teaching paradigms was lack of time. Faculty members also described lack of knowledge for accessing case materials for teaching through the electronic medical record and imaging archive system and lack of time and knowledge for creating a game or setting up a quiz on-line. Faculty expressed concern about lack of continuity between rotations and subsequent inability to build on prior learning when using some teaching paradigms that require demonstration of steps in competence. Caseload was described as a constraint, either because it was very high, making it difficult to see all the cases and still find time for teaching, or because it was very low. Caseload is also seasonal in some species, necessitating wise scheduling of those clinical experiences for students. Course coordinators expressed concern about using teaching animals and the necessary paperwork, expense, and concerns about animal welfare. Finally, biosecurity constraints sometimes made it difficult to schedule field trips in a timely fashion.

Discussion

The show-and-tell, or apprenticeship, model is the most commonly used teaching paradigm at this institution. This traditional method of teaching has its advantages as delineated previously and, if used judiciously, is a valuable teaching method. Effective clinical teaching in the apprenticeship model requires structured interaction between the student and clinician. Many models for case review exist. These include the Aunt Minnie model of pattern recognition, the one-minute preceptor model, and the SNAPPS model.^{5,8,9} All of these models require the clinician to ask focused questions of the student, to verify the students' strengths and weaknesses, and to model their own thought process.

Variation in types of teaching paradigm used by type of rotation was most evident when comparing the clinical rotations with the "other" rotations, which was expected. The show-and-tell model was used slightly more of the time on small animal clinical rotations than on large animal clinical rotations (49 versus 42%), most likely due to the larger caseload in the small animal hospital. Conversely, topic rounds were more commonly employed in large animal than in small animal (20 versus 11%, respectively). Evidence-based medicine and critical reading were much more common on the clinical rotations than on the "other" rotations and usually were described as a requirement by faculty for students to demonstrate use of the primary literature for case management. Some clinical rotations also held a regular journal club for faculty, house officers, and staff, with some permitting and some requiring student participation. The whole topic of ethics and roles in society was somewhat perplexing to coordinators responding to this survey. They discussed situations as they arose but all assumed that students had received more formalized training earlier in the curriculum and no attempt was made to re-create that on any service. Students on services that required or encouraged them to attend departmental Morbidity and Mortality Rounds would hear ethical discussions through that venue.

Knowledge of specific barriers preventing r faculty members from considering alternative teaching paradigms is valuable to collegiate administration. A College of Veterinary Medicine Education Support group has been formed to provide support for faculty members with an interesting idea who need help finding materials or enacting it, especially if that requires technology support. The Veterinary Medical Center (VMC) and College are continuing to work with practitioners and industry partners to provide students with exposure to individual animals and animal populations for clinical training. Attention also is being paid to how improving patient care in the VMC can become a part of the curriculum; TeamSTEPPS, an evidence-based teamwork communications system for healthcare professions, is being instituted in the hospital and will be used throughout the curriculum to help build student communication and teamwork skills.¹⁰

Some of the “other” experiences included use of teaching animals or other laboratory experiences, either to provide more training before students were exposed to client-owned animals or to replace that experience when caseload was too low or did not include specific experiences deemed to be of value. Caution must be taken not just to provide clinical skills training without placing it in a larger framework.¹¹ One author describes a professional as someone who can complete a technical task within a larger context of knowledge, leading to growing mastery and lifelong learning.¹² Use of simulations and models is well described.¹³⁻¹⁵ Models and simulations and those providing assessment should be validated.^{13,14,16} Models and simulations should not take the place of learning necessary hands-on techniques but instead should be stepping-stones on the way to student exposure to authentic experiences.^{17,18} Some non-case-based learning methods are well proven clinical teaching methodologies. For example, review of authentic videotaped client encounters has been well demonstrated to aid students in understanding their verbal and non-verbal communications and in increasing student competence in this discrete set of skills.¹⁹⁻²²

Good clinical training supports students’ internal motivation and is associated with deep learning, and with improved performance and enhanced well-being of the learner.²³ Students benefit greatly from appropriate feedback and reflection. Feedback can be brief, with short, concrete suggestions; formal, with time set aside to talk through a specific encounter or concern; or major, for example in a final evaluation at the conclusion of a rotation.²⁴ Students benefit most from timely feedback that makes clear to them what should be done differently the next time they face that situation, and ideally are provided with an opportunity for them to remediate and practice.²⁵ Faculty members often fail to give feedback because they are not observing the learners firsthand, they feel like the student is doing fairly well and do not recognize the value of reinforcing those behaviors, or they fear student reactions to negative feedback, either as an emotional response or as poor instructor evaluations.²⁵ Reflection is another valuable component of learning that often is not stressed during clinical training. This may be because time is insufficient or because the clinicians are not capable of being reflective themselves while busy on clinics.^{3,24} It is valuable to build in time for students to reflect on what they have seen and done in a clinical service and for faculty members to model such reflection. Psychological growth within an educational program requires reflection as described by Kolb.^{1,26}

A systematic review of the literature defined three things required by students to build internal motivation and provide an optimal clinical learning experience.²⁷ Students desire autonomy, or ability to make their own decisions. Clinicians can foster this by promoting student participation in case management, by providing different learning approaches, and by giving students choices in their learning. While students desire autonomy, they also greatly value accessibility of instructors as they encounter individual problems.²⁷ Students also desire competence, or capability of performing tasks that are challenging but not unreachable. Clinicians can foster this by providing structured learning opportunities that provide challenge, by valuing student work, and by providing feedback. Finally, students desire relatedness, or a sense of belonging to their professional community. Clinicians can foster this by respecting students, acknowledging their own mistakes or concerns, providing emotional support, and by being an open-minded and accepting member of the healthcare team of which they and the student are members.²³

Students generally rate their clinical instructors more highly than those instructors rate themselves.²⁸ Specific attributes students find most compelling in a clinical instructor include knowledge,

enthusiasm, and respect for student independence.²⁹ Good clinical teachers do not view teaching as an opportunity to display their own knowledge but rather as a process of identifying where students need help and creating interventions that permit them to discover information themselves.³⁰ Clinicians should be cautious when self-assessing their shortcomings as a clinical instructor and should recognize that students highly value their passion and knowledge of their subject.

Conclusion

Show-and-tell is the primary teaching methodology employed on clinical rotations at the University of Minnesota but many other teaching methods are used. Students benefit from being presented with a variety of learning experiences. Clinicians struggle to find time to enhance clinical teaching while managing caseload. Use of proven teaching methodologies and provision of support by the College should lessen faculty concerns while improving clinical experiences for the students.

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Figure 1. Teaching methodologies for all rotations (percentage of total)

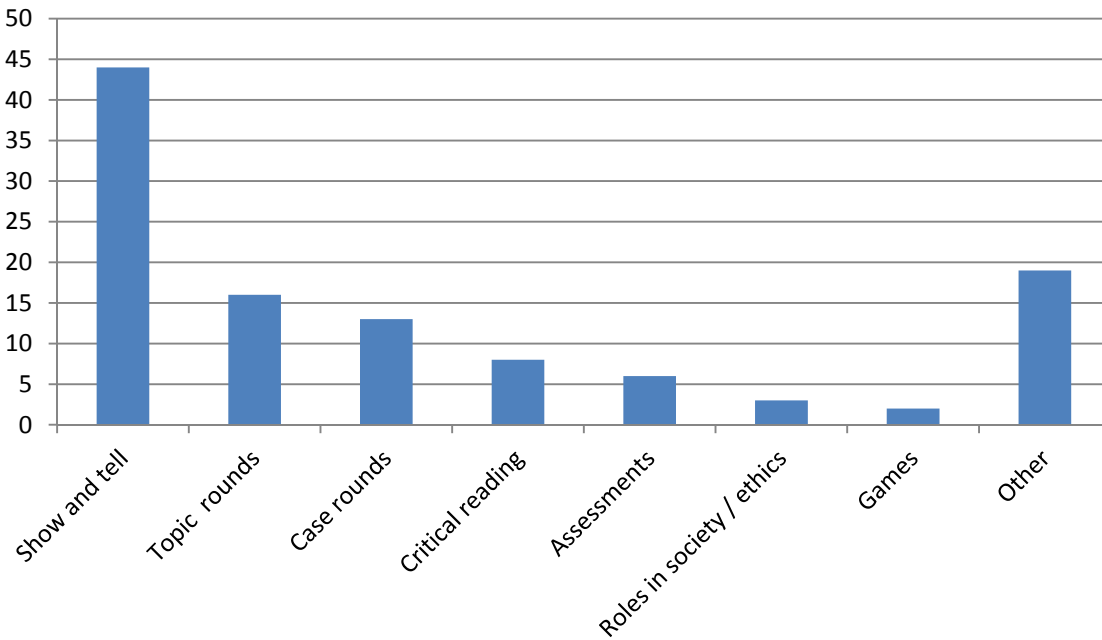
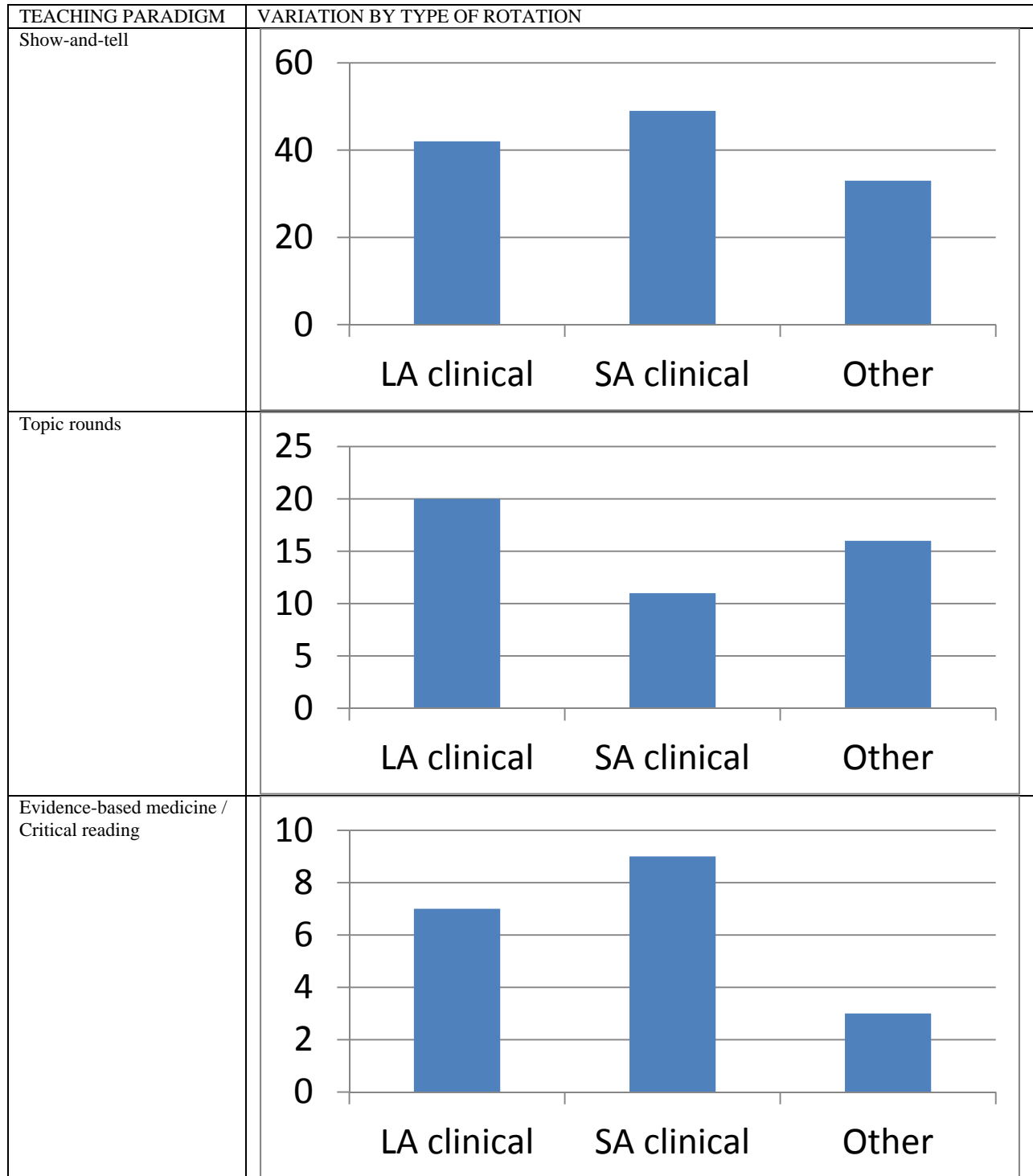
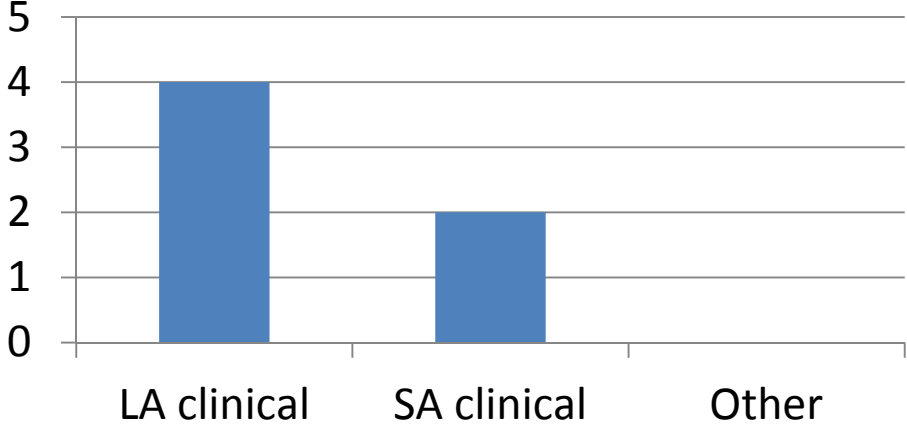
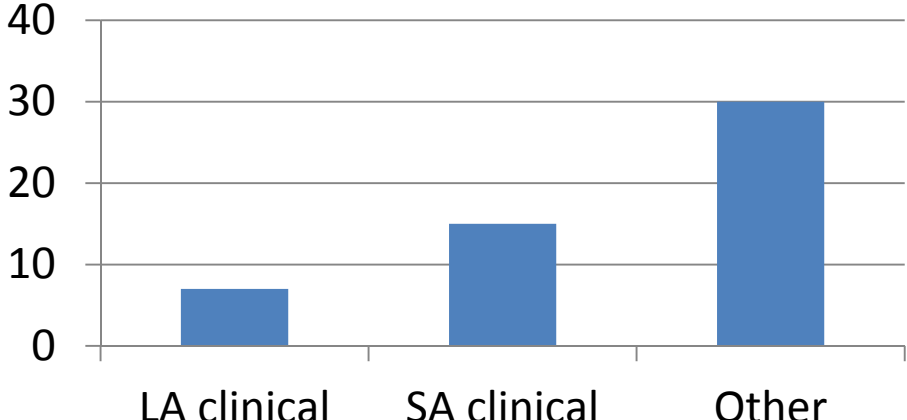
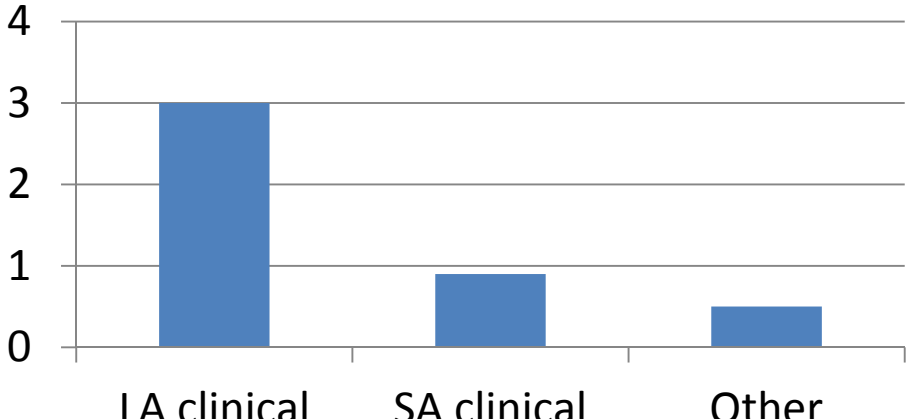


Figure 2. Teaching methodologies by type of rotation



Roles in society / ethics	 <p>A bar chart with a vertical axis from 0 to 5. The horizontal axis has three categories: LA clinical, SA clinical, and Other. The bars are blue. LA clinical has a value of 4, SA clinical has a value of 2, and Other has a value of 0.</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>LA clinical</td> <td>4</td> </tr> <tr> <td>SA clinical</td> <td>2</td> </tr> <tr> <td>Other</td> <td>0</td> </tr> </tbody> </table>	Category	Value	LA clinical	4	SA clinical	2	Other	0
Category	Value								
LA clinical	4								
SA clinical	2								
Other	0								
Case rounds	 <p>A bar chart with a vertical axis from 0 to 40. The horizontal axis has three categories: LA clinical, SA clinical, and Other. The bars are blue. LA clinical has a value of 7, SA clinical has a value of 15, and Other has a value of 30.</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>LA clinical</td> <td>7</td> </tr> <tr> <td>SA clinical</td> <td>15</td> </tr> <tr> <td>Other</td> <td>30</td> </tr> </tbody> </table>	Category	Value	LA clinical	7	SA clinical	15	Other	30
Category	Value								
LA clinical	7								
SA clinical	15								
Other	30								
Games	 <p>A bar chart with a vertical axis from 0 to 4. The horizontal axis has three categories: LA clinical, SA clinical, and Other. The bars are blue. LA clinical has a value of 3, SA clinical has a value of 1, and Other has a value of 0.5.</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>LA clinical</td> <td>3</td> </tr> <tr> <td>SA clinical</td> <td>1</td> </tr> <tr> <td>Other</td> <td>0.5</td> </tr> </tbody> </table>	Category	Value	LA clinical	3	SA clinical	1	Other	0.5
Category	Value								
LA clinical	3								
SA clinical	1								
Other	0.5								

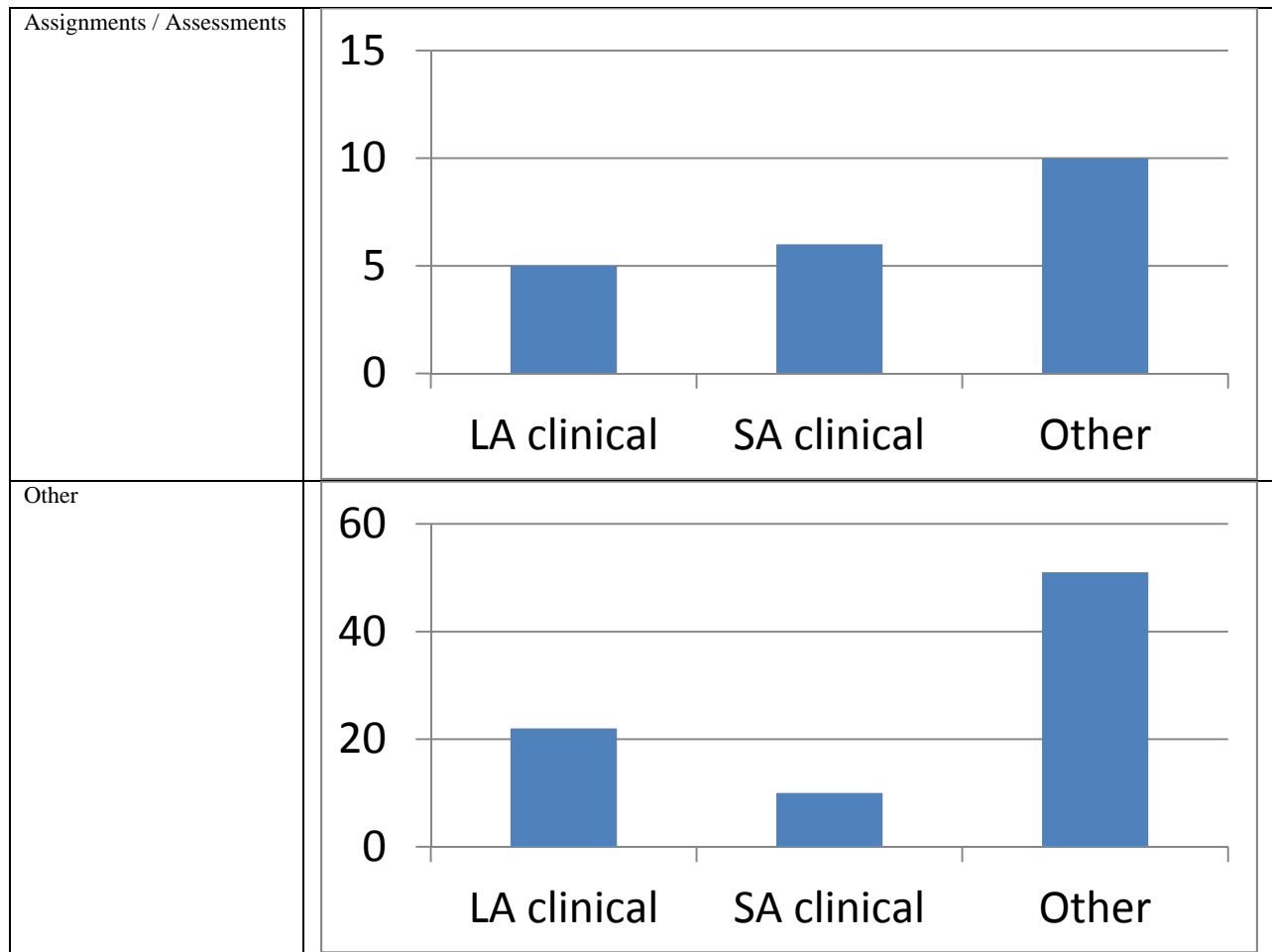


Table 1. Rotation requirements by track
ROTATION REQUIREMENTS BY TRACK

SMALL ANIMAL	FOOD ANIMAL	EQUINE	MIXED ANIMAL / INTERDISCIPLINARY	RESEARCH
Orientation to clinics	Orientation to clinics	Orientation to clinics	Orientation to clinics	Orientation to clinics
4 SAM (1 SAM-A + 3 SAM-B)	1 LAM + 3 LAM or DOFC or SwPPDxT or Camelid or Feedlot or SmRum or RAOIs with ambulatory service	3 LAM + 1 LAM or SAM or RAOI	4 medicines	4 medicines
2 surgeries total: 1 SAS + 1 ESAS or shelter or shelter RAOI	2 LAS or 1 LAS + 1 Bov Sx or RAOI	2 LAS	2 surgeries	2 surgeries
1 public health	1 public health	1 public health	1 public health	1 public health
1 necropsy	1 necropsy	1 necropsy	1 necropsy	1 necropsy
1 anesthesiology	1 anesthesiology	1 anesthesiology	1 anesthesiology	1 anesthesiology
1 clinical labs	1 clinical labs	1 clinical labs	1 clinical labs	1 clinical labs
1 radiology	1 radiology or	1 radiology or	1 radiology	1 radiology

	imaging RAOI	radiology RAOI		
2 GP + 1 Dent + 1 ECC + 1 Derm or Derm RAOI	DOFC or SwHPI + 6 FA rotations	1 ELamP + 1 EqAmb + EqThI + 3 equine rotations	1 GP + 1 ECC + 4 FA, Eq or SA rotations	
3-5 externships*/RAOIs	3-5 externships*/RAOIs	3-5 externships*/RAOIs	3-5 externships*†/RAOIs	
6-8 elective rotations	4-6 elective rotations	4-6 elective rotations	4-6 elective rotations	16 elective rotations, externships*, or RAOIs
28 total	28 total	28 total	28 total	28 total

* One externship must be a general practice-type experience in a revenue-generating for-profit facility

† An extra 2 weeks of externship may be taken in place of one elective rotation with mentor approval for externships requiring longer blocks of attendance

Bov sx = bovine surgery, Dent = small animal dentistry, Derm = comparative dermatology, DOFC = dairy on-farm campus (DEC), ECC = small animal emergency/critical care, ELamP = equine lameness and podiatry, Eq = equine, EqAmb = equine ambulatory, EqThI = introductory equine theriogenology, ESAS = elective small animal surgery, FA = food animal, GP = general practice, LAM = large animal medicine, LAS = large animal surgery, RAOI = rotation at an outside institution, SA = small animal, SAM = small animal medicine, SAS = small animal surgery, SmRum = small ruminant, SwHPI = introduction to swine health and production, SwPPDxT = swine diseases, diagnostics, therapeutics, and prevention

Table 2. Clinical rotations













Large animal clinical rotations	Small animal clinical rotations	Other
<ul style="list-style-type: none"> • Beef production cow-calf • Biosecurity for food animals • Bovine surgery • Camelid • Dairy on-farm clinic • Dairy production medicine I-IV • Dairy theriogenology palpation / podiatry • Equine ambulatory • Equine dentistry and nutrition • Equine lameness and podiatry • Equine sports medicine • Equine theriogenology advanced • Equine theriogenology intro • Feedlot • Food animal disease and diagnostics • Fresh doe and goat management • Large animal medicine • Large animal surgery • Minnesota Zoo • Miracle of Birth • Mixed animal radiology • Overview of dairy production medicine • Poultry medicine clerkship • Small ruminant • Swine diseases • Swine health and production advanced • Swine health and production intro 	<ul style="list-style-type: none"> • Acupuncture • Advanced SA theriogenology • Banfield • Behavior • Cardiology • Companion bird • Comparative anesthesiology • Dermatology • Emergency critical care • Exotic animal medicine • General practice • Neurology • Nutrition • Oncology • Ophthalmology • Raptor • SA Dentistry • SA medicine A and B • SA Radiology • SA rehabilitation • SA surgery • SA ultrasound • UMN spay/neuter 	<ul style="list-style-type: none"> • Advanced veterinary public health • Clinical laboratories • Exotic animal necropsy • Necropsy • Public health

Appendix 1. Survey instrument

Please complete a separate survey for each rotation you coordinate. For each of the listed teaching paradigms, please estimate the percentage of time over two weeks spent on the activity by the students. The "comments" section gives you a place to describe those activities in detail; this is helpful particularly if you think they work very well or if you see ways to improve use of this activity.

1. Rotation

- Acupuncture
- Advanced Veterinary Public Health
- Comparative Anesthesiology
- Exotic Animal Medicine
- Exotic Animal Necropsy
- Laboratory Medicine
- Minnesota Zoo
- Necropsy
- Ophthalmology
- Public Health
- Mixed Radiology
- SA Radiology
- Equine Dentistry and Nutrition
- Equine Lameness and Podiatry
- Equine Sports Medicine
- Equine Theriogenology Advanced
- Equine Theriogenology Intro
- Equine Ambulatory
- Biosecurity for FA
- Bovine Surgery
- Beef Production Medicine Cow Calf
- Camelid
- Dairy On Farm Clinic
- Dairy Production Medicine 1
- Dairy Production Medicine 2
- Dairy Production Medicine 3
- Dairy Production Medicine 4
- Dairy Theriogenology Palpation / Podiatry

-  Fresh Doe and Goat Management
-  FA Disease and Diagnostics
-  Feedlot
-  Miracle of Birth
-  Overview of Dairy Production Medicine
-  Poultry Medicine Clerkship
-  Swine Disease
-  Small Ruminants
-  Swine Health and Production, Introductory
-  Swine Health and Production, Advanced
-  LA Medicine
-  LA Surgery
-  Advanced SA Theriogenology
-  Banfield
-  Behavior
-  Cardiology
-  Companion Birds
-  Dermatology
-  Emergency Critical Care
-  General Practice
-  Neurology
-  Nutrition
-  Oncology
-  Raptor
-  SA Dentistry
-  SA Medicine A
-  SA Medicine B
-  SA Rehabilitation
-  SA Surgery
-  SA Ultrasound
-  UMN Spay Neuter

2. SHOW-AND-TELL / APPRENTICESHIP = student does some hands-on case management, much observation of faculty and house officers, relatively little independent decision-making

PERCENTAGE TIME SPENT OVER TWO WEEKS

COMMENTS

3. TOPIC ROUNDS = discussion between students and faculty on a given topic, chosen by the faculty for completeness or by the students for interest

PERCENTAGE TIME SPENT OVER TWO WEEKS

COMMENTS

4. EVIDENCE-BASED MEDICINE / CRITICAL READING = faculty-led discussion of current literature and value in case management

PERCENTAGE TIME SPENT OVER TWO WEEKS

COMMENTS

5. ROLES IN SOCIETY / ETHICS = discussion of ethical concerns about specific cases, larger role of veterinarians in health provision and in society

PERCENTAGE TIME SPENT OVER TWO WEEKS

COMMENTS

6. CASE ROUNDS = daily review of cases in the hospital or facility, discussion between students and faculty regarding case management

PERCENTAGE TIME SPENT OVER TWO WEEKS

COMMENTS

7. GAMES = games used for education, played independently or in groups, or with faculty facilitation

PERCENTAGE TIME SPENT OVER TWO WEEKS

COMMENTS

8. ASSIGNMENTS / ASSESSMENTS / EXAMINATIONS = independent study work that is structured and submitted for evaluation / grading. Evaluations for self-assessment or submitted for grading.

PERCENTAGE TIME SPENT OVER TWO WEEKS

COMMENTS

9. OTHER (please describe) = Required attendance at Grand Rounds, cytology rounds, M&M rounds, peer teaching, specific projects, etc.

PERCENTAGE TIME SPENT OVER TWO WEEKS

COMMENTS

10. Please describe one activity that is particularly successful on your rotation and one activity that you hope to add or improve upon in the next 1-2 years (include information about barriers to implementation if applicable).

