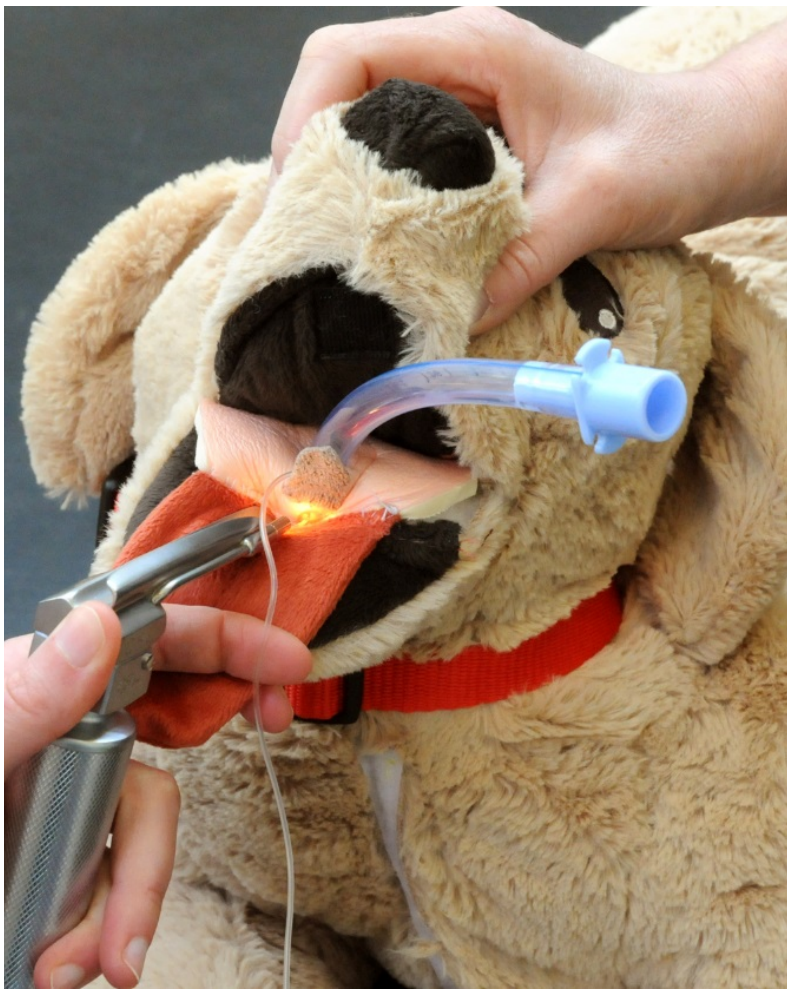
A Guide to Veterinary Clinical Skills Laboratories



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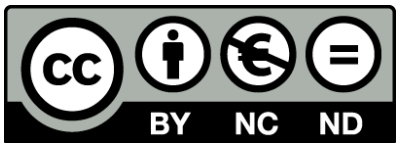

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Note:

There are a number of ways to describe a clinical skills facility e.g. clinical skills laboratory, clinical skills centre, clinical simulation laboratory, etc. and in some cases there are a number of rooms in different places or buildings rather than all being in one site. For simplicity a single term has been used throughout the booklet: Clinical skills laboratory (CSL).

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Chapter 1: Introduction

Co-authors: Sarah Baillie, Emma Read

Clinical and practical skills are an essential part of the competences required of veterinary graduates (European Association of Establishments for Veterinary Education (EAEVE) 2014, Royal College of Veterinary Surgeons (RCVS) 2014 American Veterinary Medical Association (AVMA) 2014, North American Veterinary Medical Educators Consortium (NAVMEC) 2011) and clinical skills laboratories (CSLs) are playing an increasingly important role in veterinary curricula around the world. Clinical training used to rely entirely on an apprenticeship model, as described in medical education over 100 years ago (Halsted, 1904), where the trainee shadows a clinician, initially watching and then performing the procedure under the expert's supervision. Although such teaching is still central to medical and veterinary training, recent changes in veterinary education, including increasing student numbers and an expectation that where possible, the use of animals in teaching should be reduced, mean that there is a need to find additional ways to support learning.

There are a number of challenges when trying to ensure students master clinical and practical skills. These include providing sufficient opportunities for students to practise especially as the modern clinical workplace tends to be busier and finding time to teach can be difficult. Also many veterinary schools focus on providing referral level, rather than first-opinion, services; the latter often provide more suitable learning opportunities for novices.

Learning depends not only on repetitive practice but also, and preferably, being in an environment without undue stress. However, in the clinic and operating theatre students may be anxious about making mistakes in front of the clinician or owner and worried about the potentially serious consequences for the patient. Additionally, there needs to be enough time and suitable opportunities to provide feedback to learners and for them to act upon suggestions made for improvement.

A CSL is a designated area where students can practise a range of practical and clinical skills and provides a means of addressing many of the above issues while complementing the use of animals in teaching. As a result students should be better prepared for, and able to optimise their learning in, the clinical setting, whether at veterinary school, in affiliated practices or on extramural work-placements e.g. on farms.

The CSL is a student-centred space and affords a number of specific benefits including having access to timely feedback and being able to practise repeatedly in a safe and relatively stress-free environment, where there is no risk of harming animals. The student can make mistakes and learn from them, which is an important part of the learning process. Additionally, compared to the somewhat opportunistic learning in clinics, the CSL provides more consistent, accessible training. Students can tailor their learning needs to address specific skill deficiencies or be strategic in relation to the veterinary course e.g. by revisiting the CSL in preparation for an upcoming surgical rotation.

There are a number of advantages for veterinary schools in having, and providing training in, a CSL. Practical sessions can be pre-planned, organised and comprehensive i.e. a set of skills can be taught to all students in a standardised way, learning outcomes can be mapped to graduate competences, and assessed using validated methods e.g. Objective Structured Clinical Examinations (OSCEs). For optimal benefits, the use of the CSL should be integrated into the curriculum so that the skills build upon each other. Initially the student learns basic animal handling or individual clinical skills, which are then combined to perform procedural skills. At a more advanced level, technical skills can be combined with professional skills such a communication, decision-making and team work. As repetitive practice is crucial to mastery of clinical skills, in addition to taught practical classes, it is helpful to allow students open access to the CSL or to provide drop-in sessions.

Despite the obvious benefits of a CSL, there are a number of considerations when designing a new facility, making improvements to an existing one and when having to plan annual budgets. There is considerable knowledge and evidence to draw upon, particularly from medical education and other health professions. The medical literature documents best practice and is an excellent source of tips, providing opportunities to learn from others' experiences and mistakes. However, veterinary schools are unlikely to have access to similar levels of funding, which means there is a need for resourcefulness (and as the veterinary community often proves, 'necessity is the mother of invention') and sharing. The willingness of those who already have a veterinary CSL to host visitors, the emergence of online communities e.g. NOVICE (for more information about joining the forum see Chapter 10) and an increasing number of veterinary clinical skills conferences and workshops, has already assisted in the rapid growth of CSLs and the range of skills students can learn on models. Other key factors that underpin success include a member of faculty taking the leadership for the clinical skills initiative and having dedicated management and staffing of the CSL and associated activities.

The aim of this booklet is to provide guidance on the key factors that lead to the successful design, implementation, running and sustainability of a CSL. The development of CSLs takes time, thought, funding and considerable effort; sometimes there is opportunity to develop a completely new CSL from scratch but more often it involves a staged approach and small steps towards a larger goal. The short chapters in this booklet are designed to provide easily accessible information and tips from authors who have been involved in all stages of the veterinary CSL initiative; some have been teaching in or running CSLs for many years and others can draw upon recent experiences setting up new CSLs. As well as citing some references within the text of some chapters, there is an extensive list of useful papers and reviews provided towards the end of the booklet for further reading.

Chapter 2: What to Teach in a Clinical Skills Laboratory

Co-authors: Emma Read, Máire O'Reilly, Marc Dilly, Naomi Booth

Overview: One of the most commonly asked questions when developing a clinical skills laboratory (CSL) (or programme) is: "What should we teach?" The CSL should be a space for students to learn and practise psychomotor skills (see Chapter 7) i.e. the practical skills that will be required throughout the course and at graduation. Emphasis should be placed on developing global proficiency in a range of core skills while recognising that teaching all of the skills and techniques required of an experienced veterinarian is neither appropriate nor possible. The goal should be to teach a representative sample of skills to the level expected of a new graduate, that will allow development of foundational principles, and which can be drawn on at a later date in novel situations. Although students will initially need to think carefully about how to perform each stage of a skill or procedure and should be provided with opportunities to practise until becoming proficient. The CSL should not be used as an area where time is spent just studying facts.

What is a clinical skill?

In its simplest form, a clinical skill is a psychomotor skill; a set of learned, coordinated movements, and currently in veterinary education, this is usually what is meant when the term 'clinical skill' is used. However in medical education, the term may include cognitive skills such as clinical reasoning; Michels *et al.,* (2012) found that doctors identified three aspects to clinical skills: underlying knowledge, procedural steps and clinical reasoning. Basic clinical skills training may simply introduce the practical skills, however with more advanced students, learning and assessment may place the procedure in context, and require additional cognitive or communication skills, for example including the implementation of a treatment plan.

Mapping to graduate competences

Graduate competences are defined by regulatory bodies (e.g. EAEVE, RCVS, AVMA) in documents that list the high level skills, knowledge and attitudes that are expected of newly qualified veterinarians. The documents do not provide detailed or exhaustive lists but should be used when mapping skills and to inform the development of the CSL. For example, in the UK, the Royal College of Veterinary Surgeons' Day One Competences (RCVS 2014) states that graduates must be able to 'perform aseptic surgery correctly', which will encompass the basic skills underpinning aseptic techniques and surgical procedures such as scrubbing-up, gowning, gloving, instrument handling, knot tying and suturing.

In addition, a number of surveys have produced skills lists (e.g. Hill *et al.,* 2012; Hubbell *et al.,* 2008; Luby *et al.,* 2013; Royal Veterinary College, 2007) and the reader is directed to the reference section for further information.

Range of skills to be considered

Skills taught in a CSL are likely to cover a number of broad areas such as:

1. Husbandry and handling
2. Clinical examination
3. Obtaining diagnostic samples
4. Laboratory skills
5. Diagnostic imaging and other ancillary tools
6. Post-mortem examination
7. Drug and fluid administration
8. Anaesthesia
9. Surgical skills and theatre practice
10. Nursing skills
11. Emergency procedures

Adapted from 'Bachelor of Veterinary Medicine Day One Skills' (Royal Veterinary College, University of London, 2007).

How to organise skills into manageable components

There is a continuum in clinical skills training from learning simple techniques through to performing procedures on live animals and it can be helpful to have a range of skill difficulties in the CSL for learners at different stages. Skills stations can be developed in a way that encourages a logical progression whereby students become competent at simple skills on task trainers before progressing to procedural skills on more sophisticated models or cadavers, and eventually live animals. For example, initially it is easiest to learn suture patterns on a bench-top model but placing the suture pad vertically and/or attaching it to a model leg is more realistic for an equine limb wound. Complex tasks, which may require combinations of skills and/or greater manual dexterity would overwhelm novice learners. For further information on how to teach skills effectively see Chapter 6 in this booklet.

It is also helpful to consider at what stage in the veterinary curriculum each component should be taught. This may relate to other teaching in the curriculum, or to work-based learning opportunities such as extra-mural studies (EMS). For example, animal handling will be taught early in the curriculum as these skills are fundamental, whilst basic surgical skills will be needed before the first clinical experience to make the most of these learning opportunities.

Financial resources and feasibility

Financial and other resource considerations should not be overlooked or underestimated and may limit what can be offered in a CSL. Increased numbers of students may place a further strain on available resources. Space, manpower, accessibility and a lack of interest or time from 'in house' support may all be factors. The list of skills to be taught and the desired outcome for the learners will have to be prioritised in the face of any constraints and the local context.

Top tips

- “Keep your eye on the prize” – what are the learning outcomes? Have a clear picture of what students are expected to be able to do upon graduation
- Consider what will be taught in the CSL and what will be covered elsewhere in the curriculum
- Consider how students will be supported in progressing from simple skills to procedures, or from learning on models to cadavers and live animals
- Recognise that the teaching of clinical skills (in the CSL and elsewhere) will depend on financial resources and other limitations
- The online ‘Veterinary Clinical Skills & Simulation’ group in NOVICE contains a list of stations that different veterinary CSLs use; see Chapter 10 for information about joining the network

Chapter 3: Where to Set Up a Clinical Skills Laboratory

Co-authors: Marc Dilly, Sarah Baillie, Nicki Coombes, Máire O'Reilly

Overview: When deciding where to set up a clinical skills laboratory (CSL) there are several options and venues. Often there are existing rooms and facilities that can be adapted or it may be possible, funds permitting, to design and build a completely new centre. Whichever approach, there are some important considerations when planning the CSL. Factors such as the local environment (e.g. proximity to other teaching areas and clinics), the amount of funding (for building work, modifications to existing rooms, fixtures and fittings, and then the equipment, models, etc.), the existing facilities (consider the best and most efficient ways to use the space) as well as the faculty support (securing senior management buy-in is crucial) and organisational structure (e.g. staffing, technical support) may affect the location of a CSL. The CSL can be centralised in one building or distributed in separated buildings and linked to other facilities. Room layouts can vary from a large room (e.g. an old large animal theatre) or several smaller rooms. One important point when setting up a CSL is to find a location that is suitable for the type of teaching i.e. hands-on training sessions (practicals) and is preferably flexible (can be adapted for different types of class). It is highly beneficial for students to have options for self-directed learning (as mastery of clinical and practical skills requires repetitive practice) and therefore provision of drop-in or appointment-based access to resources and the facility should be provided. Overall, the CSL layout and design should be flexible enough to support the teaching and assessment of multiple clinical skills.

Considerations for setting up a CSL

There are a number of important considerations when deciding where to set up a CSL. The goal is to provide a safe environment for learning and teaching where students can practise with confidence. Where possible, the facility should be as realistic as possible to give a sense of the clinical environment.

Size

The size of a CSL should ideally be large enough to accommodate multiple training sessions at the same time. Existing CSLs have a wide range of sizes; some start by adapting a single room while others have space in excess of 1,000 m². It is important to consider whether a large space, with or without multiple rooms, is the best option, particularly when the CSL will be operated by a limited number of staff; an adaptable single space or a more manageable size may be a better option.

Location

Ideally, the location of the CSL should be close to the main teaching buildings and clinics to allow students to drop-in and practise more easily between other commitments or when the clinics are quiet. Most existing CSLs are in one building instead of using multiple separate locations. The CSL should have flexible and suitable rooms, adaptable for different class sizes, and provide a safe and reasonably realistic setting to teach and learn clinical skills. A large open space delivers a lot of flexibility and can be used for multiple, and possibly concurrent, classes by using screens or

room dividers to create several smaller teaching areas. However, flexibility generates a greater workload for staff needing to reset the CSL for each different teaching session. If the veterinary school has multiple sites e.g. the earlier years are primarily taught within the main university and the later years are at a clinical campus or at off-site practices (distributed model), providing a smaller satellite CSL or having certain skills stations available in boxes should be considered to enable students to practise in relation to their current learning needs.

Rooms

The CSL should comprise rooms or areas suitable for a wide range of clinical skills e.g. treatment rooms, consulting rooms, operating theatre, communication skills facilities. Some rooms or areas are more appropriately used for a specific skill, such as surgical preparation, which will include scrub sinks. However, most rooms should support different teaching and learning methods wherever possible. Examples of existing CSL layouts are shown in Appendix II.

Students should be able to drop-in to practise, refine and maintain their skills. This could be provided by scheduling open access sessions in certain rooms, allowing students keycard access (i.e. using student identification (ID) cards), or dedicating an area within the CSL for open-access (e.g. by using rooms dividers).

One issue that is often overlooked when setting up a CSL is having a dedicated space for storage. While it may appear to be a poor investment and a lower priority than providing more space for teaching, there are several reasons for ensuring there is adequate storage. On the one hand, replaceable items, models and simulators are still easily accessible but are protected from being 'borrowed' or stolen. On the other hand, expensive equipment is at a risk of damage if there is free access and usage without supervision.

Features

Some features to consider when deciding where to set up a CSL:

- Reception and sign-in area to provide assistance and key information (this could be an un-manned desk by the entrance)
- Computer network infrastructure and wireless
- Flexible multimedia tools and video recording/playback facilities
- Sinks may be necessary; consider existing plumbing or whether it can be added
- Hard wearing and 'easy clean' flooring and appropriate drainage
- Storage rooms, shelves and boxes for model, equipment and replacement stocks
- Locker rooms (ideally) or an area for bags with rows of coat hooks
- Office(s) for support and teaching staff

Top tips

- If possible, make sure the CSL is in close proximity to other areas used by students (clinics, teaching spaces, student common room) to encourage frequent access
- Be flexible, ideally using a small number of rooms and/or subdivide large open areas to optimise the use of space
- Provide enough storage space/rooms
- Clearly signpost the CSL so staff and students know how to find it

Chapter 4: Equipping a Clinical Skills Laboratory

Co-authors: Emma Crowther, Marc Dilly, Nicki Coombes, Máire O'Reilly, Emma Read, Rikke Langebæk

Overview: The amount of equipment, furnishings and models needed will depend on the particular circumstances at each institution. For example, if the clinical skills laboratory (CSL) is to occupy an existing building or former laboratory, benches, chairs and storage may be readily available, whereas in a new-build, such equipment may need to be purchased. Existing equipment can often be repurposed although may then limit some aspects of the CSL's design.

Furniture

Student workspaces (tables, benches, etc.) are essential and can be either fixed or movable to allow different CSL uses at different times. Some skills stations will require utilities such as water and electricity, and it will often be appropriate for stations such as basic diagnostic skills (e.g. blood smear) to be permanently located near these resources. For other stations, many existing CSLs use wheeled tables e.g. typical consulting room tables, which can be rearranged as necessary, with rubber mats to prevent equipment slipping on the metal surfaces. Each station will need sufficient space for students to practise the skill, and additional workspace for learning resources (e.g. instruction booklets); magazine racks are useful for storing worksheets/instructions when not in use. Instrument tables and small cupboards (preferably on wheels) provide useful extra surfaces and storage for consumables and spare equipment. Moveable room dividers may prove useful to partition areas of the CSL; these can also be used to display posters and notices and for OSCE stations.

Storage

A store room close to the CSL is ideal, however it is sometimes necessary to store equipment within the CSL. It is often useful to keep the equipment for a particular station or practical session in one storage box, such that all the equipment is conveniently available e.g. 'Lin Bins' (http://www.linbins.com/) and 'Really Useful Boxes' (http://www.reallyusefulproducts.co.uk/uk/html/onlineshop/fullrange_rub.php), and having a range of sizes allows small consumables (e.g. needles, syringes) to be kept separately from larger stores of reserve stock.

If a large storage area is available, space to keep larger or less frequently used models, donated items and a workbench for creating models are particularly useful.

Models and mannequins

Mannequins range from simple home-made models to technologically advanced high fidelity simulators. Detailing which are suitable for each skill is beyond the scope of this booklet, but below are some points to consider, with examples.

- Cost: Consider on-going maintenance and replacements in addition to initial outlay; if thousands of students can use an expensive model, this may be

more cost effective than a cheap, disposable model, particularly if a large amount of staff time is needed to make the model.

- Homemade models: The creativity and flare of laboratory technicians or other members of the team should be considered before buying commercial products as some models can be made on-site.
- Stage of learner: A novice learner may learn the basics of a skill using a simple model e.g. if the task is predominantly co-ordination and dexterity, whereas a more advanced student may need a higher fidelity model to refine their skills. An example is knot tying; initially tying a knot around a bean bag is sufficient to learn the hand movements, but ligating a simulated blood vessel would test if a more advanced learner can tie a secure ligature.
- Limitations of transferability: Consider whether the model enables students to develop competence such that they are safe to gain experience on live animals. Identify the limitations of any model and make these clear to students e.g. for equine naso-gastric intubation '*When using the model, you will need to guide the tube into the oesophagus as the model will not swallow*'.
- Suitability: Identify steps that make a procedural skill difficult and design a suitable model e.g. for ligating deep in a cavity use balloons to simulate intestines and to impair visualisation.
- Multiple uses: Consider whether a mannequin can be used for teaching more than one skill.
- Storage: Large models that are not permanently in use will need sufficient storage space.

Whilst there are mannequins available for a variety of skills, it is helpful to consider what the student needs to learn. In many instances an educationally sound model can be made from easily and cheaply sourced materials (Table 1). Carefully researching commercial and home-made models is extremely worthwhile.

Table 1: Some examples of home-made models used in veterinary CSLs.

Skill	**Materials**	**Notes**
Suturing	Non-adhesive absorbent wound dressings (e.g. Allevyn), hide, silicone (e.g. Dragon Skin), suture material, needles, needle holders, scissors, forceps	Once the basic technique has been learned, materials can be attached to animal models to simulate real life scenarios, e.g. wound on equine limb, leather placed vertically at flank height for a cow laparotomy.
Feline castration	Wooden beads, wool, narrow bore tubing, cat toy, haemostats	Create a tunnel from dorsum to perineum using tubing. Thread wool through and attach bead (testicle). Practise autoligation.
Intra-muscular injection	Dog soft toy, small orange, glove, needle, syringe, water for injection	Create a pocket in lumbar area. Place orange in glove in pocket. Inject into orange (remember to remove the orange afterwards!).

Clinical equipment

Clinical equipment requirements vary depending on the type of station. Surgical equipment, such as gowns, gloves, and instruments are likely to be essential; a dedicated scrub sink and possibly a theatre lamp may be useful for surgical stations. In addition to anaesthetic machines and breathing systems, anaesthesia stations may need secure cylinder storage, piped gas lines and scavenging.

It is essential to comply with relevant health and safety regulations and, as necessary, provide lab coats, gloves and other personal protective equipment (PPE). If using clinical samples, clinical waste disposal and appropriate hand washing and cleaning facilities will be necessary, as will sharps disposal for needles or glass. Using decommissioned x-ray machines avoids radiation safety considerations.

Sourcing clinical samples and materials will be dependent on the regulations and ethical guidelines of each institution.

Sources of equipment

There are numerous sources of equipment; which are most useful depends on the budget and the priorities of the CSL.

- Veterinary wholesalers may offer a discount for bulk purchases; the institution may have an existing relationship or have negotiated a deal
- Second hand items such as anaesthetic machines can be purchased at medical supplies auctions
- University clinics, local practices and hospitals may be happy to donate out of date stock (e.g. suture material), or disposable items that are adequate for use in the CSL
- Manufacturers may provide samples, consumables or equipment or may be able to identify sponsors for specific stations; it may be appropriate to acknowledge their support in the CSL
- Some institutions have a recycling programme and a website to search or advertise for equipment. Technical and support staff often know of unwanted items on campus which may be available

Top tips

- Before purchasing anything, develop a plan as to how the space will be used and the layout of the CSL
- Thoroughly check the set-up of each station to ensure no equipment has been overlooked e.g. a closed gloving station requires gowns
- Consider buying in bulk – either for multiple practicals, or with other groups on site, such as clinics or research laboratories
- There is on-going debate regarding the value of high and low fidelity models; carefully consider each model's merits and limitations
- Consider allowing students to be able to sign out equipment (in a similar way to a library loan) e.g. for basic equipment such as suture packs

Chapter 5: Managing a Clinical Skills Laboratory

Co-authors: Nicki Coombes, Alison Catterall, Máire O'Reilly, Marc Dilly

Overview: The management of clinical skills laboratories (CSLs) covers a wide variety of jobs and supports a number of activities. In addition to teaching, CSLs may be used for examinations (e.g. OSCEs), research projects, public engagement events, Continuing Professional Development courses (CPD, also known as Continuing Education) and by student clubs. Different facilities will have different staffing; some may have administrative and technical support, others may not. It is helpful to keep the organisation as simple as possible and to have clear protocols in place for all users.

Booking procedure

It is important to determine which activities and users have priority for booking the CSL as it is often not as simple as 'first come first served'. If there are multiple people expecting to use the space, some form of 'triage' has to be implemented. The academic timetable for examinations is usually prioritised, because either the exams are set in the CSL or students will need access to the CSL to practise.

There must be strict adherence to a bookings diary, ideally supported with a booking form specifying what is required on the day (equipment, room layout, IT support etc.) and who is responsible for the activity. It is inadvisable to allow the CSL to be part of a central room bookings system, as it is preferable for users to come directly to the CSL staff so expectations can be managed; advice can be given as to what is required to run the class, how many students can be taught at one time etc. New staff may not realise how long a practical class can take to set-up and may need guidance when they do so for the first time. It is important to support new users of the CSL but how much time is available will depend on the specific role of CSL staff at each institution.

All users of the CSL (students and staff) should be informed about what is expected of them e.g. are students to tidy up after themselves, who re-stocks consumable equipment and who pays for any materials used – is there a central budget or does each department fund its own activities? This can be a difficult issue and may affect local storage of different departments' goods.

Multiple room use

If the CSL is large, it is not uncommon for two separate classes to run in the room at the same time. This does require co-operation, for example, not speaking too loudly, as large CSLs may have echoing acoustic properties. Portable or sliding screens can be used to sub-divide an area. Consider having a 'core skills' area that is always available for students' use even when other classes have been booked to use the CSL.

Selection of teaching material and skills

Other chapters cover what should be taught in a CSL and what resources are required. Acknowledging that constraints may have to be placed on what can and cannot be provided is important; it is easy to try to be all things to all people but sometimes CSL managers have to say 'No'. It is better to do a few things well, than many things badly.

Teaching principles

A variety of teaching methods can and should be accommodated, with supporting learning resources. Videos, instruction sheets, one to one sessions, and encouraging other members of staff to drop in with students all contribute to learning. Peer teaching should be encouraged in the CSL as benefits include the learner being helped by someone who has recently mastered the skill (please refer to Chapter 10 for more information on peer assisted learning).

Web presence and IT

A message board can be developed using an institution's online tools (e.g. virtual learning environment, intranet or internal web-pages) with information about timetabled practicals, drop-in sessions, special classes, new stations or to ask for volunteers for various activities. A site to collate videos, instruction sheets or links to other websites may also be useful. If students know in advance which skills will be taught in a practical, they can prepare using the online resources or if a student is unable to attend a class, the materials can be used to catch-up. Online resources require regular maintenance and updating as techniques change or the CSL introduces new resources. The availability of laptops or computer stations can enhance a CSL but as the space is primarily for learning 'practical' skills, IT resources should provide support and not become a replacement. Social media is increasingly becoming part of learning. A Twitter feed, Facebook page or other social media can encourage users to feel integrated and to be aware of what is occurring in the CSL.

Health and safety

Health and safety always has to be taken seriously. Potentially dangerous equipment, chemicals and clinical samples are used in the CSL and users may have unsupervised access. A health and safety awareness register can be used in combination with normal attendance registers for students to sign-in when accessing the CSL e.g. students sign to say they understand and will abide by the health and safety rules.

Top tips

- It is useful to have a notice board near the CSL entrance to detail what is happening, where and at what times each day to reduce enquiries
- If there are cupboards in the CSL containing stocks of equipment, decide if these are to be freely accessible to all users or are to be locked
- Let all users (students and staff) know what is expected of them and what support is available
- Write worksheets describing how to tidy up and re-set a station. The behaviour will become embedded 'good practice' and will be appreciated by all when working in a veterinary surgery
- Colour coding documents and instruction sheets for different courses or programmes can help users recognise the relevant resources
- If setting up other users' practical classes, meet with them, have detailed lists of what is required and photograph the set-up for future reference.
- The most important factor in the success of a CSL… the CSL manager!

Chapter 6: Supporting Resources

Co-authors: Emma Crowther, Marc Dilly

Overview: It is important to have suitable resources to support activities in the clinical skills laboratory (CSL). Teaching materials can be provided in various formats e.g. instruction booklets and videos, posters, information cards and slide shows. The resources should be easily accessible in the CSL and ideally also available online for private study. It is worth considering how resources will be utilised; for example instruction booklets for a scrubbing up station would be quickly damaged by students' wet hands, and laminated posters may be more appropriate.

Teaching materials

The ready availability of supporting learning resources helps to ensure all staff teach a skill in a consistent manner. There may be several appropriate ways of performing a skill and individual staff may have a preferred method. However in the CSL, the initial aim should be for students to achieve basic competency in one correct method; variations to the technique may overwhelm novices and a standardised approach is also important when students will be assessed e.g. using an Objective Structured Clinical Examinations (OSCEs) format. Students should be informed that they may observe various correct (and occasionally incorrect) methods in practice and if necessary the alternatives and variations can be introduced at a later stage.

When developing teaching materials, consider each of the steps necessary to perform the skill. Some steps may relate to OSCE checklists, but the specific instructions should be more detailed. For example, an OSCE checklist on intravascular catheterisation may include 'opens packet maintaining asepsis', but the teaching resource should explain specifically how to open the catheter packaging correctly, as it may not be obvious to a learner. An expert's technique becomes automated, so there may be a surprisingly high number of steps involved even in simple skills (Read and Baillie, 2013, Low-Beer *et al.,* 2011). Additionally, teaching materials should be reviewed with staff from the clinic or department in which the skills are routinely performed.

The level of detail a learner requires will depend on previous experience and for advanced skills it may be possible to refer to component skills taught earlier in the curriculum. For example, simple interrupted suture may be taught initially as a basic surgical skill with every step detailed and explained, but may be incorporated as a single step of a procedural skill (e.g. ovariohysterectomy) for more advanced learners.

Many students will value having materials available to access in their own time in addition to during taught practical sessions. Teaching resources ensure that students' self-directed learning is structured and help to avoid incorrect techniques being passed between students.

Instruction booklets

Hardcopy instruction booklets should contain photographs and/or a description of each step in a skill. Booklets have advantages as they are cost effective to reproduce, are

usable anywhere, don't require internet access or technology, and allow students to work at their own pace, flipping forwards and backwards as necessary. However, producing detailed booklets is time consuming and it may be difficult to clearly photograph or describe complicated movements. The format and layout of instructions should be consistent, so that information is easy to find; this will also help create a professional image of the CSL. A page from a booklet is shown as an example in Appendix I.

In addition to providing step-by-step instructions, booklets can include supplementary information, for example:

- Equipment lists so students have all the necessary equipment to perform the skill, which also encourages adequate preparation
- Guidance on how to reset the station to ensure the area is ready for the next student, which also reduces staff time spent clearing up, allows smooth running of practical classes and encourages respect for team work
- How to safely dispose of equipment to conform with regulations and prepare students for clinical experience
- Common mistakes to avoid, or useful tips to make the skill easier
- Legal aspects related to the skill e.g. prescribing regulations
- Safety notes and links to relevant risk assessments to encourage safe practice and comply with health and safety regulations
- References to additional resources e.g. QR code linking to a video resource

Videos

Videos allow students to observe an expert performing a skill and capture more detail than instruction booklets. However, production requires considerable time commitment and some technical expertise, and access to a screen and possibly internet connection for viewing. Some CSLs have networked computers or wall-mounted screens and students may be able to access videos on their personal smartphones or tablets. A number of clinical skills videos are already freely available online e.g. on YouTube (http://www.youtube.com/user/TiHoVideos). Existing online videos provide easy access for students without any institutional time or cost investment, however it is advisable to review these resources and provide an approved list for students.

If the CSL has a projector, tele-screen or interactive whiteboard, videos can be displayed to the whole class. It is also possible to project a demonstration in real-time, which allows large groups of students to see and follow the instructor more easily. Projectors or digital photo frames can also be used to display slide shows containing instructions, however, all students then need to work at the same speed.

Other resources

A dedicated area on the virtual learning environment (VLE) allows students to access resources remotely. A portfolio may be used for students to record their progress.

Signs advertising and directing students to the CSL help encourage use and opening times should be displayed near the entrance to the CSL as well as online. Signs within

the CSL will be required to direct students to different areas, to the local rules and to the ‘Health and Safety’ and ‘First Aid’ notices.

Equipment inventories are particularly useful if the CSL is spread over several rooms or locations, or if equipment is left unsupervised. A comments book or whiteboard is a convenient way to communicate between staff and students and can be used, for example, to note down when equipment has run out or been damaged and to make suggestions for new skills stations. The CSL should be reserved primarily for practical work but some reference books such as drug formularies may be useful.

A sheet with a standardised template can be useful for recording details of practicals including class size, duration, number of staff, preparation time, equipment and CSL layout (including photographs) and will help make setting up practicals that repeat annually, or even weekly, much easier. The information will prove particularly useful for large classes with multiple stations. A similar approach is advised when setting up and running OSCEs.

Instructor information can be provided to staff before practicals, particularly if they have not previously been involved. The opportunity to review teaching resources and the practical plan is often appreciated.

Registers may be required for students to sign into practical classes or during open access time; alternatively it may be possible to operate a booking system or key card access to allow students to use the CSL for self-directed learning.

Top tips

- Creating a template for written resources reduces the time needed for formatting and ensures instruction booklets remain consistent (the authors find Microsoft PowerPoint A4 portrait layout particularly useful)
- Ensure students know which resources are available by providing lists in the CSL and/or online – and keep the lists updated
- Piloting instructions with a colleague who is not familiar with the skill can be invaluable – mistakes and poorly described steps will be spotted!

Chapter 7: Effective Learning of Practical Clinical Skills

Co-authors: Naomi Booth, Nicki Coombes

Overview: A wide range of faculty members now find themselves involved in teaching practical clinical skills, also known as psychomotor skills (see Chapter 2), often outside the familiar environment of the clinic and in a clinical skills laboratory (CSL). Whilst many of the qualities of an effective teacher may be usefully applied, these should be considered as a foundation. Teaching strategies such as talked demonstrations, simulations or step-by-step guides are often adopted. Whilst these are excellent supporting resources, a more structured approach to delivery should be considered. Effective teaching can reduce anxiety and promote confidence in students preventing an overreliance (on both our and their parts) on serendipity during extramural studies (EMS) and clinical placements where students may or may not receive high quality opportunities for learning and practice (McManus *et al.,* 1998; Watkins, 2000).

Competence in clinical skills provides a foundation for progression in the clinical setting benefiting students, patients, EMS providers and faculty members in clinics, who are able to build upon key skills delivered earlier in the curriculum rather than having to start over with the basics. In the medical profession it has been hypothesised that better prepared students will perform more skills in the clinical environment (Remmen *et al.,* 1999). In an age of increasing student numbers and potentially diminishing clinical learning opportunities, earlier attainment of skills competence and better preparedness upon entering the clinic will become increasingly important.

The Learning Continuum: Defining and achieving competence

As outlined in Chapter 2, considering what level of competence students are expected to achieve is important. Dreyfus (2001) envisaged competence as a 'stage on the road to professional excellence in a hierarchal fashion' moving from novice to expert. Dreyfus and Dreyfus (1988) describe a continuum model for learning psychomotor skills where learners move from novice, advanced beginner, competent and proficient through to expert and master (Figure 1). The model adopted by medical educators was originally applied to skills such as driving a car (Carraccio *et al.,* 2008).

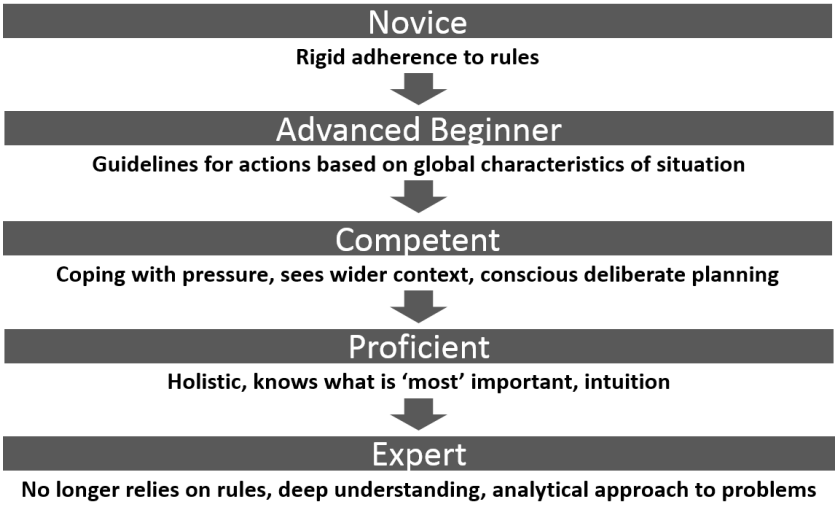


Figure 1. Model of skill acquisition: Novice to expert (Dreyfus & Dreyfus, 1988)

Our aim is for students to become consciously competent. In this state they will still have to consciously think and perform elements of the skills, although some movements may have become automated. Whilst unconscious competence may appear preferable, at this level the learner is likely to have achieved total mastery of the skill. Students learn most effectively when 'consciously incompetent' and thus are willing to enter into a learning activity. There is a danger area when undergraduates or qualified veterinarians are oblivious to their lack of competence in performing a skill and therefore it is vital that students also learn to recognise when this is the case. The timeframe for the achievement of competence will vary between individual learners (ten Cate *et al.,* 2004).

Expertise requires significant time investment with many repetitions of the same procedure. Our definition of an expert may simply be "graduate physicians or final year students contrasted with learners at various stages" (Ericsson *et al.,* 2006). Whilst expert performance can be considered the highest level of skills acquisition, most professionals reach a stable level (Reznick and MacRae, 2006). Ultimately, competence is not a single defined point of achievement but habitual lifelong learning (Leach, 2002). It is however vital to also realise that competence, whilst important, does not necessarily predict actual performance or competence in the real-world setting (Ringsted *et al.,* 2001).

Frameworks for teaching psychomotor skills

Whilst an understanding of the learner's development can help set realistic expectations, a structured framework for teaching a psychomotor skill can increase the effectiveness and quality of a teaching session, benefitting both learners and teachers. Whilst 'See one, do one' is a commonly touted teaching practice, it is not the most effective way of teaching the complex procedures required of medical and veterinary graduates (Grantcharov and Reznick, 2008).

George and Doto (2001) describe a more applied teaching framework, a simple five-step model, which is now utilised internationally for the Advanced Trauma Life Support course and set as a worldwide standard (Society of American Gastrointestinal and Endoscopic Surgeons, 2010). The framework is widely used for teaching practical clinical skills.

The most effective sequence in the authors' experience teaching in veterinary CSLs, is described below and in Figure 2. The original order of steps 3 and 4 (from George and Doto) are reversed giving the following sequence: an overview of the cognitive elements of the skill; a silent demonstration; student verbal description of the skill; a verbalised demonstration, and finally student performance of the skill with feedback or coaching. This is illustrated below in the example for learning the principles of ligation in the context of orchiectomy:

- Step 1: Contextualisation - Teacher introduces skill and its relevance. Students discuss different methods of castration in small groups or pairs
- Step 2: Visualisation - Students watch silent video or live demonstration of the ligation technique

- Step 3: Verbalisation - Students outline the steps observed to the teacher, providing an opportunity for correction and clarification
- Step 4: Verbalised demonstration - Repeat step 2 with sound or verbalised demonstration
- Step 5: Practise and Feedback - Multiple opportunities to perform both in taught sessions and during self-directed learning with good quality feedback

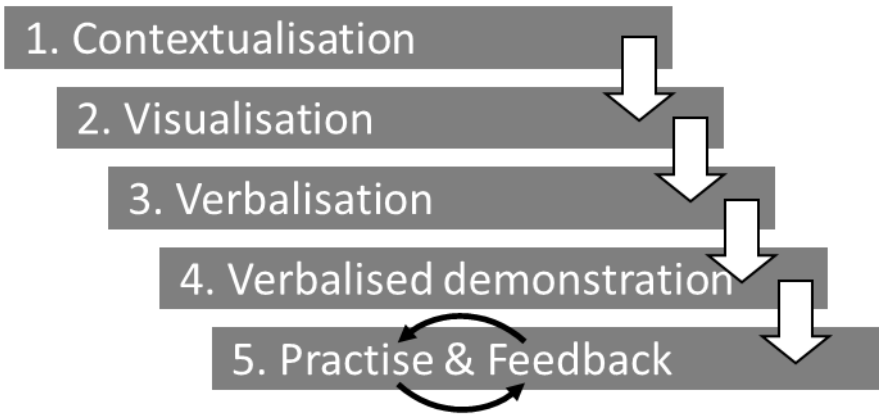


Figure 2. Modified version of George and Doto's five-step model *(in the above example steps 3 and 4 are reversed compared to the original order)*

The five-step framework can be developed for both component parts and entire procedures, positively encouraging the teacher to break down the task into manageable steps, to consider the appropriate level of desired competence and also to cater for a variety of learning styles. Step 2, visualisation (silently), can initially appear quite awkward to the teacher but with practice feels natural and the benefits become apparent. Steps 3 and 4 were originally described in the opposite order but the authors have found, in their experience, particularly for larger group sizes, asking the students to feedback the steps as a group after step 2 i.e. visualising/watching the technique, is more practical and has the greatest benefit.

The role of deliberate practice

Practice aligned with coaching and immediate feedback on skills is essential and appears to slow the decay of acquired skills (Reznick and MacRae 2006). Repeated practice of psychomotor skills decreases anxiety and increases confidence resulting in the benefits already highlighted. Additional support and instruction, subsequent to the initial class demonstration helps to reduce perceived workload and frustration of trainees improving their subjective learning experience (Das and Elzubeir, 2001; Perry 2009). The time required for mastery of a skill has been estimated as 10,000 hours of deliberate practice (Ericsson and Lehmann, 1996) when referring to the motor skills required by musicians and sportsmen. Deliberate practice, and not just hours spent, for example, in a clinical setting, is critical for the development of mastery (Ericsson and Lehmann, 1996). The individual must focus on a defined task, with the aim of improving particular aspects. Repeated practice provides the opportunity for correction of errors, polishing performance and achievement of automaticity (Issenberg *et al.,* 2005).

The importance of feedback

Good quality feedback is vital for students to monitor their progress and self-assess as they work to achieve and maintain competence (Issenberg *et al.,* 2005). It is argued "performing skills without supervision or feedback increases confidence but not competence" (Marteau *et al.,* 1990). Critical feedback is vital, and the most important element, for efficient skills transfer (O'Connor *et al.,* 2008). Feedback is best delivered by suitably trained staff and with a low teacher to learner ratio and supervised learning is more effective than unsupervised (Bradley and Postlethwaite, 2003; O'Connor *et al.,* 2008). However, in reality it is necessary to balance providing opportunities for repeated practice with the availability of feedback. Therefore, providing accessible, good quality supporting learning resources is crucial and will enable students to check correct technique during practicals and when returning to the CSL in their own time.

Qualities of the clinical skills teacher

Duvivier *et al.* (2009) constructed a list of desired qualities, competences and strategies for clinical skills teachers:

- Qualities
    - Enthusiasm and passion
    - Respect for their own and student's limitations
- Competences
    - Knowledge of:
        - Curriculum
        - Student's knowledge level and prior experience
- Strategies
    - Adaptable
    - Constructive and stimulating feedback
    - Communication of expectations and outcomes
    - Provide a safe environment

Other factors from the students' perspective which may influence their ability to learn effectively are; motivation (both intrinsic and extrinsic), the format of assessment, availability of support and feedback during and after a teaching session, fractionation of a task into appropriate sized chunks, appropriateness of the simulation, and availability of peer support. Many of these factors are within our control. For example, if teachers lack enthusiasm or respect for the student's or their own limitations, students are unlikely to be motivated to learn. It is perhaps worth reflecting upon how many of the above skills your students would consider you possess.

How to help a struggling student

Where learners are experiencing difficulties, the teacher must identify the underlying cause. Potential issues have been described by George and Doto (2001) and provide a useful reference list and include: a learner's inherent inability to perform a given task, inadequate description or recall of a demonstration, imprinting of previous incorrect performance, incorrect or misunderstood feedback, affective factors (such as fear, anxiety, intimidation, distraction, embarrassment) and low skill value (perceived lack of importance or relevance), and inaccurate learner perception of performance.

Top tips

- Teaching practical and clinical skills is a ‘skill’ in itself. Consider the teaching qualities you currently have and whether these are optimal
- Consider adopting George and Doto’s five-step model (or modified version as described above) to provide a more structured approach to the delivery of teaching sessions. Try it out and adapt as appropriate
- Both ‘learner’ and ‘teacher’ factors influence the effectiveness of any practical skills teaching experience
- Remember undergraduate learners are novices and adjust your expectations accordingly
- Provide as many opportunities for structured practice and high quality feedback as possible
- Novice learners are puzzle-solving and may not be able to vocalise at the same time. Give students time to work through a skill and remember it is better to learn one part of a skill well, than three vaguely

Chapter 8: Integrating Clinical Skills into the Curriculum

Co-authors: Robin Farrell, Emma Read, Sarah Baillie

Overview: Clinical skills are one of the core domains of competence required by veterinary graduates and need to be integrated into a curriculum together with cognitive skills and professional attributes. The approach to teaching and assessment of clinical and practical skills will be different for each university based on a number of factors including the type of curriculum and length of course, academic year structure, timing and type of work-placements, equipment, availability of a clinical skills laboratory (CSL) or other buildings, and number of students. It can be useful to design a specific clinical skills theme, course or programme that runs throughout the curriculum to help signpost these important skills to students, staff and external stakeholders. When developing or reviewing a clinical skills programme there are a number of key elements to consider.

What skills to include in the curriculum?

There are existing lists of practical and clinical skills published by the relevant accrediting bodies and from the literature, which should form the basis of any curriculum (see also Chapter 2). The lists can be expanded and reviewed as required through consultation with stakeholders including clinicians, employers, placement providers and students. Skills should be linked to the relevant stage in the curriculum and where appropriate aligned with other courses (horizontal integration) and built upon successively (vertical integration).

What to consider when deciding where in the curriculum to teach clinical skills?

In many veterinary schools the initial practical teaching aims to develop students' animal handling and husbandry skills, which underpin clinical practice and prepare students for work-placements on farms, equine establishments, in kennels, etc. Clinical skills should be timetabled to precede and then complement clinical experience, whether at veterinary school or in practices as part of extramural studies (EMS) or a distributed model.

The literature advocates teaching clinical skills early in the curriculum. This is developed from the idea of a spiral curriculum where topics, subjects and themes are revisited at increased levels of difficulty (Harden and Laidlaw, 2012). A spiral curriculum allows for repeated visits to a domain and reinforcement of learning which in turn lead to better acquisition and retention of skills (Moulton *et al.,* 2006). In reality, when, where and how practical and clinical skills are integrated into the curriculum will also depend on resources, facilities and space. If clinical skills teaching begins in the lower years, there can be more iterations and a more comprehensive list of skills can be taught and assessed. However, the more extensive the clinical skills course, the more resources are required.

As discussed in Chapter 7, the student's intrinsic motivation to practise skills is important and should not be overlooked. Engagement can be promoted by providing clinical context for skills, linking skills with basic science to highlight relevance, and

implementing a comprehensive programme of assessment (both formative and summative) to enhance learning as well as ensure competence.

Designing a comprehensive and integrated clinical skills theme or course

A veterinary curriculum's clinical skills course or 'vertical theme' ideally incorporates a number of factors and the following should be considered:

- Progression of learning:
  - Students should start by practising individual skills on task trainers or bench-top models followed by assessment e.g. an Objective Structured Clinical Examination (OSCE)
  - Progress to combining a group of related skills to perform a procedure using a model or simulator followed by assessment e.g. an OSCE
  - Progress to performing procedures on a live animal under supervision followed by assessment e.g. Direct Observation of Procedural Skills (DOPS)
- Taught classes to introduce skills and allow for provision of feedback during the learning experience
- Timely assessments (summative and formative) and the use of appropriate assessment methods e.g. OSCE, DOPS
- Development of good teaching practice:
  - Train staff on how to teach skills and provide effective feedback and a safe environment for learning, and for the role of examiner
  - Consider training peer tutors, new graduates and technicians to help in both timetabled taught classes and to support extra practice sessions
- Opportunities for self-directed learning (as deliberate practice is key to success)
- Supportive learning materials which include the context surrounding the skills (declarative knowledge) available before, during and following a taught class
- Provision of instruction booklets, videos and detailed descriptions of how to perform a skill correctly (procedural knowledge) available before, during and following a taught class
- 'Take home' consumable items for practice e.g. bandages, gloves, suture materials
- Time (classes timetabled within the curriculum), space (physical) and all supporting resources (models, videos, instruction booklets, peer tutors, trained instructors) available for students to practise and remediate
- Opportunities to link to other aspects of the curriculum e.g. the underpinning basic science, animal husbandry, communication and professional skills, clinical reasoning and critical thinking, ideally through "putting it all together" procedure-based practical sessions and simulations

Factors to consider in providing opportunities to practise

Students' ability to perform psychomotor skills varies and mastery of practical and clinical skills requires deliberate, repeated practice. Therefore, it is crucial to schedule sufficient timetabled slots and provide access to the CSL for individualized learning,

self-directed learning, remediation and extra help for those struggling with particular skills. Remember that some skills are harder than others to attain, requiring more time and practice, and some students may master one skill fairly easily and yet find another more challenging.

The costs of setting up and maintaining a CSL and its associated resources will affect the amount of teaching that can be provided and the level of integration of clinical skills into a curriculum. Resources need to be carefully planned and implemented efficiently and effectively. The formal curriculum can be complemented by provision of a model library loan system, online resources and, if feasible and appropriate, an open access policy. The budget must include purchase of resources (models and consumables e.g. gloves, catheters and suture materials) for taught classes, additional practice sessions and assessments. In some institutions, students are responsible for purchasing their own materials and in this case detailed information concerning which materials are required and where students can purchase the materials must be available.

Top tips

- Perform a review of clinical and practical skills in the existing curriculum to identify current teaching and assessment (what, when and how) and map these to graduate outcomes and published skills lists
- Develop a specific clinical skills ‘theme’ or course that is integrated vertically throughout the curriculum
- Provide sufficient scheduled slots within the timetable and ideally a drop-in or open access policy
- Strategically timetable teaching and assessment to complement other learning activities (didactic, practical and clinical) and drive learning
- Use resources wisely to promote effective and efficient learning (consider staff time, equipment costs and the need to provide opportunities for practice)
- Don’t forget assessment; provide a combination of formative and summative and use valid and reliable methods
- One of the most important factors for success is to assign a member of staff with a particular interest in clinical skills to champion and lead the clinical skills theme or course and/or oversee the CSL

Chapter 9: Assessment of Clinical Skills

Co-authors: Sarah Baillie, Emma Read, Nicki Coombes

Overview: Assessment of practical and clinical skills is crucial to measure competence, to identify areas requiring further practice and inevitably will drive learning. One widely used method is the Objective Structured Clinical Examination (OSCE) which was introduced in medical education about 40 years ago as a more standardised, objective and reliable way of assessing certain clinical skills (Harden *et al.,* 1975; Harden, 1979). The OSCE tests competence at the 'Shows' level of Miller's pyramid (Miller, 1990) and students are required to demonstrate a technique or skills in an artificial setting e.g. on a model, rather than in a clinical situation. Therefore OSCEs are often run in a clinical skills laboratory (CSL).

The OSCE has been widely adopted and adapted in veterinary curricula and in some cases renamed e.g. Objective Structured PRactical Exam (OSPRE/OSPE), Objective Structured Practical Veterinary Exam (OSPVE) or Objective Structured Assessment of Technical Skills (OSATS). Clinical skills are also assessed in the workplace when students are performing procedures on patients and there are a range of methods used in medical education e.g. Direct Observation of Procedural Skills (DOPS). Workplace-based assessment (WBA) methods are described in '*A Guide to Assessment in Veterinary Medicine'* (Baillie *et al.,* 2014), which is freely available online and therefore will not be discussed in detail here.

What is an Objective Structured Clinical Examination (OSCE)?

An OSCE consists of multiple mini-stations (typically 10 – 20) often set-up using temporary dividers or screens positioned around the CSL and the students rotate in sequence, completing a variety of tasks. Each station in the circuit lasts exactly the same amount of time e.g. 5 or 6 minutes for basic skills such as gloving. For certain OSCEs that embrace multiple aspects of a patient interaction e.g. history taking, physical examination, diagnosis and treatment plan, the station time may be longer e.g. 15 – 20 minutes. The student reads a scenario, then enters the station to undertake the task in front of an examiner and then moves on to the next station. The circuit is often controlled via timed 'public address' announcements informing students what to do next.

The OSCE is now widely adopted in veterinary education at different stages in the curriculum, formatively and summatively, and may be seen as a 'rite of passage' to work-placements and clinical rotations. In the early years, stations typically test animal handling skills e.g. placing a muzzle on a dog, turning a sheep, placing a halter on a calf. In the clinical years, basic and more advanced skills can be assessed e.g. bandaging a wound, placement of an intravenous catheter, suturing, preparing a blood smear, and communication skills e.g. history taking. The station set-up varies and can include: live animals, models, laboratory equipment, and role-players/simulated clients. A number of example OSCEs can be found on the Royal College of Veterinary Surgeons (RCVS) website (RCVS VN OSCE Stations), which are used in veterinary nursing/'vet tech' examinations but test similar skills to those taught in veterinary curricula.

What needs to be considered when using OSCEs?

Blueprinting the exam: The selection of stations should sample skills taught in the course and be mapped to the curriculum and graduate competences. The breadth of skills to be tested will encompass a range of species involved, as well as the level of difficulty. With the more holistic OSCE (15 – 20 minutes patient interactions) blueprinting needs to consider several dimensions of competence within each station including: stages in a clinical case, body systems and, in veterinary medicine, species.

Preparing the stations: A number of OSCEs testing a range of basic skills are in the public domain with information available online, which is a useful starting point when developing stations. A team usually creates or edits material, producing documentation including scenarios, itemised mark sheets/checklists, equipment lists, examiner guidelines and examiner comment sheets. Once prepared the station should be reviewed ideally by both teaching staff and clinical experts. It is also advisable to pilot each station to determine whether the instructions (scenario) are clear, if the task can be completed within the allotted time and to identify if the examiner can reset the station quickly.

Marking: There are two types of marking scheme commonly used in OSCEs either independently or in combination: detailed checklists and holistic global rating scales. The checklist has multiple items (often 15 – 25) that the examinee did or did not complete/undertake. Each item can be equally weighted i.e. 1 or 0 although some critical steps (e.g. fatal errors, a break in sterility, etc.) may carry a heavier weighting (more marks) or be a requirement to pass the station. The checklists are usually accompanied by a global rating scale for the examiner to make a more subjective judgement (selecting one of 4 - 7 categories with descriptors across the spectrum from a bad fail to an excellent pass). Traditionally, detailed checklists were considered to be more objective and reliable than global rating scales. However there is evidence that global rating scales are more reliable and able to measure increasing levels of expertise (Regehr *et al.,* 1998) and these are growing in popularity. Examiners should be encouraged to use the comments section on mark sheets to record any unexpected events and provide feedback, particularly for students needing to improve. An example of a mock OSCE marking sheet is shown in Appendix III.

Pass mark: A standard setting method is used to determine a defensible passing score and the modified Angoff and borderline methods are most commonly used for OSCEs. The modified Angoff method involves a group of experts each estimating whether a minimally competent borderline student would or would not successfully complete a checklist item correctly. The checklist items for each expert are summed and the average of the group of experts determines the pass score. Another approach is to use the examination data (both the checklist and global rating scores) to determine the passing score via a borderline regression or borderline group method. The Angoff method is labour intensive, requiring 6 to 8 experts whereas once the examination data are entered for the borderline methods the pass mark is calculated mathematically by computer.

Examiner training: Training is important and introduces the format to those who have not encountered OSCEs previously while allowing staff to become familiar with the

layout of stations and the running of the whole examination. A mock OSCE (see Appendix III) can be acted out in front of staff (and students) or recorded and made available as a video; the performance should include an example of a model student as well as some of the common issues encountered. Groups of examiners for a particular station should discuss the running of the station, checklist items and global rating scale to improve consistency and inter-rater reliability.

Assessing the assessment: Post-hoc analysis allows determination of reliability and is usually high if there is enough sampling (around 15 - 20 stations). However, examiners need to be trained and station and inter-rater (examiner) reliability should be monitored. Poorly performing stations can be identified and improved before being used again. Overall, OSCEs are considered by students to be fair and objective (Syme-Grant and Johnstone, 2004) as the same scenarios are presented to all students and the same marking criteria are applied.

Top tips

- Don’t underestimate the time and resources required to set-up and run OSCEs
- The OSCE should be blueprinted and piloted prior to use
- Care must be taken to standardise the OSCE across candidates using objective checklists and/or global rating scales and by training examiners
- OSCEs can be formative or summative
- Standard setting should be used to determine a cut score for minimally acceptable performance rather than reliance on an arbitrary pass mark
- Assessing the assessment is critical, including gathering feedback from staff and students, to avoid repeating mistakes and to allow improvement of the exam with repeated deployment
- OSCEs are typically run in CSLs where students demonstrate skills in an artificial setting often on models. There are other methods for assessing clinical and procedural skills in the workplace e.g. DOPS

Chapter 10: Short Reviews

A: Peer Assisted Learning (PAL)

B: An Online Forum: Network Of Veterinarians in Continuing Education (NOVICE)

C: Are Students Learning Useful Skills?

D: Student Emotions When Learning Surgical Skills

E: Contextualised Simulation

A: Peer Assisted Learning (PAL)

Author: Naomi Booth

Peer-Assisted Learning (PAL) has been defined as “people from similar social groupings who are not professional teachers, helping each other to learn and learning themselves by teaching” (Topping, 2005). It is a teaching concept which has gained wider recognition amongst veterinary educators resulting in the implementation of PAL programmes involving haptic technology and surgical skills across a number of veterinary schools (Baillie *et al.,* 2009; Booth *et al.,* 2013). There are pedagogic, academic and professional benefits, notably:

- Peer Tutor benefits: Development of teaching skills and attributes, improvements in content-related knowledge and skills, increased responsibility, confidence, communication and self-directed skills
- Peer Learner benefits: Development of knowledge and skills, with increased opportunities for questioning in a less threatening environment. Increased confidence and personal responsibility

A well designed PAL programme provides benefits to all involved and is hugely rewarding, however if designed and implemented poorly results in disengagement. Ross and Cameron (2007) provide in-depth guidance to PAL implementation in medical curricula and readers may also find ‘Twelve Tips for Peer-Assisted Learning’ (Wadoodi and Crosby, 2002) to be a useful reference.

B: An Online Forum: 'Veterinary Clinical Skills & Simulation' Group in NOVICE

Co-authors: Sarah Baillie, Emma Crowther

The 'Network of Veterinarians in Continuing Education' or NOVICE is a free online forum developed to enable veterinarians, students and educationalists to share ideas and good practice.

1) To join the network go to www.noviceproject.eu

2) Follow the link to register and create an account. An administrator will verify the details and you will receive an email confirmation (usually within 24 hours)

3) Login to NOVICE

4) On the home screen follow the latest news and activities. Within NOVICE, you can do the following:

- Join groups relating to your interests e.g. Veterinary Clinical Skills & Simulation (Figure 3)
- Make connections with colleagues in your field
- Follow and contribute to discussions
- Write and read blogs e.g. from conferences
- Share files and photos
- Collate information in group wikis e.g. lists of skills
- Ask questions e.g. 'Has anyone found a model for teaching…?'
- Share tips e.g. 'We've just found 'x' works really well for making 'y'…'

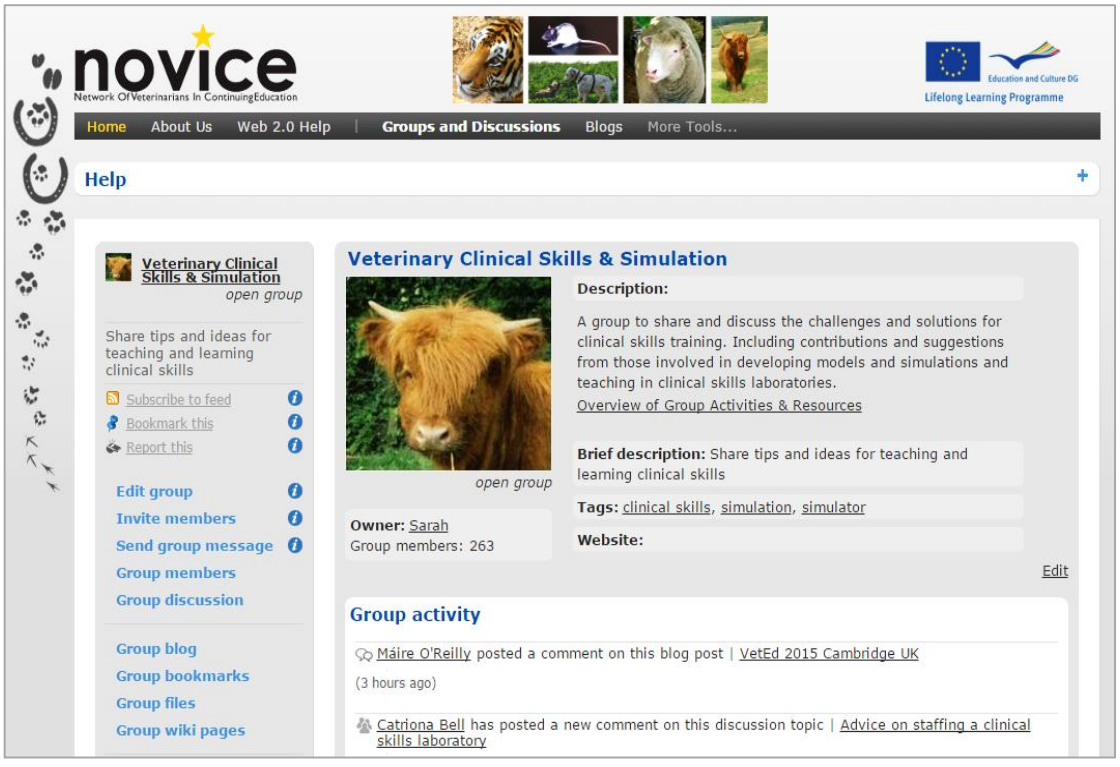


Figure 3: The 'Veterinary Clinical Skills & Simulation' group in NOVICE

C: Are Students Learning Useful Skills?

Author: Sarah Baillie

The skills students develop on a model or during simulation-based training are often presumed to transfer to the real task and result in improved performance. The assumption is not unreasonable and may have been borne out by many years of experience and teaching. However, in reality there are three possible outcomes:

i) Improved performance
ii) No effect
iii) Equipped with inappropriate skills but almost invariably increased confidence, which would have a negative outcome for trainee and patient

Therefore, studies should be undertaken to evaluate models and simulators to validate their effectiveness as teaching tools.

Validity embraces a number of criteria (Table 2) which have been defined in medical education and can be used to evaluate the design and performance of models and simulators.

Table 2: Criteria for evaluating the design and performance of models and simulators

Validity criteria	**Criteria specific to clinical skills models and simulation-based training tools**
Face	Is the model or simulator realistic (enough), believable, credible?
Content	How much of the task being modelled has been represented?
Construct	Do experts perform better on the model or simulator than novices?
Predictive	Does the measurement of skill predict future performance?
Concurrent	Do performance measurements agree with those made by other methods?
Reliability	Are consistent results produced over time and under different conditions?
Feasibility	Would using the simulator be practical? What resources are required?

In veterinary medicine studies have demonstrated that students trained on models develop useful skills (Fox *et al.,* 2013; Lumbis *et al.,* 2012) including in some instances, improved performance during the real task (Baillie *et al.,* 2005).

However, as illustrated in a systematic review of simulation-based training in human medicine (McGaghie *et al.,* 2010) providing evidence of the impact on learning can be difficult. Those running CSLs and developing models should not be deterred but should consider the validity of any model or teaching tool being used and where possible undertake studies that contribute to the body of evidence being generated to support simulation-based training.

McGaghie *et al.* (2010) developed guidelines for designing simulators in order to promote learning. These provide a useful reference when developing clinical skill models and teaching tools and when designing studies.

D: Student Emotions When Learning Surgical Skills

Author: Rikke Langebæk

During surgical training students need to learn to use skills in new combinations and under novel circumstances. Optimal learning requires both motivation and a feeling of safety (Eraut, 2004; Illeris and Andersen, 2004). However, in a surgical setting students rarely feel safe, instead experiencing high levels of anxiety and stress (Langebæk *et al.,* 2012) which are likely to have a negative impact on skill acquisition (Eysenck, 1979; Reschly *et al.,* 2008).

There are benefits if students' levels of anxiety for surgical training can be reduced. Therefore, clinical skills laboratories (CSLs) have an important role to play and it has been demonstrated that participating in a surgical skills practical with stuffed toy animal models can help reduce student anxiety (Langebæk *et al.,* 2012).

Fortunately, anxiety is not the only emotion experienced by students prior to surgery. A large proportion are also excited when about to experience their first surgical procedure, describing the emotion as 'being anxious in a nice way' or 'nervous' but 'looking forward to' surgery (Langebæk *et al.,* 2012). Additionally, in a CSL most students enjoy and look forward to training on models. There is a motivational aspect to feeling excited which in turn will benefit and contribute to learning during surgical training.

Overall, a CSL can make a major contribution and assist with students' preparation for performing surgical procedures on live animals by reducing anxiety levels but without compromising motivation. Additionally, some students will benefit from being able to return to the CSL in their own time when not under the scrutiny of a teacher or feeling pressured by other students.

E: Contextualised Simulation

Author: Sarah Baillie

Clinical skills laboratories (CSLs) provide an excellent environment in which students are taught and can practise a range of technical skills. However, focusing purely on technical skills can be an over simplification and only represents one part of the clinical competence 'jigsaw'. In human medicine there has been a move to include other skills in simulations such as communication skills, decision making, situational awareness, professionalism, team work and leadership. The aim is to incorporate multiple aspects of the clinical setting and patient encounter, placing the technical skill in context while still allowing the trainee to practise in a safe environment (Kneebone and Baillie 2008).

Examples of contextualised or 'patient focused' simulation include attaching a suture pad to the arm of a role-player/simulated patient (Kneebone *et al.,* 2006), practising gynaecological examinations using a hybrid simulator consisting of a bench-top model and role-player (Higham *et al.,* 2007) and in veterinary medicine using a bovine simulator to undertake a fertility visit in the presence of a 'farmer' (Baillie *et al.,* 2010). As well as enabling the trainee to integrate skills, the role-player can provide feedback. Trainees can practise a standard encounter e.g. combining history taking and clinical reasoning with a practical task, while maintaining professionalism. More challenging situations can be presented e.g. attempting to suture or inject an angry or drunk patient, or by sabotaging the scenario e.g. the role-player leads the trainee down the wrong path and into making a mistake. In such situations the trainee, instructor or role-player can call a 'time-out', discuss the problem, roll-back the scenario and then repeat the simulation.

In human medicine contextualised simulation has been shown to improve face validity (realism) and trainee performance (Nikendei *et al.,* 2007). The simulation does not necessarily need to be 'high tech' and opportunities to adopt a more integrated approach in veterinary medicine should be considered as CSLs provide the ideal setting.

References and Further Reading

Acton RD, Chipman JG, Gilkeson J, Schmitz CC. Synthesis Versus Imitation: Evaluation of a Medical Student Simulation Curriculum Via Objective Structured Assessment of Technical Skill. *Journal of Surgical Education,* 67(3): 173-178, 2010.

American Veterinary Medical Association (AVMA). Accreditation Policies and Procedures of the AVMA Council on Education. www.avma.org/ProfessionalDevelopment/Education/Accreditation/Colleges/Documents/coe_pp.pdf, Accessed 20.02.2015.

Baillie S. Utilization of Simulators in Veterinary Training. *Cattle Practice* 15(3): 244-248, 2007.

Baillie S, Crossan A, Brewster S, Mellor D, Reid S. Validation of a Bovine Rectal Palpation Simulator for Training Veterinary Surgeons. *Studies in Health Technology and Informatics,* 111: 33-36, 2005.

Baillie S, Pierce S, May SA. Fostering Integrated Learning and Clinical Professionalism Using Contextualized Simulation in a Small Group Role-Play. *Journal of Veterinary Medical Education*, 37(3): 248-253, 2010.

Baillie S, Warman S, Rhind S. A Guide to Assessment Methods in Veterinary Medicine. 2nd Edition, September 2014 http://dbms.ilrt.bris.ac.uk/media/user/260731/A_Guide_to_Assessment_in_Veterinary_Medicine.pdf , Accessed 31.01.2015.

Baillie S, Shore H, Gill D, May SA. Introducing Peer-Assisted Learning into a Veterinary Curriculum: A Trial with a Simulator. *Journal of Veterinary Medical Education,* 36(2): 174-179, 2009.

Berg D, Raugi G, Gladstone H, Berkley J, Weghorst S, Ganter M, Turkiyyah G. Virtual Reality Simulators for Dermatologic Surgery: Measuring Their Validity as a Teaching Tool. *Dermatologic Surgery,* 27(4): 370-374, 2001.

Booth NJ, Brennan, M., Baillie,S. Wapenaar, W. Peer-Assisted Learning; a Sustainable Programme for Teaching Canine Castration, presented at *4th Veterinary Education Symposium,* 2013, Dublin.

Bradley P, Postlethwaite K. Setting up a Clinical Skills Learning Facility. *Medical Education,* 37 Suppl 1: 6-13, 2003.

Brannick MT, Erol-Korkmaz HT, Prewett M. A Systematic Review of the Reliability of Objective Structured Clinical Examination Scores. *Medical Education,* 45(12): 1181-1189, 2011.

Carraccio CL, Benson BJ, Nixon LJ, Derstine PL. From the Educational Bench to the Clinical Bedside: Translating the Dreyfus Developmental Model to the Learning of Clinical Skills. *Academic Medicine*, 83(8): 761-767, 2008.

Das M, Elzubeir M. First Aid and Basic Life Support Skills Training Early in the Medical Curriculum: Curriculum Issues, Outcomes, and Confidence of Students. *Teaching and Learning in Medicine,* 13(4): 240-246, 2001.

Dent JA. Current Trends and Future Implications in the Developing Role of Clinical Skills Centres. *Medical Teacher,* 23(5): 483-489, 2001.

Dreyfus H. On the Internet. London: Routledge, 2001.

Dreyfus HL, Dreyfus SE. Mind over Machine. New York, NY: Free Press, 1988.

Duvivier RJ, van Dalen J, van der Vleuten CP, Scherpbier AJ. Teacher Perceptions of Desired Qualities, Competencies and Strategies for Clinical Skills Teachers. *Medical Teacher*, 31(7): 634-641, 2009.

Eraut M. Kinds of Professional Knowledge: Modes of Knowledge Use and Knowledge Creation. *Developing Professional Knowledge and Competence*. New York: Routledge Falmer, 40-58, 2004.

Ericsson KA, Charness N, Feltovich P, Hoffman R. *The Cambridge Handbook of Expertise and Performance.* Cambridge: Cambridge University Press, 2006.

Ericsson KA, Lehmann AC. Expert and Exceptional Performance: Evidence of Maximal Adaptation to Task Constraints. *Annual Review of Psychology,* 47: 273-305, 1996.

European Association of Establishments for Veterinary Education (EAEVE). List of Recommended Essential Competences at Graduation "Day-One Skills" http://www.eaeve.org/fileadmin/downloads/sop/SOP_Annex4to8_Hanover09.pdf, Accessed 20.02.2015.

Eysenck M. Anxiety, Learning, and Memory: A Reconceptualization. *Journal of Research in Personality,* 13(4): 363-385, 1979.

Fox V, Sinclair C, Bolt S, Lowe J, Weller R. Design and Validation of a Simulator for Equine Joint Injections. *Journal of Veterinary Medical Education,* 40(2): 152-157, 2013.

George JH, Doto FX. A Simple Five-Step Method for Teaching Clinical Skills. *Family Medicine*, 33(8): 577-578, 2001.

Gerke E, Barrett D, Arnold C, Hale-Mitchell L, Baillie S. Synthetic Models for Teaching Farm Animal Technical and Clinical Skills to Veterinary Undergraduates. *Cattle Practice*, 2015 (in press).

Grantcharov TP, Reznick RK. Teaching Procedural Skills. *British Medical Journal*, 336(7653): 1129-1131, 2008.

Halsted WS. The Training of the Surgeon. *Bulletin of the Johns Hopkins Hospital,* 15(162):267-275, 1904.

Harden RM. How to Assess Clinical Competence - an Overview. *Medical Teacher*, 1(6): 289-296, 1979.

Harden R, Laidlaw J. Essential Skills for a Medical Teacher, an Introduction to Teaching and Learning in Medicine. Edinburgh: Elsevier, 2012.

Harden R, Stevenson M, Downie W, Wilson G. Assessment of Clinical Competence Using Objective Structured Examination. *British Medical Journal*, 1: 447-451, 1975.

Higham J, Nestel D, Lupton M, Kneebone RL. Teaching and Learning Gynaecology Examination with Hybrid Simulation. *The Clinical Teacher,* 4: 238-243, 2007.

Hill LN, Smeak DD, Lord LK. Frequency of Use and Proficiency in Performance of Surgical Skills Expected of Entry-Level Veterinarians by General Practitioners. *Journal of the American Veterinary Medical Association*, 240(11): 1345-1354, 2012.

Hubbell JA, Saville WJ, Moore RM. Frequency of Activities and Procedures Performed in Private Equine Practice and Proficiency Expected of New Veterinary School Graduates. *Journal of the American Veterinary Medical Association*, 232(1): 42-46, 2008.

Illeris K, Andersen V. Transfer of Learning in the Learning Society. *Learning in Working Life*. Frederiksberg: Roskilde University Press, 165-179, 2004.

Issenberg SB, McGaghie WC, Petrusa ER, Lee Gordon D, Scalese RJ. Features and Uses of High-Fidelity Medical Simulations That Lead to Effective Learning: A BEME Systematic Review. *Medical Teacher,* 27(1): 10-28, 2005.

Khan KZ, Gaunt K, Ramachandran S, Pushkar P. The Objective Structured Clinical Examination (OSCE): AMEE Guide No. 81. Part Ii: Organisation & Administration. *Medical Teacher*, 35(9): e1447-1463, 2013.

Kneebone RL, Baillie S. Contextualized Simulation and Procedural Skills: A View from Medical Education. *Journal of Veterinary Medical Education*, 35: 595-598, 2008.

Kneebone RL, Nestel D, Wetzel C, Black S, Jacklin R, Aggarwal R, Yadollahi F, Wolfe J, Vincent C, Darzi A. The Human Face of Simulation: Patient-Focused Simulation Training. *Academic Medicine,* 81: 919-924, 2006.

Langebæk R, Eika B, Jensen A, Tanggaard L, Berendt M. Anxiety in Veterinary Surgical Students: A Quantitative Study. *Journal of Veterinary Medical Education,* 39(4): 331-340, 2012.

Langebæk R, Eika B, Tanggaard L, Lundorff Jensen A, Berendt M. Emotions in Veterinary Surgical Students: A Qualitative Study. *Journal of Veterinary Medical Education*, 39(4): 312-321, 2012.

Leach DC. Competence Is a Habit. *Journal of the American Medical Association*, 287(2): 243-244, 2002.

Low-Beer N, Kinnison T, Baillie S, Bello F, Kneebone R, Higham J. Hidden Practice Revealed: using cognitive task analysis and novel simulator design to evaluate the teaching of digital rectal examination. *American Journal of Surgery,* 201: 46-53, 2011.

Luby CD, McIntyre K, Jelinski MD. Skills Required of Dairy Veterinarians in Western Canada: A Survey of Practicing Veterinarians. *Canadian Veterinary Journal*, 54(3): 267-270, 2013.

Lumbis R, Gregory S, Baillie S. Evaluation of a Dental Model for Training Veterinary Students. *Journal of Veterinary Medical Education*, 39(2): 128-135, 2012.

Marteau TM, Wynne G, Kaye W, Evans TR. Resuscitation: Experience Without Feedback Increases Confidence but Not Skill. *British Medical Journal*, 300(6728): 849-850, 1990.

McGaghie WC, Issenberg SB, Petrusa ER, Scalese RJ. A Critical Review of Simulation-Based Medical Education Research: 2003-2009. *Medical Education,* 44(1): 50-63, 2010.

McManus IC, Richards P, Winder BC. Clinical Experience of UK Medical Students. *Lancet,* 351(9105): 802-803, 1998.

Michels ME, Evans DE, Blok GA. What Is a Clinical Skill? Searching for Order in Chaos Through a Modified Delphi Process. *Medical Teacher*, 34(8): e573-581, 2012.

Miller GE. The Assessment of Clinical Skills/Competence/Performance. *Academic Medicine*, 65(9): S63-S67, 1990.

Moulton C-A, Dubrowski A, MacRae H, Graham B, Grober E, Reznick R. Teaching Surgical Skills: What Kind of Practice Makes Perfect. *Annals of Surgery*, 244(3): 400-409, 2006.

Nikendei C, Kraus B, Schrauth M, Weyrich P, Zipfel S, Herzog W, Jünger Y. Integration of Role-Play into Technical Skills Training: A Randomized Controlled Trial. *Medical Teacher,* 29: 956-960, 2007.

Norman G. Research in Medical Education: Three Decades of Progress. *British Medical Journal*, 324(7353): 1560-1562, 2002.

North American Veterinary Medical Educators Consortium (NAVMEC). Roadmap for Veterinary Medical Education in the 21st Century - Responsive, Collaborative, Flexible. www.aavmc.org/NAVMEC/NAVMEC-Final-Report-Roadmap-for-the-Future-of-Veterinary-Medical-Education.aspx , 2011. Accessed 20.02.2015.

O'Connor A, Schwaitzberg SD, Cao CG. How Much Feedback Is Necessary for Learning to Suture? *Surgical Endoscopy,* 22(7): 1614-1619, 2008.

Patricio MF, Juliao M, Fareleira F, Carneiro AV. Is the OSCE a Feasible Tool to Assess Competencies in Undergraduate Medical Education? *Medical Teacher,* 35(6): 503-514, 2013.

Perry RE. Laying the Foundation of Surgical Skills for Trainees (Residents). *ANZ Journal of Surgery*, 79(3): 122-126, 2009.

Ramani S, Leinster S. AMEE Guide No. 34: Teaching in the Clinical Environment. *Medical Teacher*, 30(4): 347-364, 2008.

Read EK, Baillie S. Using Cognitive Task Analysis to Create a Teaching Protocol for Bovine Dystocia. *Journal of Veterinary Medical Education,* 40(4): 397-401, 2013.

Read EK, Hecker KG. The Development and Delivery of a Systematic Veterinary Skills Education Program at the University of Calgary. *Journal of Veterinary Science and Technology,* S:4: 1-4, 2013.

Regehr G, MacRae H, Reznick R, Szalay D. Comparing the Psychometric Properties of Checklists and Global Rating Scales for Assessing Performance on an OSCE-Format Examination. *Academic Medicine*, 73(9): 993—997, 1998.

Remmen R, Derese A, Scherpbier A, Denekens J, Hermann I, van der Vleuten C, Van Royen P, Bossaert L. Can Medical Schools Rely on Clerkships to Train Students in Basic Clinical Skills? *Medical Education*, 33(8): 600-605, 1999.

Remmen R, Scherpbier A, Derese A, Denekens J, Hermann I, Van der Vleuten C, Van Royen P, & Bossaert L. Unsatisfactory Basic Skills Performance by Students in Traditional Medical Curricula. *Medical Teacher,* 20: 579-582, 1998.

Reschly A, Huebner E, Appleton J, Antaramian S. Engagement as Flourishing: The Contribution of Positive Emotions and Coping to Adolescents' Engagement at School and with Learning. *Psychology in the Schools,* 45(5): 419-431, 2008.

Reznick RK, MacRae H. Teaching Surgical Skills - Changes in the Wind. *New England Journal of Medicine,* 355(25): 2664-2669, 2006.

Ringsted C, Schroeder, T. V, Henriksen, J, Ramsing, B, Lyngdorf, P, Jonsson, V, Scherpbier, A. Medical Students' Experience in Practical Skills Is Far from Stakeholders' Expectations. *Medical Teacher,* 23(4): 412-416, 2001.

Ross MT, Cameron HS. Peer Assisted Learning: A Planning and Implementation Framework: AMEE Guide No. 30. *Medical Teacher,* 29(6): 527-545, 2007.

Royal College of Veterinary Surgeons (RCVS). Day One and Year One Competences. https://www.rcvs.org.uk/document-library/day-one-competences-updated-march-2014/, 2014. Accessed 20.02.2015.

Royal Veterinary College. Bachelor of Veterinary Medicine Day One Skills. http://www.live.ac.uk/Media/LIVE/PDFs/day_one_handbook.pdf, 2007. Accessed 20.03.2014.

Syme-Grant J, Johnstone P. Even Re-sit Students Find the OSCE Fair! *Medical Education*, 38(2): 224-225, 2004.

ten Cate O, Snell L, Mann K, Vermunt J. Orienting Teaching Toward the Learning Process. *Academic Medicine*, 79(3): 219-228, 2004.

Topping K. Trends in Peer Learning. *Educational Psychology,* 25(6): 631-645, 2005.

Wadoodi A, Crosby JR. Twelve Tips for Peer-Assisted Learning: A Classic Concept Revisited. *Medical Teacher*, 24(3): 241-244, 2002.

Watkins MJ. Competency for Nursing Practice. *Journal of Clinical Nursing*, 9(3): 338-346, 2000.

Appendix I: A Page from a Clinical Skill Station Instruction Booklet

Example booklet: Please note techniques vary at different veterinary schools, this is just ***to demonstrate the template***

University of BRISTOL

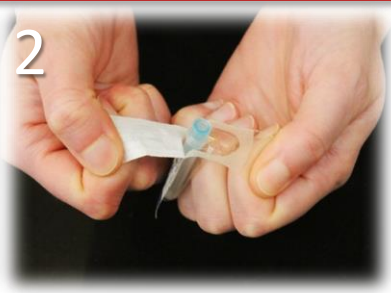
Clinical Skills: ★ Safe use of needles

The name of the station is repeated here.

1

Select the appropriate size of needle and syringe for the species and size of animal you are injecting, and the volume and viscosity of drug. Some drugs e.g. meloxicam, are thin so draw up and inject easily - use a narrow (higher G number) needle; others such as potentiated amoxicillin are very thick and you will need a wider (low G) needle. See last page for more information.

2



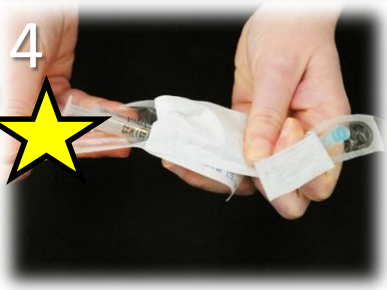
Peel the packaging off the needle, from the hub end – flaps are provided to make this easy.

3

Take care <u>not</u> to touch the hub of the needle or put it on a surface, so that you preserve sterility.

To open needles in plastic packaging, press and turn the top (green, see arrows), and remove the top. Don't touch the hub of the needle, and connect the syringe without removing the needle from the cap.

4



Peel off the packaging from the syringe, using the flaps provided. You can touch the barrel and plunger of the syringe.

5

You should take care <u>not</u> to touch the tip of the syringe to maintain sterility.

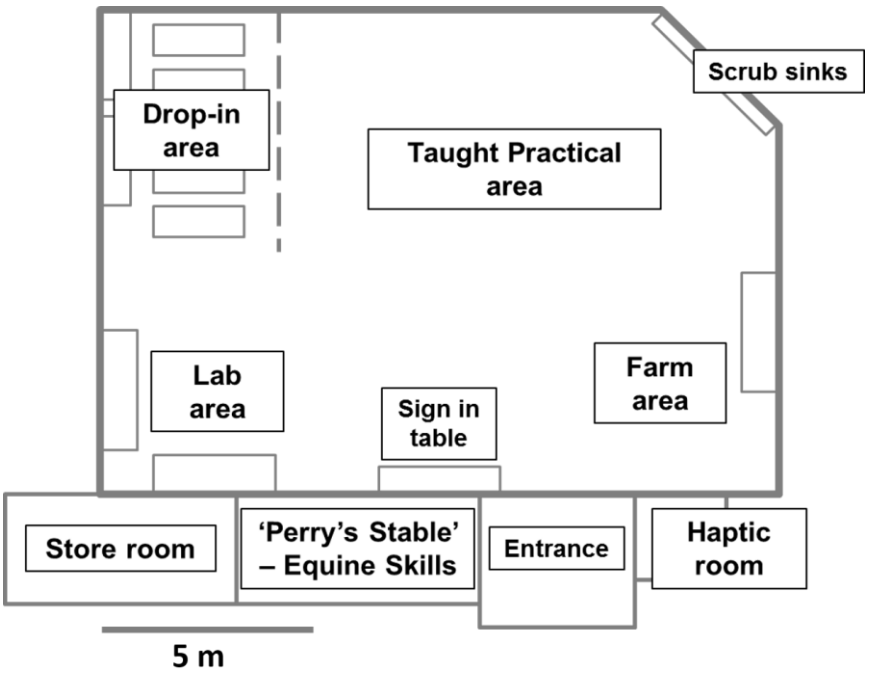
6

Connect the needle and syringe whilst the needle cap is still on the needle.

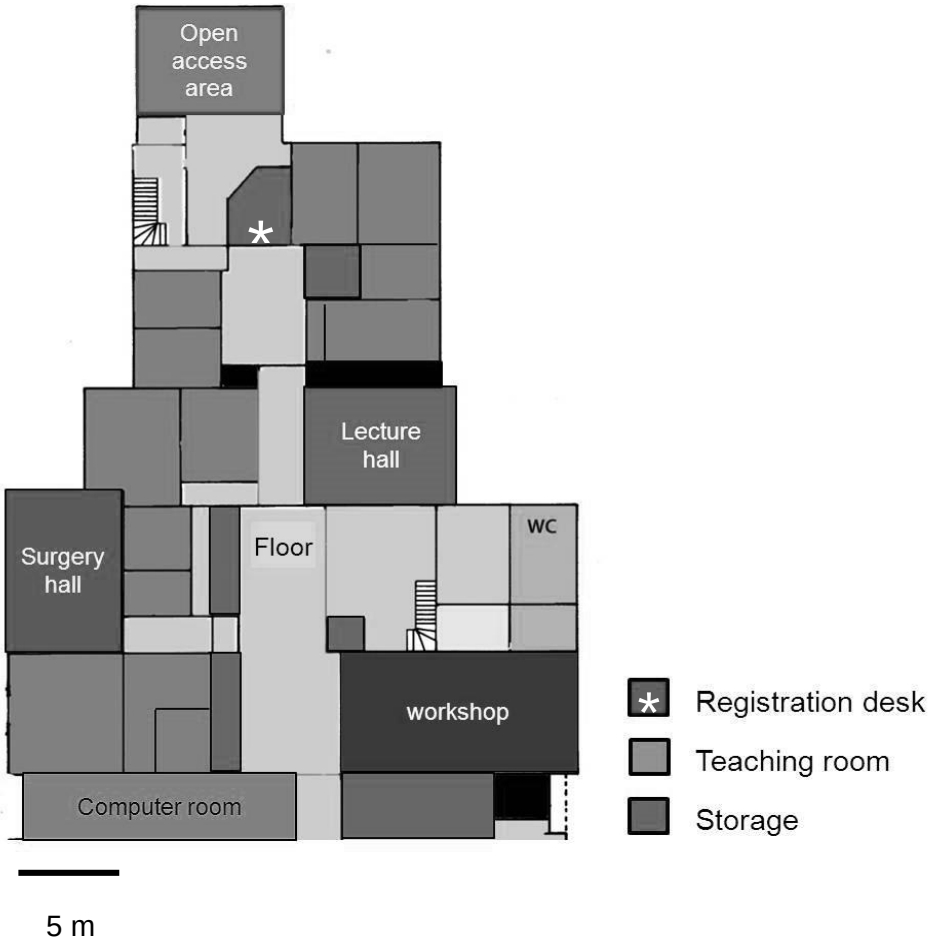
Each image is numbered, to make it easy to follow each step in turn. Whenever possible, an image is included above a text box explaining the next step.

Appendix II: Example Clinical Skills Laboratory Layouts

University of Bristol, UK *(in a repurposed large animal operating theatre)*



University of Hannover Faculty of Veterinary Medicine, Germany *(in a repurposed small animal clinic)*



Appendix III: An Example OSCE Score Sheet

UNIVERSITY OF CALGARY FACULTY OF VETERINARY MEDICINE	**Clinical Skills OSCE #X** **VetM 305 ☐** **VetM 405 ☐** **VetM 505 ☐**	**Student Label Here**	**Examiner Label Here**
Station Name:	Making a peanut butter and jam sandwich		
Date of Exam:	Click here to enter.		

The candidate should do the following (insert more lines if needed):	**Yes**	**No**
Preparing for the task (3 marks total):		
1. Wears clean clothes (1 mark)	○	○
2. Observes basic bio-safety protocols for food preparation including hand sanitization (1 mark)	○	○
3. Used thirty second contact time for hand sanitizer (1 mark)	○	○
Making the sandwich (7 marks total):		
4. Selects two slices of bread (1 mark)	○	○
5. Places slices on paper towel (1 mark)	○	○
6. Applies No Nut butter sparingly on one side of each piece of bread (1 mark)	○	○
7. Utilizes a separate utensil for obtaining and applying No Nut butter (2 marks)	○	○
8. Applies a liberal amount of jam over one slice of bread over top of the No Nut butter (1 mark)	○	○
9. Utilizes a separate utensil for obtaining and applying the jam (1 mark)	○	○

Appendix III: An Example OSCE Score Sheet (continued)

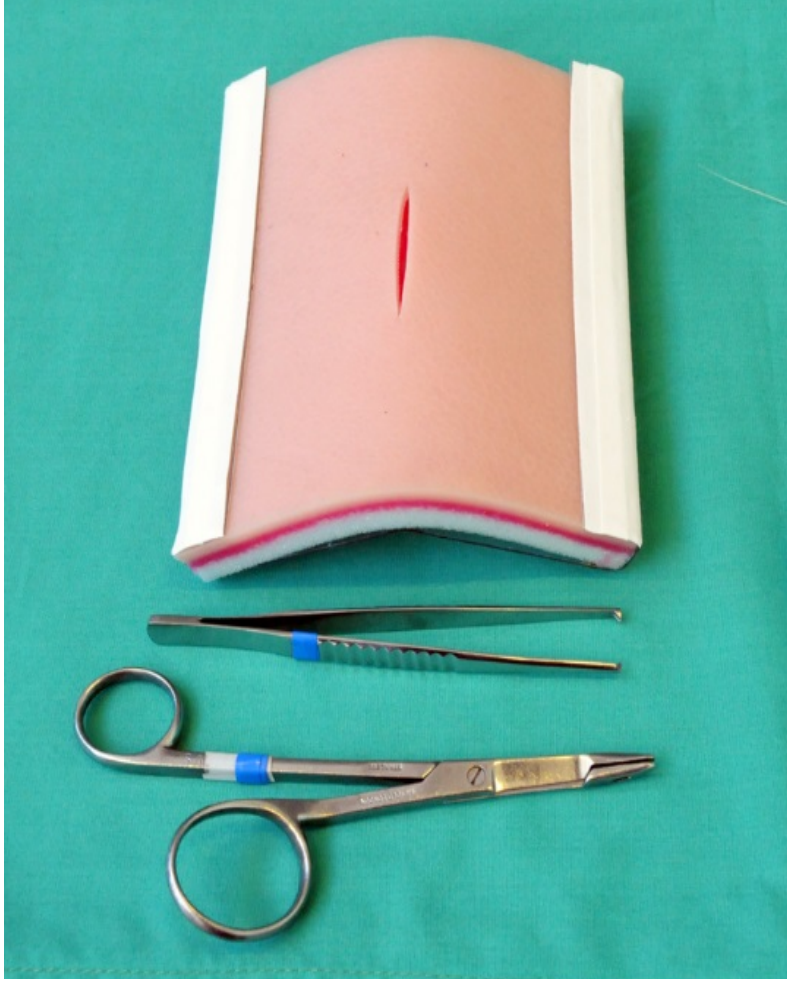
Avoids cross contamination (3 marks total):		
1. Does not cross contaminate the jam by "double dipping" into the jar (3 marks)	○	○
Finishes making the sandwich (2 marks):		
2. Presses the two pieces of bread with the jam and peanut butter in the centre making a sandwich (1 mark)	○	○
3. Cuts the sandwich in half (1 mark)	○	○
Cleans up (1 mark)		
4. Tidies the prep area and closes containers (1 mark)	○	○
Total marks for this station: 16 marks		
<u>Fatal Flaws:</u> (A student automatically fails the station if they commit any of the following errors regardless of whether they can actually perform the task given).	**<u>Yes</u>**	**<u>No</u>**
Student endangers self during the station (e.g. cuts themselves) Student endangers the examiner during the station	○	○
<u>Details of the incident:</u>		

Global rating score:

○	○	○	○	○	○
1	2	3	4	5	6
Inferior	Poor	Borderline Unsatisfactory	Borderline Satisfactory	Good	Excellent

I have read and verified the above marking sheet including, making sure that every line item has a bubble filled in, all fatal flaws are explained and that I assigned a global score based on my personal opinion of how the candidate has performed.

<u>Signature of examiner:</u>



A Guide to Veterinary Clinical Skills Laboratories