Modern ways to enhance surgical teaching skills

Frank CT Smith
Stephen R Greenwood

Abstract
Extrinsic pressures are influencing ways in which medical students and trainees learn, and are taught surgery and surgical principles. As a surgical educator it is useful to understand some of the reasons for these changes and to acquire the skills necessary to provide effective teaching. This short article looks at reasons why one would wish to develop surgical teaching skills, covers basic principles associated with delivery of effective teaching sessions and briefly reviews other avenues that may enhance teaching practice.

Keywords Competencies; ICT; learning; simulation; skills; surgical education; teaching

Introduction
Teaching and learning have always been integral features of a career in surgery. However, changes in modern surgical practice mean that the ways in which surgeons both learn and teach have had to evolve to cope with extrinsic pressures. The concept of long-term apprenticeship is being replaced by tailored teaching and structured training. Increased patient turnover, shift of patient care from inpatient to outpatient, shorter hospital stays and for instance, effects of the European Working Time Regulation on numbers of hours in which surgical trainees are available to be taught, means that exposure to clinical materials and operating opportunities is restricted. If high-calibre trainees are to be attracted, surgical units are obliged to provide quality education, rather than merely acquiesce to service demands. At the same time, development of curricula for surgical specialities and of new forms of assessment, both in the workplace and in examinations, is proceeding apace.

Not all surgical teaching is directed towards the qualified trainee. It is vital that medical students are exposed to the surgical specialities and receive good education in symptoms and signs of surgical disease, if we are to recruit the brightest students to our discipline. Increased tuition fees, the importance of ranking of medical schools on the basis of student perceptions in the National Student Survey and realization that student income plays a significant part of faculty funding have encouraged universities to place more emphasis on quality teaching. Development of academic career pathways in teaching as well as research is driving forward new opportunities in surgical education.

This short article looks at reasons why one would wish to develop surgical teaching skills, covers basic principles associated with delivery of effective teaching sessions and briefly reviews other avenues that may enhance teaching practice.

Why develop as a surgical teacher?

The General Medical Council expects that all doctors will play some role in teaching and acknowledges that the example of the teacher is the most powerful influence upon the standards of conduct and practice of trainees, whether medical students or junior doctors. In ‘The doctor as teacher’ (GMC, 1999), recommendations as to what is expected of all doctors with respect to teaching are clearly laid out:

- All doctors have a professional obligation to contribute to the education and training of other doctors, medical students and non-medical healthcare professionals on the team.
- Every doctor should be prepared to oversee the work of less experienced colleagues.
- Teaching skills are not necessarily innate, but can be learned. Those who accept special responsibilities for teaching should take steps to ensure that they develop and maintain the skills.
- Doctors are expected to be honest and objective when assessing those they have supervised or trained. Patients may otherwise be put at risk.

Attributes of the doctor with teaching responsibilities are shown in Box 1.

### Personal attributes of the doctor with teaching responsibilities (General Medical Council, 1999)

- An enthusiasm for their speciality
- A personal commitment to teaching and learning
- Sensitivity and responsiveness to the educational needs of students and junior doctors
- The capacity to promote development of the required professional attitudes and values
- An understanding of the principles of education as applied to medicine
- An understanding of research method
- Practical teaching skills
- A willingness to develop both as a doctor and as a teacher
- A commitment to audit and peer review of their teaching
- The ability to use formative assessment for the benefit of the student/trainee
- The ability to carry out formal appraisal of medical student progress/the performance of the trainee as a practising doctor

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**Box 1**

Frank CT Smith BSc MD FRCS is Reader in Surgical Education and Honorary Consultant Vascular Surgeon at the University of Bristol, Bristol, UK. Conflicts of interest: none.

Stephen R Greenwood BSc MPhil PGCE LEd FHEA is a Senior Teaching Fellow at the University of Bristol, Bristol, UK. Conflicts of interest: none.
However, there are reasons other than altruism as to why you might choose to develop your surgical teaching abilities. You might wish to include teaching as a formal component of your job plan or to enhance your curriculum vitae for career appointments (Box 2). Formal educational training opens up new opportunities with respect to educational management, organization of teaching and curriculum development.

Obtain training in educational principles

One way to improve competence in teaching is to obtain some form of formal education in teaching methods. An excellent opportunity to obtain insight into educational techniques, with the added bonus of being able to practise teaching in a controlled situation, is to participate in a ‘Training the Trainers Course’, such as those run by the Royal College of Surgeons of England.

Programmes for these courses include subject material such as small group teaching, techniques for facilitating group teaching, planning and structuring teaching sessions, staged approaches to teaching clinical skills, and giving and receiving feedback; each of these considers the development of the individual’s approach to teaching.

If you are interested in developing your teaching abilities further, you may well choose to study for a higher teaching qualification. Many medical schools run part-time courses in medical education in which it is possible to study for a Certificate of Medical Education or to a higher level for the Diploma. These courses tend to offer structured modules in various areas of education with core components such as teaching, learning, evaluation and assessment and course design; these are assessed by course work or written assignments. Modular components include topics such as educational research methods, use of information and communication technologies in education, ethics, mentoring and supervision, developing communication skills, simulation, developing professionalism and using the arts and humanities in medical education.

Obtaining a Masters degree in medical or surgical education will generally involve some pedagogical research into educational themes and production of a dissertation. Acquisition of the Fellowship of the Higher Education Academy (FHEA) demonstrates that you have complied with criteria described by the UK Professional Standards Framework for teaching and supporting learning in higher education. This may be a valuable asset if contemplating a career in surgical education.

The good teacher

A good teacher is a role model, inspiring student learning. The good teacher encourages learning in an open atmosphere in which the student is at ease asking questions. Teaching is pitched at an appropriate level so that the student remains interested and challenged. The good teacher is organized, enthusiastic and incorporates adequate preparation into their teaching schedule. Learning objectives are established early on in a teaching session, so that students know the boundaries within which they are expected to perform.

Teaching sessions should be clearly structured with a summary of the points learned at the end of the session. Good preparation will extend to the use of appropriate visual aids and provision of lecture notes or handout. Where feasible, lecture notes or summary slides can be uploaded to a common website which the student can access to recap important points or to obtain revision material.

Good teachers do not cancel sessions at the last minute and although sessions may not always run to time, the teacher will arrive punctually and will deliver teaching at advertised times. The following characteristics are features of good teaching practice.

Why develop your surgical teaching skills?

**Personal benefit**
- Satisfaction
- To enhance curriculum vitae for job application, promotion or retention
- As part of continuing professional development
- Re-accreditation/revalidation
- Change in career emphasis

**For benefit of students**
- Improve acquisition of knowledge, skills and behaviours
- Improve attainment of learning aims and objectives
- Improve performance in assessments
- Promote interest in subject

**For the benefit of the institution**
- Improve institutional results
- Attract students and high-quality staff
- For quality assurance purposes

Box 2

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Ramsden has identified six principles of effective teaching:

- interest and explanation
- concern and respect for students and student learning
- appropriate assessment and feedback
- clear goals and intellectual challenges
- independence, control and active engagement
- learning from students

**Preparation**

**Who are you teaching?** You will need to consider this carefully. Are you teaching medical students or trainees and at what stage of their course are they? Is this a masterclass for consultants? How big is the group? What level of knowledge do they already have? Different techniques will be required to teach four, eight, 24 or 250 students. Try to learn about your students’ backgrounds where feasible and determine whether they have specific problems, (such as undertaking resit examinations).

**Where are you teaching?** Attention to the environment is an important factor in effective learning. Is the seminar room/lecture theatre appropriate? Teaching space is increasingly
difficult to access in both NHS trusts and in medical schools. What about lighting, heating and ventilation? It is hard for your students to assimilate finer learning points if they are sitting shivering in a coat. Are flip charts, overhead projectors and laser pointer provided or do you need to take them? Are audiovisual facilities appropriate? Will the projector computer in the NHS trust or university only read an encrypted USB stick? Where are the lecture theatre lighting controls and how do they operate?

**When are you teaching?** Arrange protected time, get someone to hold your bleep if you are on-call and remember to turn your phone off. Ensure that your session fits into your students’ timetable and does not clash with other important commitments or teaching on which the students will miss out.

**What are you teaching?** How does the topic you are teaching fit into the curriculum, what are the learning aims and objectives and how will the material be assessed? (An aim is the broad statement of a teaching session or programme and an objective, a detailed statement of what you expect the student to be able to achieve at completion of the session). Students learn best if they know what they are setting out to do (aims) and how they are going to achieve this (objectives). Has the subject been addressed previously so that you can adapt existing teaching materials? Do you know the topic and are you prepared?

An alternative approach to determining session content is to determine what a student should be able to do by the end of the course/session or what skills they should be able to perform to a requisite standard (competencies). Competencies may be specific (placement of an interrupted mattress suture in a simulated skin pad) or generic (communication skills). When determining learning objectives, one tends to work from a syllabus, whereas with competence or outcome-based teaching sessions planning is determined by what you want from the end product.

**Session structure**

Providing a semblance of structure to a teaching session is vital if it is to be effective. The use of a lesson plan will help you to work out session timings and emphasis and will enable you to adapt planning for future sessions. A lesson plan should have a clear beginning, middle and end, (‘introduction, set, closure’).

Hartley et al.4 qualify important components of the introduction of a teaching session into a useful mnemonic, MMOPP (Mood, Motivation, Objectives, Programme and Prior knowledge). Take time at the beginning of a session to set the appropriate mood so that students feel welcome and at ease. You may use an initial session to outline the course and to set ground rules, for instance with respect to punctuality and questioning. Try to motivate students by explaining the relevance of the session content to their future practice or assessments. Clinical examples are almost always welcome. Outline session learning objectives and be prepared to negotiate these if students have specific learning needs. Provide the programme of the session to the students so that they have comprehension of what material will be covered and how this fits into the course curriculum. Establish what prior knowledge they have with respect to the topic, so that time is not wasted with unnecessary detail and new knowledge is delivered at an appropriate level.

In the middle or body of a session, the students’ interest and participation should be maintained. The body of the session is broken down into mini-topics in which key points are highlighted before moving on. Fluid links between topics should be established. You should determine the optimum pace for session delivery so that students remain challenged, but not at a pace at which you lose the slowest learners.

Less is more. It is better to teach three or four key concepts than to cram in material that will be forgotten. Determine what are the ‘need to know’ points rather than the ‘nice to know’. Vary the stimulus, particularly where learning is largely passive and students are prone to losing concentration. Changing pace or altering teaching technique may prevent attention decay. Interaction promotes active learning, but this takes longer than didactic teaching and additional time is necessary for a fully interactive teaching session and should be budgeted into the lesson plan.

Closing a session effectively is important since this capitalizes on a brief increase in the students’ attention span to reinforce key messages. Questions should be dealt with in the body of the session, rather than in closing, because there is the real risk that students will otherwise depart remembering the questions rather than key messages. Hartley et al.4 provide another useful mnemonic for the session closure, LASTT.

- Leave out questions.
- Achievement — let the students know the extent of the ground they have covered. This increases motivation.
- Summarize — this allows repetition of key information and is especially effective if the students themselves summarize key points.
- Think (for student) — encourage the student to practise newfound skills soon to reinforce learning.
- Think (for teacher) — reflect for a few minutes on the session. Make notes on your lesson plan. What went well and why? What did not go so well and why? What could you do to improve the session next time? Are extra resources necessary?

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**Practical tips for lesson planning**

- No more than three key objectives for a 1-hour lesson
- Determine ‘need to know’ versus ‘nice to know’ content
- Leave out most ‘nice to know’ content
- Highlight essential ‘need to know’ content and organize session timings to ensure this material receives appropriate attention
- Allocate appropriate time for introduction and closure since this is often forgotten
- Divide the body of the session into digestible chunks with appropriate links
- Reflect following the session
- Keep your lesson plan available for future sessions
Teaching surgical skills

Traditionally, teaching surgical skills has relied on the ‘see one, do one, teach one’ principle and volume of exposure has been a surrogate marker of surgical training. With diminishing opportunities for learning skills on ‘real patients’ and increasing emphasis on litigation, this approach is no longer ethically or medico-legally defensible.

Considerable work has been undertaken on cognitive and intellectual aspects of surgical training. Surgical skills laboratories allow students to learn and practice on models and simulators and aim to provide them with better foundations for subsequent interaction with patients.

Several models exist for teaching surgical skills. Peyton has described a four-stage approach,5 (employed in the teaching of Advanced Trauma Life Support (ATLS) courses). Initially the skill is demonstrated to the student by the teacher, first without and then with commentary. The commentary explains and reinforces what is happening, providing the student with aural and visual input. This is followed by the student describing steps in the skill, whilst the exercise is undertaken by the teacher. Finally the student undertakes supervised practice of the skill, with formative feedback from the teacher to improve performance (Figure 1). The teacher should try to provide feedback on completion of the exercise, unless the student gets stuck, since continuous feedback during performance of skills exercises inhibits learning.

Reznick and MacRae6 contend that this method of teaching maps onto Fitts and Posner’s three-stage theory of motor skills acquisition.7 In the cognitive stage, the student has to understand the mechanics of the skill, for instance tying a surgical knot. This may require task-analysis to break down the skill into its component parts, and establishing links between the steps (i.e. learning how to hold the ties, how to cross the hands and how to perform the throw to lay down a square knot). Knowledge is translated into appropriate behaviour in the integrative phase as the student practices, with formative feedback. During this period the student is able to lay down the throws of a knot more fluidly, with fewer interruptions, but still has to think about where to place his hands and how to hold the ties. Finally in the autonomous phase, practice results in smoother performance of the skill, wherein the student is no longer concentrating on the component parts and has the capacity to concentrate on other parts of the procedure. Once the skill has been learned and reinforced by practice and the student is at the autonomous phase, it is difficult to change habits (ask any golfer trying to correct their swing!). It is therefore important that initial teaching of a skill embeds correct and safe principles at an early stage.

This model of teaching has obvious implications for surgical training. Early technical skills training should take place away from the operating theatre, for instance in skills laboratories. Practice is essential until the trainee can undertake the task automatically, allowing them to concentrate on the more complex technical and non-technical issues. Finally, once the student has mastered the skill, they will still have to practise regularly to maintain proficiency. This is especially important where the skill may be needed in an emergency which is why, for instance, resuscitation competencies need regular revalidation.

Simulation

Use of inanimate models and simulators in skills training allows the student to make mistakes under supervision in a safe environment (Figure 2). Models are reproducible, portable and generally cost-effective (Figure 3), compared to the use of animals or cadavers for teaching surgical skills.8 Advances in virtual reality have also enhanced skills training. This arena offers opportunities for extensive feedback and trainee assessment. Even when the

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A process for teaching surgical skills (adapted from Hartley et al.4)

- Activate prior student knowledge
- Teacher demonstrates skill without commentary
- Teacher demonstrates skill with commentary
- Teacher demonstrates skill with student commentary
- Supervised practice by student with formative feedback from teacher

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Figure 1 Formative feedback is used to enhance student skills acquisition during anastomosis practice in a basic surgical skills course.

Figure 2 A low-fidelity cost-effective simulation solution to training in needle biopsy techniques.
simulator has low-fidelity (e.g. the laparoscopic box trainer), studies have shown that students trained on these models make fewer intra-operative errors when performing laparoscopic cholecystectomy.8,9 High-fidelity models are also available, such as those used to demonstrate sapheno-femoral dissection and ligation and carotid artery stenting,10,11 however these models are generally more expensive.

Virtual reality has been used in team training as well as in technical skills teaching to reduce surgical error (Figure 4).12 This has proven benefits, for instance, in training of trauma teams13 and for crisis management in anaesthesia.14 As the costs of software and simulators become more competitive it is likely that surgical teaching and training will become progressively more simulator-dependent.

Use of information and communication technology (ICT)

Education relies on emerging technology to a greater extent than ever before and we use computers for many aspects of teaching and teaching development. If you wish to employ ICT in your development as a teacher then investigation of facilities available may be necessary.

At a basic level, the use of computers and ICT may be involved in your preparation of graphical slides for teaching, utilizing programmes such as Microsoft PowerPoint. However, we also use didactic videos and computerized technology to deliver some of the most popular and widespread surgical courses such as the Intercollegiate Basic Surgical Skills Course. Here, the use of rich media (a range of media including slides, video, audio and text) allows communication of principles, provision of background context and enables close-up demonstration of procedures such as knot tying and suturing.

Computer-assisted learning (CAL) packages are widely used in many areas of surgical education. Students can be directed to free on-line surgical educational resources such as http://www.surgical-tutor.org.uk. If you are a current UK surgical trainee or trainer, working knowledge of the facilities provided by the web-based Intercollegiate Surgical Curriculum Programme (http://www.isscp.ac.uk/) is essential, and it is likely that you will be keeping an electronic log of your surgical procedures (http://www.elogbook.org/). Record keeping of learning objectives, work-based assessments and educational goals achieved in a placement, form part of the Intercollegiate Surgical Curriculum Project (ISCP) electronic portfolio, aiding student reflection, which many programme directors use as part of the trainee appraisal process in the Annual Review of Competence Progression and Record of In-Training Assessment.

As a more comprehensive institutional system, a virtual learning environment (VLE) consists of an integrated set of teaching and learning tools designed to enhance the students’ learning experience.15 Components of a VLE system may include curriculum mapping, student tracking, online support for student and teacher, electronic communication (email, threaded discussions, chat, blogs etc) and Internet links to external resources. Usually in a VLE, students and teacher are assigned an identification (ID). The teacher sees what the student sees, but has additional user rights to modify course and learning materials and to track student performance. Examples of commercially available VLE software packages include Moodle, Blackboard, Lotus LearningSpace and WebCT.

As a teacher, you may use ICT for:

- **Presentation** – displaying information
- **Information** – browsing or searching, use of web-links
- **Interaction** – in which the learner interacts with the material (e.g. question and answer, case studies, simulations, electronic voting systems)
- **Communication** – learner to learner or learner/teacher (e.g. conferencing, eTutorials, billboards, newsgroups, wikis, blogs, on-line discussion groups, email, social networking, YouTube, podcasts and Apps)
- **Application** – software with specific functions used by the student (spreadsheets, databases, word processing, statistical packages)
- **Assessment** – objective, for example True/False, Multiple Choice Questions, Extended Matching Questions, Single Best Answer (subjective – where there is no uniquely correct answer) etc.
- **Course management** – organizing course activities/timetabling, student guides, course handbooks.
It is beyond the scope of this article to explore the uses of ICT in teaching development in detail, but the following are examples of areas which merit further investigation by the curious reader.

**Podcasts:** are audio or sometimes video presentations, typically taking the form of an mp3 file. They are identified by an RSS URL, which are delivered to the recipients computer or mobile device, allowing access to educational material on the move. Many UK medical schools now provide their students with lectures in this format facilitating consolidation and revision of course materials.

**Wikis:** are tools enabling multiple users to edit the same webpage, allowing on-line collaborative learning and resource sharing. They are based on socio-constructivist educational principles. Concerns will always exist about the authority of content, but with this caveat firmly in mind, the medium allows useful student collaboration, for instance for group project work.

**Blogs:** are basically journals available on the web, typically updated regularly with postings maintained in a chronological order. They are easy to use and personal to the author. Academics may use blogs for instance to generate content related to professional practice, for networking and knowledge sharing, for instructional tips for students, for course announcements and for annotated web-links. Students may use blogs for reflective writing, assignment submission and review, for knowledge management, to share course-related resources, for group work dialogue and for e-portfolios.

**Electronic portfolios:** an e-portfolio is essentially a personalized electronic repository for gathering evidence of learning. It allows the student to enter and store evidence, which may be used to facilitate reflection concerning academic progress and achievement of learning aims and objectives. The developing teacher may keep an e-portfolio of evidence of teaching, lesson plans, student feedback and assessments, peer-review and appraisals. This will be essential if you want to submit evidence to the Higher Education Academy in application for the Fellowship (FHEA).

The e-portfolio can provide a vehicle for joint discussions between student and tutor, with tools to help the student plan their learning. It can also be used by the learner to present evidence of learning and achievement of competencies for job applications and in-training appraisals. As a trainer or educational supervisor in the NHS, it is likely that you will already have submitted trainee assessments or references using the NHS e-portfolio (https://www.nhsportfolios.org/). Another example of an e-portfolio of value to surgical educators is the revalidation portfolio adopted by the Joint Royal Colleges of Surgeons (https://www.surgeonsportfolio.org/).

**Communication and social networking:** the reader is encouraged to investigate further surgical educational links and uses of resources such as MySpace, Facebook, Flikr, YouTube and Twitter.

**Conclusion**

This short article has looked at reasons for improving one's surgical teaching, practical tips on teaching delivery and some aspects of uses of developing technologies in teaching and learning. The reader who is keen to obtain up-to-date information with respect to developments in medical and surgical education is directed to the Association for the Study of Medical Education, which can be found at http://www.asme.org.uk/.

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**REFERENCES**


**FURTHER READING**