

## EDUCATION ARTICLE

# The clinical education of sonographers: The effective supervision of sonographer trainees

Frank Ryan 

Dr Jones &amp; Partners, SA, Australia

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**Correspondence**

Frank Ryan, Dr Jones &amp; Partners, Adelaide, SA, Australia.

E-mail: francis.ryan@drjones.com.au

Sonographer education, clinical training and the clinical supervision of student sonographers has altered and advanced dramatically over time. Guiding a student sonographer to become a proficient, caring clinician who advocates for best practice and patient outcomes is not a simple task. This paper is presented from a past tutors' perspective and introduces the basics of a training program, which was developed and implemented, by the author, over an extensive period of time.

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**Introduction**

The aim of any sonographer training program is to develop a self-disciplined, analytical, curious, learned and above all, caring professional. Sonographers are the sleuths of diagnostic imaging, and they must develop the skill to clinically assess their patients. They must attempt to answer the clinical question by encouraging patients to divulge their signs and symptoms and then interpret this information along with their own observations. Information given is then correlated with the clinical data, provided by the referring clinician (if available) and also with the sonographic appearances which evolve as the scan progresses. The sonographer needs to have the ability to think laterally,<sup>1</sup> apply the clinical picture to the sonographic images and then expand or extend the examination to the point where the 'real' medical condition is eventually determined.

All sonographer training programs have a responsibility to teach a student that the primary goal of every examination is to provide the best diagnostic outcome for the patient. The means whereby this may be best achieved should form an integral part of the program. Ultimately, the role of the tutor/clinical supervisor sonographer is to provide a safe learning environment for students whilst providing optimal professional patient care.

Sonography students come from a broad range of graduates. This includes medical radiation science graduates (radiography, therapy radiography and nuclear medicine) and nursing and health/science graduates. Prior learning brings a varied and different perspectives. Students vary in age and clinical environment experience and have individual learning needs. Clinical supervisors and tutor sonographers need to have the ability to recognise individual requirements and abilities and adapt to each individual.

**Sonographer education**

Generally, sonography students have a primary degree in an imaging or health science. To complete a qualification in medical sonography, students are required to complete a set number of hours of supervised ultrasound experience. Applicants are responsible for organising a training position in order to meet entry requirements.<sup>2</sup> Many students choose to commence the non-scanning subjects whilst they seek a scanning position. Undergraduate programs may have alternative requirements.

Students generally enter their training at stage I of the Kolb learning cycle<sup>2,3</sup> and progress to remote supervision at the completion of training at stage III. That is, from 'unconscious incompetence' (not knowing what they do not know) to 'conscious competence' (knowing what they do and do not know or able to perform scans satisfactorily). The final stage, stage IV, (unconscious competence

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– performing scans almost instinctively without thinking of all facets involved) is acquired over time.

### Clinical supervision models

Sonographer training has developed enormously since the introduction of ultrasound as a diagnostic tool in medicine in the late 1960s and 1970s. Initially, learning was an individual hands-on 'have a go' process which later developed into basic training programs as individual skills progressed, and there were people able to pass on knowledge. Early programs, particularly in imaging departments/private radiology practices, incorporated individual short training periods in-house with competent sonographers.

The clinical supervision of sonography students differs from many other allied health disciplines in that a student commences intensive hands-on training prior to completion of a study program. It may take some time before the subjects they have completed become relevant. This occurs as their practical skills and experiences evolve. In the training program presented in the succeeding discussion, the students' current subjects and their progress through their university program were taken into account and the training adjusted accordingly.

Sonographer training and clinical supervision is largely guided by the individual employer needs (workplaces willingness to provide training) and the requirements of the educational institution where the student is attending. Sonographer training and clinical supervision should, ideally, provide a broad, comprehensive exposure to scanning procedures and protocols as well as an awareness of student needs in their studies. Training and supervision models vary considerably from centre to centre.

The following training program utilise an adaptation of the Integrated Developmental Model as described by Smith,<sup>3</sup> adapted from Stoltenberg (1981)<sup>4</sup> and later Stoltenberg and Delworth (1987).<sup>5</sup> It incorporates the stages of student development starting at level 1 where students are high in motivation yet high in anxiety and fearful of evaluation. Level 2 students are at mid-level and experience, with fluctuating confidence and motivation, often linking their own worth to successful patient examination. Level 3 students are essentially secure, stable in motivation and have accurate empathy and objectivity. Tutors and supervisors need to be aware of these stages and the principles of the Kolb learning cycle in a training program and be aware that it is essential that the student feels safe in their learning environment.<sup>6</sup> Feedback and discussion are essential and, under the program described, was constant with discussion of all

aspects of an examination occurring at the time of each examination.

### Workforce development and career pathways

Sonography is a profession in demand, and there appears to be a constant need for graduates and therefore more training positions<sup>7,8</sup> There was often a perceived unwillingness by some (in the private sector) to teach leaving training to the public institutions.<sup>9</sup> Unfortunately, training may be seen as costly and time consuming. The time required to produce a sonographer capable of working with minimal or no supervision is lengthy, often taking more than 6 months to attain competency in the more general studies. Following completion of a training module further time is required until students attain a level at which they feel proficient.<sup>6,10</sup>

The opportunity for promotion within any organisation is limited with the majority of positions being at the base level and fewer as seniority and responsibility increases (a standard hierarchical triangle). Current industry standards see most qualified sonographers in Australia commence on a level or grade higher than they were on when they started their study; often starting at grade 3, level 1 on completion. Generally, there are limited pathways after that, and career progression may see specialisation in a particular area which attracts extra remuneration or status.

### Sonographer training and clinical supervision program

The training program, developed over time, is outlined in the succeeding texts. In conjunction with the program, a basic procedure/examination protocol/information manual was written to assist students during and at the completion of their training.

#### Sonographer training program

##### Introduction

The aims of a student sonographer training program are to

- Provide the means to develop the knowledge and skills in a student where by the time they begin to practice in an unsupervised capacity they are capable and competent in the provision of a range of sonographic procedures to patients and have the confidence of their supervisors and peers.
- Develop individuals whose ethical and professional standards match those of the professional bodies guiding sonography.

## Student selection

This process involves the following:

- An interview with a human resources representative, the chief sonographer and tutor sonographer.
- Selection criteria include the following:
  - Initiative
  - Communication/people skills
  - Self-discipline
  - Empathy
  - Enrolled in an ASAR accredited post graduate program
  - Willingness to travel to obtain appropriate skills
  - A suitable primary degree

## Training

Initial training is one-on-one at a suitable site with a tutor sonographer.

- An initial training period of 1 month will allow the student to ascertain whether or not sonography is their correct career choice and the tutor sonographer to assess the students' suitability to the position/career. A formal assessment (Table 1) should be completed at the completion of 4 weeks training, and the student should have the opportunity to discuss their progress and prospects with the tutor.
- Contact and direct supervision with the tutor should be for at least 4 days per week. Day 5 may be with the tutor, an alternative senior sonographer or in duties appropriate to the students' qualifications.
- Following successful and suitable completion of the initial 4-week training and assessment period further training continues with the tutor sonographer for another 5 months, or as appropriate.
- Ideally, students should not be removed from the training program to fill in for other modality rosters.
- At the completion of 6 months training, students undergo a further formal assessment (Table 2), to establish their proficiency in the range of procedures they are expected to conduct, to determine exactly which procedures they are proficient in and those in which they need further training.
- During the 6-month training period, students are, by the very nature of the program, assessed on an ongoing basis. Where necessary, a formal assessment may be conducted as appropriate.

**Table 1** Assessment 1: Ultrasound student 4th week review

Purpose		
To give the student and the tutor sonographer an opportunity to evaluate the students' suitability and desire to continue in the training program. At this stage, the tutor will have had the opportunity to evaluate the students' suitability to continue in the program and the student an opportunity to assess whether or not they have made a suitable career choice.		
<b>Student name:..... Date:.....</b>		
<b>Assessment criteria:</b>	<b>Appropriate</b>	<b>Not appropriate</b>
<b>Initiative</b>	.....	.....
<b>Communication skills</b>	.....	.....
<b>People skills</b>	.....	.....
<b>Empathy</b>	.....	.....
<b>Self discipline</b>	.....	.....
<b>An understanding of:</b>		
<b>The role of the sonographer</b>	.....	.....
<b>Required diagnostic skills</b>	.....	.....
<b>Equipment basics</b>	.....	.....
<b>Procedure protocols</b>	.....	.....
<b>Hand-eye coordination</b>	.....	.....
<b>Recommended/not recommended for continuation of training.</b>		
<b>Tutor sonographer: ..... Date: .....</b>		
<b>Recommendation for continuation of training:</b>		
If recommended for continuation of training, tick one of the following to indicate your decision:		
<ul style="list-style-type: none"> <li>• I accept the assessment above and wish to continue in the training program.</li> <li>• I DO NOT wish to continue in the training program.</li> </ul>		
<b>Student: ..... Date: .....</b>		
<b>NOT recommended for further training:</b>		
<b>Comments – student (if desired)</b>		
<b>Comments – tutor – required</b>		
<b>Signed: ..... Tutor sonographer</b>		
<b>Date: .....</b>		

- Following successful completion of initial training, students are included on the sonographer roster and initially rostered to sites where support is available (either by an experienced sonographer or a radiologist).

The aim is to have students proficient in approximately 14 sonographic procedures by the time their 6-month training is complete. This is not always possible due to a number of factors, and they generally need some further detailed 'up-skilling' in some studies. Expertise and confidence will grow with experience in the workplace.

Not all students will be proficient in all the procedures listed in Assessment 2 at the completion of their initial training however, and the more specialised areas such as musculoskeletal and vascular sonography will often need further attention in the post-tutoring phase. This needs to be programmed on an individual student basis

**Table 2** Assessment 2: Student sonographer practical assessment

	<b>Satisfactory</b>	<b>Not Satisfactory</b>
<b>Student:</b> .....		
<b>Date:</b> .....		
<b>Examination:</b>		
<b>Assessor(s):</b> .....		
<b>Preparation for the examination.</b>		
<b>Examination room:</b>		
• Clean and tidy	.....	.....
• Clean linen available	.....	.....
• Gel available	.....	.....
• Tissues/wipes available	.....	.....
<b>Equipment preparation:</b>		
• Transducers and machine clean	.....	.....
• Correct transducers available	.....	.....
• Appropriate exam/preset selected	.....	.....
• Appropriate preset adjustments	.....	.....
<b>Patient preparation:</b>		
• Patient correctly identified	.....	.....
• Sonographer introduces self to patient	.....	.....
• Appropriate patient dress	.....	.....
<b>Pre-examination assessment by the sonographer:</b>		
• Referral read	.....	.....
• Clinical history and family history (where required) obtained	.....	.....
• Check adequate patient preparation	.....	.....
• Previous study/test information	.....	.....
<b>Information given to patients:</b>		
• Explanation of the procedure	.....	.....
• Sonographer's role explained	.....	.....
• Verbal consent obtained	.....	.....
<b>Patient care during the examination:</b>		
• Privacy and modesty is respected	.....	.....
• Communication is maintained	.....	.....
• Focus is on the patient	.....	.....
• The patients' personal needs are recognised and attended to	.....	.....
<b>The examination:</b>		
• Patient positioning	.....	.....
• Breathing techniques	.....	.....
• Appropriate sonographic windows – selection of appropriate alternatives	.....	.....
• Adequate real-time assessment	.....	.....
• Demonstration and documentation of normal anatomy and variants seen	.....	.....
• Demonstration and documentation of abnormal anatomy and pathology	.....	.....
• Correct labelling of images – anatomy, left/right	.....	.....
• Application of correct <b>Gain</b> and <b>time gain compensation</b>	.....	.....
• Correct focal zone selection and Placement	.....	.....
• Field of view (FOV) adjusted as required	.....	.....
• Suitable transducer and frequency Selection	.....	.....
• Measurements in appropriate planes	.....	.....
• The use of other controls/resources to optimise the examination, for example:		
○ Post-processing	.....	.....
○ Dynamic range	.....	.....
○ Persistence	.....	.....
○ B-mode, colour Doppler	.....	.....
<b>Collation of films, previous studies and reports</b>		
• All previous studies and reports are available, collated and presented in an organised fashion	.....	.....
• Appropriate discussion with the reporting radiologist is conducted, as required, in a professional manner	.....	.....

*Continues*

**Table 2.** Continued

**Occupational health and safety and codes of practice**

- Appropriate care is given to hygiene and cross infection practices .....
- Appropriate application of personal and patient safety issues is applied. Students should acknowledge and apply the guidelines as established by the Australasian Sonographers Association and the Australasian Society of Ultrasound in Medicine. ....

**Satisfactory completion: Y/N assessor: ..... Date: .....**

and in our practice was the responsibility of the chief sonographer.

**Assessment criteria**

Assessment 1: Completed after the initial 4-week training period. The assessment should be accompanied by an in-depth discussion between the student and tutor that analyses the students' suitability for the career. A student should demonstrate the following:

- An aptitude for the sonographer role:
  - Self-discipline
  - Initiative
  - Communication/people skills
  - Empathy
  - An understanding of the role and responsibilities of a sonographer
- A basic understanding of equipment
- Established hand–eye coordination
- A basic understanding of procedural protocols and the need to adapt to individual situations
- An understanding of the concept of a sonographers' requirement to recognise an abnormality, pathology or anatomical variant, even if a definitive diagnosis cannot be made

Assessment 2: Completed at the end of the 6-month training program. As well as continuing to meet the criteria in Assessment 1, students should also be able to demonstrate competence in conducting studies in the following areas:

- Abdomen – general
- Pelvis – male and female, including endovaginal studies
- Renal – male and female
- Small parts
  - Breast
  - Scrotal/testes
  - Thyroid
  - Parathyroid

- Salivary glands
- Basic musculoskeletal studies:
  - Shoulder
  - Lumps and bumps
  - Achilles
- Vascular studies, including
  - Deep vein thrombosis
  - Superficial thrombophlebitis
  - Carotid artery
  - Leg artery
  - Abdominal aortic aneurysm

Obstetric studies, apart from some first trimester examinations, were not included in this program. Obstetrics is a large area of study requiring significant study and clinical exposure that could not adequately be addressed in the program alongside the components that were included. Obstetrics was a subject of further study after initial training, when the students studied the obstetric components of their program.

**Examination logbook**

Throughout all phases of their training, students are expected to maintain a reflective logbook of all the examinations they have participated in. This log should include the following:

- Patient details (for referencing). Confidentiality guidelines must be adhered to
- Examination details
- A description of the students' participation in the procedure:
  - Observe only
  - Some hands-on during or after the procedure
  - Performance of the study under direct supervision
  - Performance of the study conducted under remote supervision
- A brief review of clinical history and findings
- Differential diagnoses

## Student sonographer practical assessment

A formal practical assessment is conducted at the end of the 6-month training program; however, the criteria and pro forma at Table 2 can be applied at any stage. Students are made aware that this is the format used to gauge progress during training and that which will be applied as the final formal assessment. There should be no anxiety as the process has been applied continuously.

### General assessment criteria

The following are provided as general guidelines for assessment of student competency across the broad spectrum of sonographic examinations and procedures.

### Preparation for the examination

- The examination room
- Equipment preparation
- Patient preparation
- Other

### Pre-examination

- Data preparation
- Information given to patient
- Patient care during the examination

### The examination

- Collation of images, previous studies and reports
- Occupational health and safety/codes of practice

### Post-initial training phase

This phase will depend on a variety of student and departmental needs. The following is a guide.

### Rostering

- Following successful completion of their initial 6-month training, students should be rostered to situations where they can perform a daily schedule of examinations suited to their current levels of expertise. This will vary with individual students. It takes some time after the training program to reach a comfortable level of self confidence.<sup>9</sup>
- Clerical and reception staff should be advised of each student's abilities; the range of examinations in which they are competent and the examination times required for each appointment.
- Students at this stage should not work without indirect supervision and support.

## Continuing education and training

Students should maintain a close liaison with their chief sonographer to ensure future rostering, and training can be tailored to their program of studies and with their tutor for further guidance and advice as needed.

During their second 6 months, students should attempt to gain competence in the following procedures:

- Chronic vascular insufficiency
- Arm vessel studies – artery and vein
- Obstetric studies
- Musculoskeletal studies including the following:
  - Hernias, including ventral, inguinal and Spigelian
  - Hip
  - Knee
  - Ankle
  - Hand and wrist
- Further training should be tailored to a student's study program, and they should be monitored on a regular basis and assisted where required.

## The impact of training on clinical workflow

Sonographer training and clinical supervision has a direct impact on clinical workflow, particularly at the outset of the training program.<sup>9</sup> Hands-on involvement by the supervisor is total initially with the students scanning, with patient consent, on completion of the examination. This obviously extends the duration of examinations. Over time, as a student's knowledge and dexterity progresses to the point where the hand and transducer combined become the 'third dimension' in the two-dimensional image on screen. The time a supervisor spends scanning reduces over time and moves from total involvement to no or limited involvement in the scanning process.

This is an excellent example of Kolb's Learning Cycle in action. Docherty *et al.*<sup>9</sup> suggest a system of paired scanning whereby a student is paired with two qualified sonographers (echo) could reduce the demands on time and resources.

Any institution or practice committing to a student sonographer training program must accept that there will be an impact on clinical workflow and potential income. Two people are doing the work of one and taking longer to do so. Ultimately, though, a professional emerges who has the standards, knowledge and skills required by their employer.

## The impact on patient outcomes

Examination time will be extended in a learning environment to cater for student learning; however, patient

outcomes need not be diminished. Two skill sets are in play: a very experience and a developing one. The successful examination can represent a good diagnostic outcome for the patient, a successful endeavour by the student and a satisfactory result for the supervisor.

## Conclusion

This training program was developed over several years and represents personal efforts and student input and adaption to individual student needs. The program gave a formalised means of assessment and clear guidelines for students.

Student training and supervision requires a commitment from an employer, the student, tutors and clinical supervisors associated with the training process. The emphasis must be on patient advocacy in conjunction with student learning outcomes, and it is the responsibility of those providing the training and supervision to ensure that these goals are met. The aim is to produce a capable, professional sonographer who is an asset to any employer, private or public.

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