Improving student confidence for clinical placement with a preclinical simulated session

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Abstract
It has long been known that clinical placement improves undergraduate student learning in medical imaging, and allows a contextual appreciation of knowledge. Some students lacking in self-confidence may not be maximizing learning in clinical placement due to a delay in fully participating within the medical imaging team. A preclinical session incorporating low-medium fidelity simulation can be an inexpensive but effective way to improve student confidence.

Introduction
Undergraduate Medical Radiation students at the University of South Australia attend clinical placement at various practices for several months each year. The aims of clinical placement include improving the application of theory to the clinical environment, facilitating learning of more complex practical clinical aspects, as well as encouraging graduate readiness.

For most medical radiation students, clinical placement into functioning departments significantly improves theoretical understanding (Wheat & Currie 2005a). When a student fully engages within a community of practitioners, they practice and learn knowledgeable skills. Lave and Wenger (1991) state “... the mastery of knowledge and skill requires newcomers to move toward full participation in the socio-cultural practices of a community”. This includes “learning to speak, act and improvise in ways that make sense in the community”. Full participation as part of the healthcare team at clinical placement is not an instant achievement, and the length of time required varies with student ability, previous experiences, and importantly, student confidence.

Student confidence at clinical placement
Impact of low confidence on learning
Despite the known advantages, the prospect of clinical placement can seem daunting to many students. A lack of confidence may delay the student becoming fully involved in the imaging team, thereby hindering the rate of learning achieved.

A common student concern is feeling generally unprepared. Most undergraduate students have high levels of anxiety prior to attending placement (Rompf et al. cited in Gelman & Lloyd 2008). Further to this, students who have already been to one placement are no less anxious than those about to embark on their first (Gelman & Lloyd 2008). Students are acutely aware of their lack of experience, but the gaining of experience is hindered in many by the fear of harming a patient or making an expensive time-wasting mistake. Another student concern is being inexperienced in speaking to patients. Students worry they may forget something important or not explain the procedure appropriately. This fear of mistakes then leads to some students avoiding involvement in the process altogether, preferring to observe or do another task.
Simulation
Simulation and role play can remove much of this fear of error, whilst enabling the student to practice important components of the vocation. Simulation allows students to practice problem solving, time management, radiation safety, and patient communication skills, in a contextual manner whilst in a safe environment (Holtzschneider 2007; Morgan, Cleave-Hogg, Desousa & Lam-McCulloch 2006). This improves the student’s ability to retain information and appreciate the relevance of factual information attained from didactic means.

In addition to this, simulated learning can improve critical thinking and self-confidence in students (Brown & Chronister 2009). This is important because as students become more confident, they are then more likely to adopt a more participatory role in their learning (Christie et al 2008).

Low vs High Fidelity Simulation
There are many types of simulation with arguments for and against each. Low Fidelity simulation such as role-play can be readily incorporated into ‘on-campus’ activities, but is seen by students as less realistic. High Fidelity Simulation provides a means for safely educating students without risk to human life and realistically helps learners transfer knowledge and skills into actual clinical practice (Morgan et al 2006).

A key problem with incorporating high fidelity simulation into a medical imaging preclinical session is the ability to find suitable equipment. The rapid growth of medical imaging technology has led to the burgeoning cost of equipment. This means the availability of current equipment is increasingly difficult in the university environment, particularly for courses with small student numbers. Full use must be made of clinical placement and additionally a student must appreciate that each placement they attend will use different equipment of varying capabilities and a degree of flexibility is.

Preclinical session aims/design
Following a three month holiday period, 10 nuclear medicine students beginning their 3rd undergraduate year attended a five hour on-campus preclinical session. The session was written with the aims of;

- Refreshing clinical and theoretical knowledge previously learned
- Encouraging the sharing of student experiences at previous clinical placements
- Encouraging students to ask and answer questions amongst themselves
- Encouraging participation in a safe but supervised environment
- Improving student confidence at the clinical placement which was to commence the following week.

The preclinical session was broken into three sections: (1) Role Play, (2) Positioning/ Manual Handling, and (3) Laboratory skills/Clinical quiz.

Role Play
Students first individually wrote what they would say to a patient when explaining 3 commonly performed procedures; the lung, renal and bone scans. They needed to consider the requirements of patient identification, informed consent, a legally valid and appropriate request form, radiation safety, and obtaining relevant medical information from the patient prior to commencement of the procedure.
Students were put into groups of three or four and compared notes with each other and discussed differences. This process was important, enabling students to compare past experiences, justify their thought processes, and compare different ways to effectively explain a procedure.

Each group then role played their patient discussion with a 2nd year student who was not yet familiar with these particular procedures as a ‘patient’. The ‘patient’ was given some details such as what her symptom was, her name and birth date, that she was six weeks pregnant, claustrophobic and knew nothing of the procedure she was about to have. The ‘patient’ was told she could offer as much or as little unsolicited information as desired and to answer any question if asked. Following the role play exercise, the groups compared how much information they had obtained from the patient. This allowed the students to evaluate how thorough they had been in their discussion with the patient. Some had not asked about pregnancy and some had failed to ask about symptoms which required additional images beyond what was written on the request form. These extra considerations highlighted to the students the necessity to be able to address routine procedures as well as recognizing and responding to variations in patient presentations.

A typical request form was written for each study, containing various challenges that a professional in this field will often encounter. For example, one ‘professional challenge’ was that the request form had an incorrect date of birth. Another form was not signed by a doctor, and one reported pain in the wrong area. Not all participants identified these special considerations and were able to discuss possible solutions.

During the role-play a lively discussion ensued. The students seemed very keen to find the most succinct, and effective explanation to the patient. There was discussion about whether the explanation was too complex or long, and what terminology was suitable for the general public when discussing radiation dose. This discussion hinged about the difference between the patient’s perceived risk compared to their actual risk from radiation exposure, and how this impacted legally on their duty of care and ‘informed consent’. This type of group interaction is described by Lave and Wenger (1991) as "Legitimate peripheral participation" where “a person’s intentions to learn are engaged and the meaning of learning is configured through the process of becoming a full participant in a socio-cultural practice. This part of the preclinical session took two hours.

Positioning/Manual Handling

Positioning/Manual Handling was done in the small groups of three or four, in the medical imaging suite which contains four small imaging rooms, containing x-ray machines. The x-ray bed was used to position our patient, which was either a student volunteer, or our anatomical mannequin ‘Adam’. An empty intravenous drip and urinary catheter were attached to our mannequin prior to moving it from a wheelchair and onto our bed. Part of our simulation was also performed with the mannequin ‘on oxygen’. This allowed students to familiarize themselves with the extra difficulty of manually moving an immobile patient with attachments.

Although not able to perform the many movements of a gamma camera, the Bucky board was utilised as a simulated gamma camera head. In the case where the camera was required to be more flexible, an empty radiographic film cassette was utilised to represent the field of view (FOV) of a gamma camera.

Students were asked to demonstrate how they would position a patient or the ‘gamma camera’, for a particular pathology. For example, “How would you position a patient for a fractured scaphoid?” They could then discuss in their groups the best way and demonstrate it by holding our ‘gamma camera’ (i.e. film cassette) in the correct plane and placing the patients hands in the correct position.
Students again were given typical professional challenges to the scenario. For example, “What if the patient is unable to move their arm in that position? What if they had a plaster cast on?” There was also much discussion of variations to protocol witnessed by students at their previous clinical placements.

Feedback comments regarding this part of the session included “I heard a number of alternatives which I'll try”, and “it has refreshed my memory on a few (positions) and also shown positions I haven't seen before”.

This part of the preclinical session took 1.5 hours.

**Laboratory skills/Clinical quiz**

The next stage of the preclinical session involved practicing laboratory skills. In Nuclear Medicine, most students initially treat laboratory work with excited trepidation. The fear of preparing or injecting an incorrect radiopharmaceutical is terrifying. The consequences of a mistake could impact potentially on both patient radiation safety, as well as the running of the department should studies need to be rescheduled.

A variety of syringes and needles of different sizes were used to transfer non-radioactive saline to and from glass vials, to simulate some of the actions performed whilst reconstituting radiopharmaceuticals. This task introduced the student to differences in air pressure within the vials, and the impact needle bore and syringe size has on the force required to transfer solution. It also allowed the student to practice handling syringes and needles with gloves on, and to establish the habit of safely keeping fingers a maximum distance away from a ‘radioactive’ source. Once students had familiarized themselves with these tasks, they then repeated them with the vials sitting in a lead pot, as is done clinically.

An example of the tasks performed by the students can be seen in Figure 1.

### Task B

- Using the same 10 ml syringe, draw up all of the saline from the vial (try not to leave any dribbles in the vial – or on the benchtop!)
- Get rid of all the air from the syringe leaving the needle and needle cap on (we try to get rid of air before injecting the dose into patients)
- Did you squirt any ‘dose’ into the needle cap? You can avoid this by drawing back a little bit before you get rid of air – this draws any dose from inside the needle into the syringe so it won’t squirt out when you expel air.

**Figure 1 Student task**

Simultaneously at this stage of the session, there were also laptops set up containing clinically oriented questions in a PowerPoint file with hyperlinks to the answers. This allowed individuals to go through this quiz at their own pace. These questions included choosing the correct ‘field of view’ of the gamma camera. The questions asked what position is best to look for certain pathology. Whilst the diagrams were rudimentary, these questions relied on the student being familiar with the bony landmarks used to position a patient prior to injection, as well as knowledge of the pathology being investigated (see figures 2a, 2b, 2c and 2d). Other questions in the quiz asked about needle size requirements, current hand hygiene recommendations, radiopharmaceutical dose, and asked them to label images correctly. Answers to each quiz question were discussed in the PowerPoint.
immediately after the student made a selection. If they were incorrect the answer told the student the reason why and asked them to try again.

Q1. Which camera position is best to help diagnose a loosening total hip replacement (THR)? Click on your choice.

- This position gets the entire pelvis in, the upper femora, and also gets in most of the lumbar spine. This can be useful when assessing lower back pain with possible referred pain down a lower limb. However, for assessing a total hip replacement this position may be less than ideal.
• “hips” in everyday chat often refers to the pelvis, but in fact is the proximal ends of the femora.
• Centering on the pelvis is great for identifying pelvic fractures since there are often two opposing fractures, but to rule out or confirm THR loosening, you need to aim for the prosthesis, which this view fails to do optimally.

Figure 2c Incorrect option for pathology being tested and explanation

Great!

• Total hip replacements often extend half way down the femur
• This position gets the entire pelvis and lower vertebrae to assess for referred pain from those areas, is centered nicely on the midline of the patient, and gets as much of the femoral shaft in the FOV as possible
• Ideally you want to get as much of the prosthesis in the FOV as possible, which this position achieves best

Figure 2d Correct option for pathology being tested and explanation
The final task in this quiz was to allocate scanning times to all patients for a simulated patient day list. This required consideration of an outpatient’s arrival time and scan type, so the student could work out the delay required after dose injection before the patient can be scanned. They also needed to consider length of scan, whether they would be injecting another patient at that time, and to allow a lunch break.

**Preclinical session questionnaire**

Immediately following the session, participants were invited to complete a short anonymous questionnaire assessing the impact the session had on their self-confidence for the placement the next week. They were then invited to complete a similar questionnaire at the completion of the six week clinical placement. The questionnaire also called for any suggestions the students may have.

**Preclinical session results**

*Did this preclinical session make you feel more confident with speaking to patients?*

All students that completed the questionnaire prior to clinical placement reported they felt more confident about speaking with patients following the preclinical session. One student wrote, “It was great to be able to compare other students’ explanations with my own.” Another had realized they needed to simplify their explanation to the patient more. Four out of the seven students stated that it helped ‘refresh’ their memory.

Only three out of nine participants in the post-clinical questionnaire felt retrospectively that the preclinical session had improved confidence in their ability to speak with patients. Comments included “because it wasn’t quite the same as talking to a real patient” and “I think you only feel comfortable after the first few days”. The relevance of this difference is uncertain. It could be argued that whether they think it didn’t help their self-confidence retrospectively is of no consequence. As long as at the time they started clinical placement they felt they had greater confidence, then that purpose of the session was achieved. This is stated with the assumption that a student entering clinical placement with higher confidence will be more readily able to fully participate in the clinical community and learn more effectively.

*Did this preclinical session make you feel more confident about positioning Patients at clinical placement?*

Five out of seven students prior to placement thought the preclinical session improved their confidence in patient positioning. Of the two that did not, one student said “since every place is different I think this depends where we go” and commented “it was good to hear about people’s stories from other places”. Seven out of nine perceived their confidence in patient positioning was improved by the session, when surveyed after clinical placement. Comments included that it encouraged the student to pay more attention to positioning correctly at clinical, and “It did give me demonstrations of positioning I hadn't seen before but then did see at placement”. This seems to support that the familiarity of a previously seen technique allows more rapid acceptance and clinical engagement of the student.

*Did this preclinical session make you feel more confident with handling needles and syringes?*

Four out of seven students said the preclinical session improved their confidence with handling needles and syringes. Of the three that said it didn’t, two said it was because they had done these tasks previously while at placement. This seems to indicate that there are less perceived benefits in simulation once a student has entered a more participatory role in a clinical task.
From the post-clinical survey, five out of nine students felt it helped with confidence. Of the four remaining students, one said, “but I learnt a lot more of this at placement”. The reason the student wrote this comment is unclear. Perhaps they felt they learnt more because of the simulation training, or perhaps they were indicating they overcame that obstacle regardless of their confidence. Another student who felt their confidence was not improved by the session said the preclinical session was not long enough. This seems to indicate that the student felt they would have gained confidence if they had been able to have more simulation time.

Do you feel you learned anything else new?
Of the comments received by students several found the lap top quizzes useful. This may be a reflection of learning preferences. One student commented on the scheduling task, noting it was something she hadn’t done before. Two students requested computer processing software, either on campus or in a local hospital department. One student requested the session be held in a department after hours. This is something that may be of great benefit if available.

How long do you think this preclinical session should be if held prior to each placement?
Suggested times varied with most students suggesting two to three hours, with a mean time of 3.5 hours. It is important that that the preclinical session does not need to be lengthy to be effective. According to Eisenbrey, Ciak and Hackbarth (1990) short periods like this of preclinical simulated learning can “improve students’ preparation for the next level of professional practice”.

Would you come to another preclinical session?
All seven students that answered the pre-placement questionnaire said they would come again to a preclinical session. Comments included, “Missing the session may have made me feel really nervous when starting placement” and, “it’s a good refresher and indicates what needs to be further revised”.

Similarly after placement eight out of nine said they would definitely attend another preclinical session, with one student stating “anything that gives you practice in an environment where mistakes can be encountered head on is good”. The remaining student said they would ‘maybe’ come, if the simulation covered more advanced procedures. This was consistent with other comments by all students suggesting discussion of more advanced procedures for subsequent sessions. It would be logical to incorporate the recently covered curriculum into the preclinical session.

Discussion
Low and medium fidelity simulation are effective teaching tools to achieve well engaged students in an inexpensive manner. Students are able to perform a task, evaluate their performance and that of others, and discuss their evaluations, without fear of error in the workplace. The introduction of more simulation in the classroom “could enhance the preparation for placements and accelerate placement teaming” (Rosie & Murray 1998; McCormack et al. 1992). For small specialised programs such as nuclear medicine, cost prohibits the introduction of specific equipment for high fidelity simulation on campus. Despite this, low fidelity simulation has been found to be very beneficial. Benefits include increasing student self-confidence prior to clinical placement and thereby allowing students to maximise their learning in the clinical environment.

The preclinical session received overwhelmingly positive reactions from students with all participants perceiving it increased their self-confidence prior to placement. The amount of
prior knowledge a student has can be linked to a student’s self-esteem in some students (Rosie & Murray 1998). By incorporating a flexible and engaging learning environment and presenting facts in a contextual manner, students learn how to process, evaluate and apply their knowledge more effectively (Lave & Wenger 1991).

Wheat and Currie (2005b) suggest that affective contextual learning at clinical placement may have an ongoing affect on the student’s ability to develop skills in subsequent placements and gain a deeper theoretical understanding.

**Conclusion**

A preclinical session using low-medium fidelity simulation and group discussion is perceived by undergraduate nuclear medicine students to improve confidence prior to clinical placement.
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