ORIGINAL ARTICLE

The masked educator-innovative simulation in an Australian undergraduate Medical Sonography and Medical Imaging program

Kerry Reid-Searl, RN, RM, PhD,[1] Anita Bowman, AMS, MAppSc (Ultrasound),[2] Margaret McAllister, RN, Ed D,[1] Cynthia Cowling, MEd, BSc,[2] & Kelly Spuur, PhD, BApSc (MedImag), DipHSci (MedImag) [2,3]

[1]School of Nursing and Midwifery, CQUniversity Australia, Rockhampton, Qld, Australia
[2]School of Medical and Applied Science, CQUniversity Australia, Rockhampton, Qld, Australia
[3]School of Dentistry and Health Sciences, Charles Sturt University, Wagga Wagga, NSW, Australia

Abstract

Introduction: Clinical learning experiences for sonography and medical imaging students can sometimes involve the practice of technical procedures with less of a focus on developing communication skills with patients. Whilst patient-based simulation scenarios have been widely reported in other health education programmes, there is a paucity of research in sonography and medical imaging. The aim of this study was to explore the effectiveness of Mask-Ed™ (KRS Simulation) in the learning and teaching of clinical communication skills to undergraduate medical sonography and medical imaging students. Mask-Ed™ (KRS Simulation) is a simulation technique where the educator is hidden behind wearable realistic silicone body props including masks. **Methods:** Focus group interviews were conducted with 11 undergraduate medical sonography and medical imaging students at CQUniversity, Australia. The number of participants was limited to the size of the cohort of students enrolled in the course. Prior to these interviews participants were engaged in learning activities that featured the use of the Mask-Ed™ (KRS Simulation) method. Thematic analysis was employed to explore how the introduction of Mask-Ed™ (KRS Simulation) contributed to students' learning in relation to clinical communication skills. **Results:** Key themes included: benefits of interacting with someone real rather than another student, learning made fun, awareness of empathy, therapeutic communication skills, engaged problem solving and purposeful reflection. **Conclusions:** Mask-Ed™ (KRS Simulation) combined with interactive sessions with an expert facilitator, contributed positively to students' learning in relation to clinical communication skills. Participants believed that interacting with someone real, as in the Mask-Ed characters was beneficial. In addition to the learning being described as fun, participants gained an awareness of empathy, therapeutic communication skills, engaged problem solving and purposeful reflection.

Introduction

The education of sonography and medical imaging students using simulation can potentially be focused on technical skills acquisition, rather than on communication skills required in patient interaction. A recent report by Thoirs, Giles and Barber noted that a number of radiographic interactive tutorial systems were available which ranged from image interpretation to image quality.[1] Only one was identified that included patient–practitioner interaction.[2] The report covered all the imaging technologies and radiation therapy technologies, yet only concentrated on hardware and software simulation devices. The report mentioned the need for facilities to develop the clinical skills

of patient assessment; however there was little mention of the non-technical skills that need to be developed.

Simulation in the health sciences

Research in simulation for the nursing and medical professions is well documented. Systematic reviews agree that simulation is a useful adjunct tool but not necessarily a replacement for clinical practice.[3,4] A review of simulation-based learning in nursing using manikins compared to other educational strategies, found that it had some advantages provided protocols and guidelines were closely adhered to and situations were contextualised to meet local conditions.[5] The use of simulation was also more effective if it included feedback, reflective practice and was integrated with other learning strategies.[6]

Simulation in sonography and medical imaging

The use of sectional and anthropomorphic phantoms has been prevalent in medical imaging education for over 50 years as a mechanism to reduce the use of medical radiation and to facilitate a safe clinical learning environment. However, there is no literature to support their effectiveness as a learning tool or as a method to facilitate the theory-clinical continuum. Furthermore, there is little research on the use of phantoms and simulated learning and their learning effectiveness in the medical radiation sciences.[1]

There has been some research carried out more recently with simulator devices in sonography. Studies by Persoon et al.[7] in transrectal sonography devices, Weidenbach et al.[8] on echocardiography simulator and Knudson et al.[9] for sonography simulation for trauma, determined that the students rated them highly for ease of use and near replication of the clinical experience. The studies did not however evaluate their effectiveness compared with teaching in the clinical environment. Patient–practitioner interactions were also not evaluated.

Role play

Role play is routinely used in sonography and medical imaging curricula. Halket, McKay and Shaw documented evidence that role playing exercises with actors in the context of the classroom improved communication and the history taking skills of medical imaging students when they later undertook their placement in the real clinical setting.[10] This finding was also documented by Buckley in an interprofessional project that included medical imaging students.[11] Investigations into blended learning approaches for medical imaging education by Cockbain et al.[12] and

Bleiker et al.[13] described improved skills but emphasised again that the contextual and debriefing components were critical to success as an educational intervention. Teaching the clinical skills of Doppler sonography was enhanced by the use of role playing, with resultant improvement of patient physician communication.[14]

Recent studies by Sim with medical imaging students examined the learning effectiveness of 3D simulated patients called Avatars.[15] The virtual role play scored high in participation, flexibility and fun. Students' interviewing skills, empathy for the patient and interdisciplinary understanding were improved. Gao, Noh and Keohler found that students rated their experiences with role playing and virtual 3D patients equally, with introverted students feeling more comfortable with the 3D experience.[16]

Hansen found similar experiences with students using these different mediums but warned that pedagogical outcomes of these technologies were still unfounded.[17] The complexities of the electronic technology sometimes hindered the educator more than the student. Triola, Feldman, Kalet, Zabar, Kachur, Gillespie and Lipkin agreed that the electronic format is the least intimidating method of simulated learning. They further argue that for the student to be better prepared for the real clinical environment, a hybrid or blended approach of electronic or virtual simulation is beneficial followed by role playing with standardised patients and then the real experience of the clinical environment.[18]

A simulation learning innovation

At a regional Australian University a teaching innovation applied the method of Mask-Ed ™ (KRS Simulation) to assist sonography and medical imaging students to integrate technical and communication skills.

Mask-Ed™ (KRS Simulation) is a humanistic simulation method involving silicone body props being worn by the role player, who is a skilled educator. The skilled educator then transforms into a character/patient. The character/patient has a carefully created history and story that allows them to become a platform for learning and teaching. The character becomes the teacher, the coach and directs the learning for the student. However, it is the hidden educator who is carefully navigating the experience. The benefits of an educator, rather than an actor or real patient playing the role are that the educator is able to lead students to demonstrate and re-demonstrate technical as well as communication skills that are relevant to the clinical scenario until the student is able to demonstrate competence.[19,20]

Mask-Ed simply means masking the educator and the education process. The KRS acronym (knowledgeable,

realistic and spontaneous) summarises key aspects for the educators' stance within the role play. Their knowledge as a clinician is an important component that allows subtle feedback to be conveyed to students about the effectiveness of their technical and communication skills. For the simulation to be effective, it needs to be realistic. In this way students become immersed and allow their true self to interact. In other simulation scenarios students often fail to fully engage because they are aware that the experience is artificial and thus do not communicate as they would if they were in the authentic situation.[21] Spontaneity is another important aspect of the experience that helps to make the simulation captivating and fun. Neither the masked educator nor the student know precisely what will happen in the interaction as the direction will depend on the actions of the student and the responses of the character.

Whilst Mask-Ed™ (KRS Simulation) has been utilised and researched within the nursing discipline, it has not been applied to undergraduate sonography or medical imaging education and thus its relevance and transferability to other disciplines is not known.[22]

The Study

An exploratory qualitative post-intervention study was undertaken. Ethical clearance was obtained through the CQUniversity Human Research Ethics Committee. Participants were first year Bachelor of Medical Sonography and Bachelor of Medical Imaging students enrolled in a foundation level course with an emphasis on learning to care. Core learning in the course included: infection control and prevention, manual handling, falls and pressure injury prevention, assistance with elimination and vital signs. The course was of 12 weeks duration comprising lectures, online learning and involved a 2-day residential school.

Aim

The aim of this study was to explore how Mask-Ed™ (KRS Simulation) contributes to undergraduate medical sonography and medical imaging students learning in relation to clinical communication skills.

Method

Students were invited to participate in this research at the commencement of term via an electronic email and willing participants were instructed to contact the principal investigator. An information sheet and consent form was then sent to them explaining the research and inviting them to participate in a focus group. A focus group approach to data collection was used as it afforded an efficient method of identifying and exploring student perceptions in a socially safe environment.[23] This study was conducted in 2012–2013.

The learning experience

Mask-Ed™ (KRS Simulation) was integrated throughout the course that students were enrolled in. Students interacted with two Mask-Ed characters through three components of the course. The characters were Muriel Moore, a retired matron and stickler for doing the right thing and Cyril Smith, a retired butcher and first-aid guru (See Figs. 1 and 2). The first component of the course with Mask-Ed involvement included pre-recorded videos demonstrating patient–health care professional

Figure 1. Muriel Mona Moore – retired matron and stickler for doing the right thing.

Figure 2. Cyril Smith – retired butcher and first-aid guru.

interactions. These videos were used during lectures. In the videos the characters were involved in a number of typical patient activities. For example, Muriel attended a breast clinic. The video showed her being engaged in the processes related to undergoing a mammogram and breast ultrasound. This included preliminary discussions surrounding the intervention. The hidden educator behind Muriel could direct the scenario to involve skills relating to the imaging procedures, therapeutic communication, patient safety, hygiene and explicit consent.

A second example was a video of Cyril which involved him attending an imaging department for an abdominal ultrasound. In the video Cyril was engaged in therapeutic communication with the sonographer concerning his medical history and gaining informed consent. Both videos formed part of a lecture on therapeutic communication including history taking and informed consent. After viewing the ten minute videos, students

were debriefed and discussion occurred relating to the interactions observed with theoretical concepts.

The second component of Mask-Ed involvement was a written assessment (featuring Muriel's history and videos of her experiences at a breast clinic). The written assessment item required students to read Muriel's patient history and then watch two ten minute videos of her imaging procedures (mammogram and breast ultrasound) in a breast clinic. A series of structured questions then required answering.

The final component was a 2-day residential school (where Cyril and Muriel were the patients for students' skill-based activities). The residential school occurred 8 weeks after the lecture on therapeutic communication and 2 weeks after the submission of the written assessment. The residential school was an immersive learning experience where the characters appeared in real-time scenarios. The scenarios included students undertaking a health history and performing non-invasive procedures. During the experiences the hidden educator was able to direct the learning giving guidance and support. At the completion of the scenario the hidden educator de-masked in front of the students. The character was gone and the hidden educator appeared to debrief with the students. Each scenario took approximately 40 minutes.

Focus groups

Following the intervention, three focus groups were undertaken to explore participants' responses to the use of Mask-Ed as simulation approach to teach communication skills. Hennink explains that a successful focus group discussion relies heavily on the creation of a permissive, non-threatening environment within the group where the participants can feel comfortable to discuss their opinions and experiences without fear that they will be judged by others in the group.[24] The focus groups were conducted after course completion to minimise any perception that grades may be affected. A research team member facilitated the focus group. This individual had not been involved in the simulation. During the focus groups participants were given information again about the study, consent was confirmed and they were then asked a series of four semi-structured questions. The focus group interviews were recorded and transcribed verbatim. Transcripts were sent to the research team members to undertake thematic analysis. Each member reviewed the transcripts separately before coming together as a team to decide on the key themes. The researchers identified and categorised themes using the framework approach described by Ritchie and Spencer.[25] The 5 key stages of this approach involved familiarisation, identifying a

thematic framework, indexing, charting and finally, mapping and interpretation.

Results

Eleven students from a total of thirty-one participated in two focus group sessions. Thematic analysis revealed key themes of: benefits of consolidating patient care, knowledge through interacting with someone real rather than a peer, learning made fun, awareness of empathy, development of skills of therapeutic communication, engaged problem solving and purposeful reflection.

The benefits of interacting with someone real

Participants explained various benefits to interacting with a real person rather than a peer.

> It took me out of the classroom role and made me feel more like a health care worker as I was dealing with a real patient and the way that you deal with a real patient is very different to how you deal with a student.
>
> P2

In this excerpt, the participant highlighted that their behaviour changes depending on whether they see themselves as a student or a practitioner. Given that students are learning to develop in both roles, it is appropriate that simulation learning aims to support the development of both roles.

Another participant stated:

> It makes you think that it's an actual patient and you've got to treat them like an actual patient …..sometimes when we're in class and practicing on each other you just get really embarrassed, and people just giggle, but when [the experience happened], it made you think that they were a patient and it was really effective.
>
> P5

These insights reveal that immersion in the event as if it were real is one of the strengths of Mask-Ed that has been previously noted.[22] The activity would appear to be beneficial in enabling students to really think about how they communicate with a real person. Thus, when it comes time to assessing this behaviour, Mask-Ed™ (KRS Simulation) may be able to yield from the student more authentic behaviours and thus provide more relevant and helpful feedback for improvement.

Learning made fun

As findings from this study indicate, learning that is fun is memorable as well as engaging.

> I think it was really awesome and what I liked about it was it made the whole thing more relaxed, it was a bit of a fun way of doing it as opposed to just reading a book and getting a profile and just working on the profile. I thought it just made it more interesting and fun to do.
>
> P2

> I think it was fun, but it was still kept really professional, … there was stages where she would be a typical old patient and it would make you think this is what they are going to be like with little quirky things in there but at the same time you still had to be professional so you couldn't muck around or joke around.
>
> P4

These data indicate that the Mask-Ed™ (KRS Simulation) experience was fun for students and made them feel more relaxed. Learning episodes that are fun are known to engage learners.

Awareness of empathy

Many simulation activities, such as those that use manikins, body parts or graphic images involve activities that are obviously not real and thus do not elicit from participants much emotional pull. However, with the Mask-Ed™ (KRS Simulation) experience, effective stimulation was clear. Students felt empathy and altered their behaviour because of this awareness.

> It made me think about if it was literally a real life patient how to treat them, that's the way I was thinking. Because I didn't have enough knowledge to know what was wrong with them and what good questions there was to ask but just how to treat a patient and then if it was a real life patient how they would actually feel.
>
> P6

Wiseman's influential work understanding the concept of empathy has helped educators and clinicians to appreciate that empathy can be taught and that educators ought to be either constructing or facilitating access to situations where students can have an opportunity to see the world as the patient sees it.[26] In this simulation learning, that situation is provided for students. But more than that, a higher level of empathy is cultivated when learners understand, accept and do not judge that person's world view. This kind of simulation is likely to assist in the higher level development of that empathy.

Communication skills

Because the person playing the role of the patient was also a skilled educator, they had the ability to gently

guide and develop students' communication skills as these data suggest.

> When we were going up to ask questions she would help us at the same time so that we wouldn't embarrass ourselves in front of everyone. And she was just being really helpful and trying to give us a couple of hints being the character... She was just really nice.
>
> P6

While students could identify their growing ability to communicate with patients, some also identified that they needed to have more opportunities to experience this kind of learning so that other kinds of personalities and interactions could be safely encountered and deconstructed.

> I think [we need] more exposure. It is like having a clinical placement and then just going for one day and then not having anything else to do with it.
>
> P2

Engaged problem solving

The realistic, unpredictable and authentic nature of this learning experience were features that successfully engaged students in wanting to problem solve and practice using problem-solving techniques.

> ...you wanted to find out what the problem was, gave it a more personal touch. When you just get profile on a piece of paper and you just read it, that's all it is, but when you see Muriel, you put a personal touch to it and it has some meaning.
>
> P2

Purposeful reflection

Data also revealed that the opportunity to have one's practice gently critiqued by the educator prompted reflection and self-awareness.

> [...after the simulation the un-masked educator] went through and said this was good because of this and this, showing us support, showing right and wrong. For you individually it helped you to know what was good and what was bad with your own skills and mannerisms [which] you don't always notice... It makes you aware.
>
> P11

Frequently reflection involves only students identifying aspects about content or process that could have been improved. But in this learning situation, when the masked educator takes off the props and assumes their usual role of educator, they provide students with their impressions based on being on the receiving end of those students' care. The unique nature of the Mask-Ed

experience prompts a genuine dialogue about practice, which does not involve students becoming defensive, or teachers being accused of being too critical. It seems to be a very successful way of showing students their strengths and areas for improvement.

Discussion

The themes that emerged included many that were consistent with the findings of other simulation research. The high-fidelity Mask-Ed™ (KRS Simulation) leads to a level of reality in patient care that allows the participants to suspend disbelief. This creates a highly effective learning environment which promotes consolidation of knowledge.[27] It was noted by Kneebone et al. that the use of a combination of actors as standardised patients, with high-fidelity mannequins can lend an even greater level of reality, laced with emotional content, to simulation.[28] The Mask-Ed™ (KRS Simulation) combines an 'expert educator' patient with simulation in a similar theatrical experience. This emotional content leads us to the theme of empathetic response and engaged problem solving which has been related to the authenticity of high-fidelity simulation.[6] The theme of learning made fun has been related to effective learning which is itself associated with individualised, active learning experiences.[29] Mask-Ed™ (KRS Simulation) gave the students the opportunity to apply positive patient care and communication skills, but students identified the need for repetitious practise which is a key feature of effective simulation.[6] Purposeful reflection also emerged as a theme. The use of intra-experience feedback is a key feature of the simulation process which is known to lead to effective learning.[6]

Unique benefits

The results of this study revealed that the experience was favourable and that this kind of humanistic simulation needed to occur more regularly. Furthermore, the data revealed that where the educator performs a dual role as patient and educator it is enjoyable and challenging for the students. Unlike what may occur in peer role plays, this experience did not elicit embarrassment or discomfort when the learner was receiving critical feedback from an experienced other.

The Mask-Ed characters are carefully created to be humorous with an intention of making the learning fun. The benefits of fun in learning are widely acknowledged.[30,31] Appropriate fun can create a positive learning environment, encourage engagement with the task, focus student attention and diffuse undesirable emotion and behaviour. The humorous quality of the Mask-Ed™ (KRS Simulation) interaction goes beyond

these elements to add a unique benefit to the experience. The patient characters, for example, are not inhibited and speak more directly and openly than perhaps a typical patient might. They offer their unsolicited opinion, object, explain, coach, guide, validate and criticise and gain the trust and the desire of students to want to help.

The empathic engagement that is made possible through this experience is also significant. Not only do students have an experience to appreciate, through the very helpful and elaborate self-disclosure of the characters, the world view of the patient; but they have coaxed to communicate that empathy through dialogue and thus lift the skill of empathy to a higher level.[26]

Problem solving, critical thinking and reflection skills were also developed in this experience and are integral to sonography and medical imaging practice. Like other forms of high-fidelity simulation,[32] the Mask-Ed™ (KRS Simulation) method would appear to be particularly useful in promoting a deeper level of learning and is thus a useful tool for sonography and medical imaging students.

Limitations

All studies have limitations and this study is no exception. Because many students were off campus at the time the focus groups were conducted, there was only a small participation rate (35.5%). The time students spent engaging in the Mask-Ed™ (KRS Simulation)' scenario was relatively short and there was a time lapse between this learning and the focus groups. Data were collected after course completion to minimise any perception that grades may be affected. In addition, the second focus group session experienced technical problems and the tape was not able to be transcribed. However, records of the interview were made. Thus, the findings may not represent the full range of student experiences.

Conclusion

Mask-Ed™ is a new and novel pedagogical initiative that contributes positively to the learning and teaching of clinical communication skills in patient care and patient–practitioner interaction in undergraduate medical sonography and medical imaging. Mask-Ed™ was used to create an enhanced learning environment which was not only fun but also an effective technique. The use of high-fidelity simulation combined with interactive sessions with an expert facilitator demonstrated that students benefited from dealing with a "real patient as evidenced through engaged problem solving and purposeful reflection. The use of Mask-Ed™ in undergraduate medical sonography and medical imaging programs

should be further validated with a more comprehensive study of both cohorts.

Acknowledgements

Conflict of Interest

The authors declare no conflict of interest.

References

1. Thoirs K, Giles E, Barber W Use of simulated learning environments in radiation science curricula. University of South Australia, Adelaide, 2010.
2. Sica GT, Barron DM, Blum R, Frenna TH, Raemer DB. Computerized realistic simulation: a teaching module for crisis management in radiology. *Am J Roentgenol* 1999; **172**: 301–4.
3. Schout BMA, Hendrikx AJ, Scherpbier AJ, Bemelmans BL. Update on training models in endourology: a qualitative systematic review of the literature between January 1980 and April 2008. *Eur Urol* 2008; **54**: 1247–61.
4. Van Nortwick SS, Lendvay TS, Jensen AR, Wright AS, Horvath KD, Kim S. Methodologies for establishing validity in surgical simulation studies. *Surgery* 2010; **147**: 622–30.
5. Cant RP, Cooper SJ. Simulation-based learning in nurse education: systematic review. *J Adv Nurs* 2010; **66**: 3–15.
6. Issenberg SB, McGaghie WC, Petrusa ER, Gordon DL, Scalese RJ. Features and issues of high fidelity medical simulations that lead to effective learning: a BEME systematic review. *Med Teach* 2005; **27**: 10–28.
7. Persoon M, Schout B, Martens EJ, et al. A simulator for teaching transrectal sonography: how useful and realistic is it? *Simul Healthc* 2010; **5**: 311–4.
8. Weidenbach W, Wild F, Scheer K, et al. Computer-based training in two-dimensional echocardiography using an Echocardiography simulator. *J Am Soc Echocardiogr* 2005; **18**: 362–6.
9. Knudson M, Sisley A. Training residents using simulation technology: experience with sonography for trauma. *J Trauma* 2000; **48**: 659–65.
10. Halkett GK, McKay J, Shaw T. Improving students' confidence levels in communicating with patients and introducing students to the importance of history taking. *Radiography* 2011; **17**: 55–60.
11. Buckley S, Hensman M, Thomas S, Dudley R, Nevin G, Coleman J. Developing interprofessional simulation in the

undergraduate setting: experience with five different professional groups. *J Interprof Care* 2012; **26**: 362–9.

12. Cockbain MM, Blyth C, Bovill C, Morss K. Adopting a blended approach to learning: experiences from Radiography at Queen Margaret University, Edinburgh. *Radiography* 2009; **15**: 242–6.

13. Bleiker J, Knapp K, Frampton I. Teaching patient care to students: a blended learning approach in radiography education. *Radiography* 2011; **17**: 235–40.

14. Nikendai C, Kraus B, Schrauth M, et al. Integration of role-playing into technical skills training: a randomized controlled trial. *Med Teach* 2007; **29**: 956–60.

15. Sim J, James J, McDonald M, et al. Learning via Avatars: An experiential journey for Medical Imaging students. New Zealand Institute of Medical Radiation Technology Conference (NZIMRT): Quality Counts, Auckland, New Zealand, August 17–18, 2012.

16. Gao F, Noh JJ, Keohler MJ. Comparing role playing activities in Second Life and face to face environments. *J Interact Learn Res* 2009; **20**: 423–43.

17. Hansen M. Versatile, immersive creative and dynamic virtual 3-D learning environments. *J Med Internet Res* 2008; **10**: 26.

18. Triola M, Feldman H, Kalet AL, et al. A randomized trial of teaching clinical l skills using virtual and standardized patients. *J Gen Intern Med* 2006; **21**: 424–9.

19. Reid-Searl K. De-Masking Cyril Smith: how the use of role play became a serious educational tool. *Connections* 2010; **13**: 34–35.

20. Reid-Searl K, Eaton A, Vieth L, Happell B. The educator inside the patient: students' insights into the use of high fidelity silicone patient simulation. *J Clin Nurs* 2011; **20**: 2752–60.

21. Fort C, Fitzgerald B. How simulation improves perioperative nursing. *OR Nurse* 2011; **5**: 36–42.

22. McAllister M, Reid-Searl K, Davis S. Who is that masked educator? Deconstructing the teaching and learning processes of an innovative humanistic simulation technique. *Nurse Educ Today* 2013; **33**: 1453–8.

23. Krueger RA. Focus groups: a practical guide for applied research, 3rd edn. Sage, Thousand Oaks, CA, 2000.

24. Hennink M. International focus group research: a handbook for the health and social sciences. Cambridge University Press, Cambridge, 2007.

25. Ritchie J, Spencer E. *Qualitative data analysis for applied policy research*. In: Bryman A Burgess RG (eds). Analyzing Qualitative Data. Routledge, London, 1994.

26. Wiseman T. A concept analysis of empathy. *J Adv Nurs* 1996; **23**: 1162–7.

27. Wayne DB, Siddall VJ, Butter J, et al. A longitudinal study of internal medicine residents' retention of advanced cardiac life support skills. *Acad Med* 2006; **81** (Suppl.): S9–12.

28. Kneebone RL, Kidd J, Nestel D, Barnet A, Lo B, King R, Yanz GZ, Brown R. Blurring the boundaries: scenario-based simulation in a clinical setting. *Med Educ* 2005; **39**: 580–7.

29. McGaghie WC, Issenberg SB, Petrusa ER, et al. Effect of practice on standardised learning outcomes in simulation-based medical education. *Med Educ* 2006; **40**: 792–7.

30. Baid H, Lambert N. Enjoyable learning: the role of humour, games, and fun activities in nursing and midwifery education. *Nurse Educ Today* 2010; **30**: 548–52.

31. Powell J, Andresen L. Humour and teaching in higher education. *Stud High Educ* 1985; **10**: 79–90.

32. Burns H, O'Donnell J, Artman J. High fidelity simulation in teaching problem solving to 1st year nursing students: a novel use of the nursing process. *Clin Simul Nurs* 2010; **6**: e87–95.