

understanding of pathophysiology through the writing of scenarios. We sought to extend the potential of simulation by asking students to write, deliver and debrief simulation scenarios.

**What was tried?** During an established 2-day, scenario-based programme using a manikin patient (Laerdal SimMan), final-year medical students were asked to write, deliver and debrief a simulation scenario while working in groups.

Students were encouraged to base their scenario on any clinical case they had encountered. They were given a standard template with headings for learning objectives, patient details, required learner actions and simulated patient responses to those actions.

Students had 1 month to prepare a patient history, script for the patient, hospital medical record, and relevant blood test and radiology results. Preparation required thorough research of the pathophysiology and clinical evolution of the chosen condition, as well as expected responses to pharmacological interventions.

Scenarios underwent expert review at an early stage of development and again immediately prior to delivery. Scenarios were delivered by students ('instructor' peers), with one student 'acting' as the voice of the patient (audible from the manikin's mouth) and others acting as nurses. Another group of students functioned as scenario participants ('learner' peers), assessing and treating the simulated patient. Each scenario was followed by an educational debriefing, facilitated by the 'instructors'. A total of 79 students participated. Groups took turns in 'instructing' and 'learning', without prior knowledge of the other groups' scenarios.

**What lessons were learned?** The delivery of peer-written and peer-run simulation scenarios was feasible, although it represented a demanding exercise for the simulation faculty staff. Unanticipated actions on the part of both the student participants in the scenario and the student instructors delivering the scenario required flexibility and spontaneity.

Expert review of scenarios prior to delivery was a key factor in successful delivery as students tended to write scenarios that expected an unrealistically high level of performance from their peers.

Students were able to perform high-standard educational debriefing. Preparing for technical debriefing motivated students to research best-practice management guidelines for their chosen condition. With minimal teaching students were able to provide their peers with feedback on non-technical behaviours (teamwork and communication) based solely on exposure to previous instructor-led debriefings.

All simulation scenarios are evaluated for quality assurance. For the peer-led simulation exercises, students were asked whether the components of developing, delivering and debriefing the scenario improved their knowledge; students agreed in 94%, 91% and 96% of responses, respectively. Students ( $n = 79$ ) gave the exercise an overall mean rating of 4.6 on a scale of 1–5 (1 = unsatisfactory, 5 = excellent).

Qualitative feedback from students suggested potential benefits not foreseen by the instructors, which are now the subject of an ongoing research project. These included better understanding of the patient's perspective acquired by acting as the voice of the 'patient' and improved interprofessional understanding achieved through acting as a nurse.

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## Lessons learned: a different approach to teaching electrocardiogram interpretation

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**What problems were addressed?** Learning to interpret basic 12-lead electrocardiograms (ECGs) remains a challenging rite of passage in pre-clinical medical education. As students matriculate into medical school from more diverse backgrounds than ever before, some students require more intensive study to acquire the basic skills necessary to begin clinical rotations. Classically, didactic sessions disseminated basic information and allowed little opportunity to practise these new skills. Previously, our course incorporated small-group sessions to allow students to engage with an experienced electrocardiography interpreter. However, having multiple small-group facilitators resulted in differing experiences and emphases across the groups and, in some cases, conflicting information. Unfortunately, this approach led to unequal testing results and differing levels of student satisfaction. In addition, with increasing clinical workloads, the recruitment of capable facilitators presents a formidable challenge.

**What was tried?** To better standardise the ECG learning experience, we incorporated an audience response-based texting program ([www.polleverywhere.com](http://www.polleverywhere.com)) to enable the class to interpret an ECG individually and simultaneously in

a supervised classroom setting. We ran three half-day sessions for which material was split into, respectively: (i) heart rhythm identification; (ii) atrioventricular blocks and ECG interval interpretation, and (iii) myocardial infarctions, ischaemia and hypertrophy. Each session began with an abbreviated didactic presentation highlighting the skills necessary to interpret that session's ECGs. After the presentation, the entire class simultaneously reviewed a single ECG for 1–2 minutes and then each member individually answered a multiple-choice question by texting the answer. When most students had answered the question, the instructor presented the aggregate of the submitted answers and reviewed the ECG, highlighting the correct answer. This also afforded the instructor the opportunity to specifically address why the other answer choices were incorrect. This process was conducted for 20 ECGs in each session.

To enable the evaluation of their skills, students answered proctored ECG-based questions on an ECG quiz and as part of their final examination. When student performance was evaluated during the final year of the small-group sessions, the total class scored an average of 78.5% on the composite proctored ECG questions. In the first year in which the audience response-based texting approach was incorporated, the class scored an average of 89.0% on similar proctored ECG-based questions.

**What lessons were learned?** Several lessons can be gleaned from these experiences. Firstly, working through more ECGs enables students to enhance their learning by immediately applying their newly acquired skills. Secondly, immediate feedback provided students with the guidance they needed to correctly understand and apply those basic skills. Immediate feedback remains a valuable tool to improve learning in clinical performance.<sup>1</sup> Thirdly, having a single facilitator ensures all students receive the same information and have similar experiences. Finally, in circumstances in which small groups are the preferred setting, efforts should be made to prepare separate facilitators to ensure each group receives similar information and covers the same material. To this end, a training session for small-group facilitators may be beneficial.

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## A novel approach to teaching electrocardiogram interpretation: learning by drawing

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**What problems were addressed?** Undergraduates struggle with electrocardiogram (ECG) interpretation and find ECG teaching difficult to engage with. The traditional approach to learning ECG interpretation is to review as many traces as possible and to receive feedback from a competent ECG analyst, such as a doctor. Various approaches to improve both competency in interpretation and learner engagement have been proposed; however, no single method or format of teaching has been found to be most effective.<sup>1</sup>

**What was tried?** A novel approach to ECG interpretation was developed to encourage students to engage more and think more critically when analysing waveforms. We define the cognitive analytical process of interpreting an ECG as follows: (i) the interpreter identifies features on an ECG trace that deviate from the physiological norm; (ii) the interpreter recognises several of these individual features as part of a characteristic pattern, and (iii) the interpreter gives this characteristic pattern a diagnostic label based on his or her understanding of various pathophysiologicals.

We reversed this process by giving students a diagnosis and asking them to draw the ECG trace that would correspond. This required the students to recall the characteristic pattern of the diagnosis and the specific features that constitute it, before attempting to reproduce a final ECG. An example trace was then shown to the students, who were asked to consider how their drawn representation of the diagnosis reflected the example trace and how it differed. Further feedback was given by the teacher facilitating the session.

This was initially trialled with three junior doctors teaching three groups of seven students, who submitted written feedback. The teachers then gave feedback themselves on the technique via semi-structured interviews.

The effect on ECG interpretation competency was later assessed using a controlled trial in which pre- and post-course quiz scores were analysed. The