

The use of Personal Response System (PRS) technology as a tool to promote safe clinical decision making amongst UCL medical students

Overall aims and objectives

New medical graduates are expected to 'make clinical judgements and decisions, based on the available evidence' and 'medical schools should take advantage of new technologies to deliver teaching' (Tomorrow's Doctors, 2009). However, 44% of healthcare professionals felt that Foundation Doctors were unprepared to make clinical decisions (Illing, 2008).

The aim of this project was to incorporate more opportunities for final year medical students to demonstrate decision making, through the use of Personal Response System (PRS) technology and the design of suitable materials.

The objectives of this project were to:

- Collaborate with current final year medical students and Foundation Year doctors
- Design clinical vignettes to be used in conjunction with PRS
- Collate student evaluations of the content of these new learning materials

Methodology: Explanation of what was done and why

A current final year medical student and Foundation Year doctor, who attended the pilot PRS sessions, volunteered to participate in this project. Involvement of these collaborators was designed to increase the face validity of teaching materials, through 'peer-peer' and 'near-peer' relationships. A list of clinical and situational themes was generated. These were transformed into single-best answer type vignettes to be used in conjunction with TurningPoint software and PRS.

Project outcomes: Description and examples of what was achieved or produced

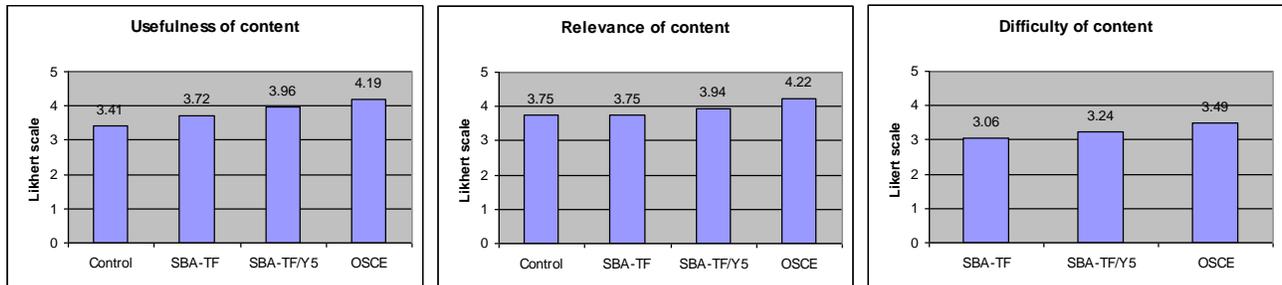
Two clinical themes were developed into single best answer (SBA)-style questions and formatted using TurningPoint software. This presentation was used in conjunction with PRS during departmental teaching for all final year medical students in eight rotations of approximately 40 students.

See Appendix 1: "Please Sir, I want some more....more SBAs!"

Student evaluations

PRS was '*useful for committing to a decision and being concrete about it*'. It '*provides a good discussion point and it's interesting to see how others vote*', which '*encourages audience participation*'. Audience participation ranged from 90 – 100% (36/40; 41/41).

Students found the PRS materials that were designed with the 'near-peer' input more useful (SBA-TF/Y5), relevant and difficult, than those previously designed by me (SBA-TF). In comparison, students rated the small group mock OSCE practice session most highly.



Evaluation & reflection

How did the project enhance student learning?

Participation with anonymity

'I find being able to try my answer out without fear of looking stupid helpful'. 'It makes it easy to go against the flow – and rewarding if you are right!' Participation was consistently above 90% using PRS and students were confident that there was no underlying summative component to its use during these teaching sessions.

Calibration & benchmarking

Aside from the potentially competitive nature of PRS use, students found a formative benefit because *'it is really useful to know whether my peers all know more than me! It is a bit of a motivating kick up the backside if you are amongst the only 5% who don't know the answer'*.

Interactive decision making

'I think it makes a case study genuinely interactive...e.g. "so what would you all do next?' PRS enabled me to gain the majority view from the audience, rather than individual views, which allowed me to iteratively adapt to the student needs. It can be difficult for an 'expert' clinician to not be able to explicitly explain the rationale for why one option is better than another, but using SBAs as a tool focused and forced me to use evidence based medicine to justify my clinical decision making. Students raised relevant questions and answered mine – an example of collaborative learning.

Pitch

'Too often I sit in lectures where the lecturer contents themselves that the students should be at a certain level and hence just pitches the content too high'. Perhaps lecturers are frequently misled by the minority of students who answer their questions correctly and assume that this represents the general standard of student knowledge.

Pace

'The pace felt just right – enough time to have a think but not too long to prevaricate (i.e. do I really know the best answer?)'. PRS facilitated case-based discussion between students themselves – 'the voting system was a stimulus for more free form debate' and allowed me to identify areas of knowledge deficiency on which to focus, share the possible options available and clarify the decision making process.

Group size

A group size of 40 students appeared to be the optimal size for both me and a student commented: PRS *'can play a role in bigger audiences but the free form debate after voting in the session (with a larger group size of 70) felt a bit out of control'.*

Peer-assisted learning

Involvement of a current final year student and Foundation Year doctor to generate themes and PRS materials is an example of 'peer-assisted learning'. The student evaluations supported the additional benefit of PAL in terms of the feedback on the content usefulness and relevance.

How did the outcomes compare with the original aims?

The original aims were addressed.

In addition, I have collected data related to:

- Confidence ratings, self-reported difficulty ratings and actual SBA correctness scores
- Video recordings of students' attitudes to PRS use

How did the project benefit the student workers?

Unfortunately the student workers were not available to present their work to current final year students due to other clinical commitments.

I have included the student worker's comments in Appendix 2.

How has the project developed your awareness, understanding, knowledge, or expertise in e-learning?

PRS technology

As an academic GP with an interest in e-learning, innovation and responsibility for curriculum design and implementation, the use of PRS has suited my intentions and exceeded my expectations of this technology with respect to promoting decision making.

TurningPoint software

This software is as easy to use as PowerPoint for designing slides and presentations. Steve Rowett has taught me other capabilities of TurningPoint, such as demographics linkage of slides to yield further useful comparison data.

Standard-setting

Voting introduces an element of competitiveness in the classroom, which may either increase self-efficacy and confidence in those who answer correctly or potentially alienate voters who consistently answer incorrectly. Due to the range of ability within the student cohort, it may be feasible to use Angoff-type methods for standard-setting purposes.

Scalability and sustainability

How will the project continue after the ELDG funding has discontinued?

Question design

This is probably the most time-consuming part of the process. I have learnt that contributions from current students and Foundation Year doctors improve the quality of the content of scenarios (as reported by students themselves). These collaborative SBAs appear to be more challenging for students. Development of a bank of questions in various themed areas would be my goal for the future.

Situational & clinical scenarios

With the expertise and support of Steve Rowett, I have learnt that PRS may lend itself and be suited to promoting decision making for situational scenarios in addition to clinical scenarios. Situational judgement tests are therefore increasingly used as an assessment tool for professional development.

Student involvement

Students were motivated to participate by volunteering themes and giving constructive feedback on developing SBAs. Participation of Foundation Year doctors will enable UCL alumni to remain strong affiliations with the Medical School and contribute to course improvements. This is beneficial for their professional development and research/teaching portfolios.

Might it be expanded to other areas of UCL?

I think that PRS will have a role in any course that involves decision making or uses SBAs for its assessments, particularly where lecturers teach large groups (of 40 students). PRS underpins educational theory, as teachers are easily able to:

- 'Diagnose' knowledge gaps
- Check student understanding and give timely explanations
- Promote decision making and reasoning, through designing stimulating materials
- Encourage teacher-student interaction and student-student discussion

Transferability to other Faculties

I would be keen to collaborate with my counterparts in other Faculties to share my experiences of using PRS. I think that PRS use would be applicable to many areas, such as:

- Arts-based subjects:

- To provoke debates following a vote using PRS
 - Psychology, law, English literature, political science, business studies and economics
- Science-based subjects:
 - To generate problem-solving approaches and conceptual reasoning from real-life scenarios
 - Veterinary medicine and dental studies and other allied health sciences, e.g. occupational therapy, pharmacy, mathematics, physics, engineering

Dissemination

How will the project outputs or results be disseminated to the department, College or externally?

Together with Steve Rowett and my administrator, Maryanne Ogbogbo, we presented a workshop at the eLearning in Healthcare Conference, Higher Education Academy in Birmingham, in June 2011. The delegates were a mixture of healthcare professionals, eLearning Technology advisors; speakers represented national organizations, such as NICE and the Department of Health.

I am also presenting another workshop related to this project at WONCA in Poland, in September 2011. The President of the Royal College of General Practitioners will be attending this conference.

Moving forward, I intend to follow on from these workshops by preparing submissions for relevant peer-reviewed educational and GP-related journals.

Appendix 1



...more SBAs!

Dr Alena Chong
& Jawad Naqvi

Penny Lane is a 56 year old florist:

- I threw up this morning
- Feeling dizzy, as though I will fall over (30 min attacks)
- When I take orders over the phone I have been making mistakes because I can't hear properly
- I have an annoying buzzing in my ears

What is the most likely diagnosis?

1. Acoustic neuroma
2. Acute labyrinthitis
3. Benign positional vertigo
4. Menière's disease
5. Multiple sclerosis

What medication would you prescribe for her?

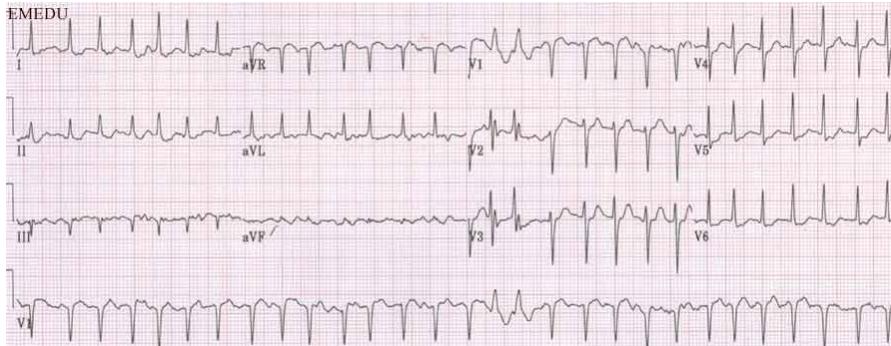
1. Betahistine
2. Domperidone
3. Metoclopramide
4. Ondansetron
5. Prochlorperazine

Discussion

- List 3 differential diagnoses of vertigo
 - What is the underlying pathology?
 - What are the distinguishing features?
- List the treatments for vertigo

Dorothy Peters: 78 years old

- What is the rate?
- What is the diagnosis?



What is the rate on the ECG?

1. <50 bpm
2. 50-80 bpm
3. 80-110 bpm
4. >110 bpm

What is the diagnosis?

1. Atrial fibrillation
2. Atrial flutter
3. Sinus rhythm
4. Ventricular fibrillation
5. Wolff-Parkinson-White syndrome

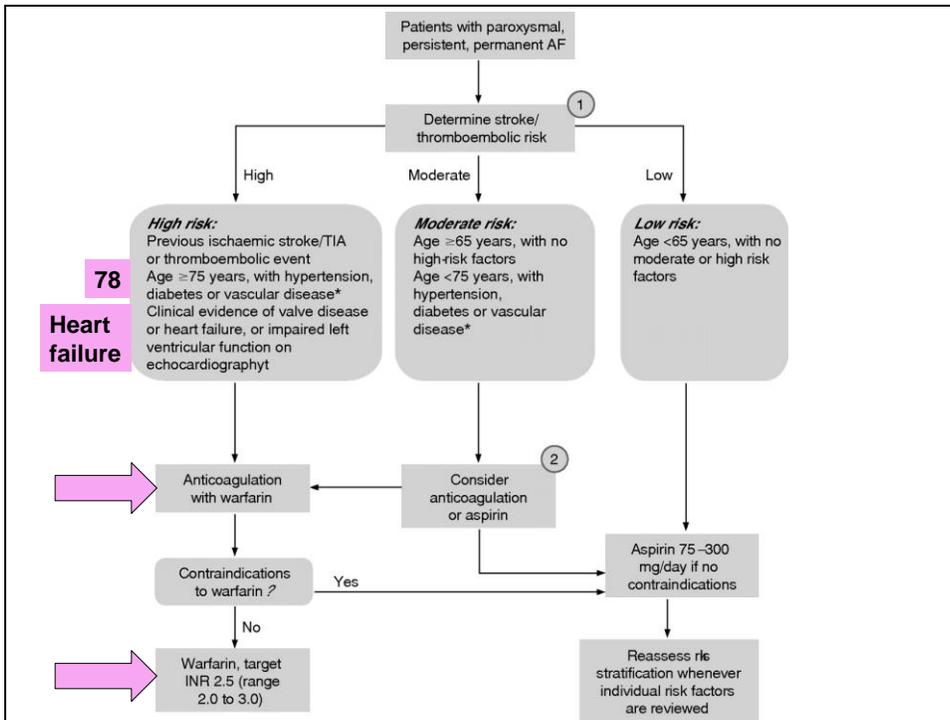
Dorothy Peters: 78 years old

- I'm feeling rather short of breath
- Since 1 week
- Asthma: on inhalers
- Puffy ankles

- Pulse = 149 bpm irregularly irregular
- BP = 132/76
- Bilateral pitting odema (lower third of leg)
- Fine inspiratory crackles on auscultation

Which is the most suitable antithrombotic therapy for her?

1. Aspirin 75mg
2. Aspirin 300mg
3. No antithrombotic therapy required
4. Warfarin (target range INR 1-2)
5. Warfarin (target range INR 2-3)
6. Warfarin (target range INR 3-4)



What is the most appropriate management?

1. Amiodarone
2. Atenolol
3. Bisoprolol
4. DC cardioversion
5. Digoxin
6. Diltiazem
7. Flecanide
8. Sotalol
9. Verapamil

Discussion

- ECG interpretation
- Rate-control v rhythm-control
- Permanent v paroxysmal
- Factors: age, co-morbidities, symptoms
- Drug modes of action
- Drug interactions & contraindications
- Drug benefits v side effects
- Stroke risk stratification algorithm
- Thromboprophylaxis

Why is the answer digoxin?

- Improves symptoms of heart failure and exercise tolerance
- Reduces hospitalisation due to acute exacerbations
- But it does not reduce mortality

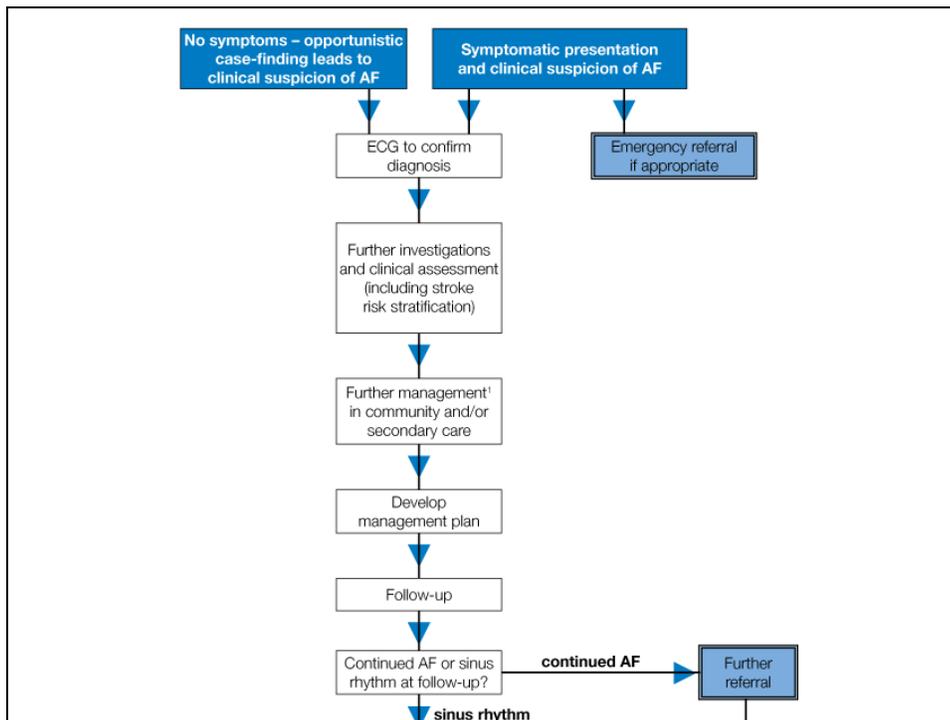
- BNF: p114

Which of the following contributes most to digoxin toxicity?

1. Anaemia
2. Leucopenia
3. Liver impairment
4. Renal impairment
5. Thyroid impairment

What do I know about digoxin?

- What are the contraindications of digoxin?
– BNF: p82
- What are the symptoms of digoxin toxicity?
– BNF: p82
- How would you check for digoxin toxicity?
– BNF: p82



Appendix 2

PRS Evaluation from student worker

- 1) How did the prs project enhance student learning?
- 2) How has the prs project benefitted you?
- 3) How has the prs project developed your own awareness, understanding, knowledge, expertise in e-learning?
- 4) Other courses/teaching sessions that might benefit from PRS through out the medical curriculum Year 1-5?

- 1) The PRS project generally enhanced student learning through a number of processes:
 - a. Active and stimulating learning rather than passive learning made possible with large student numbers: Today many medical schools use the small group problem based learning sessions to encourage an active learning process rather than lectures to impart knowledge to the student. I feel that PRS goes some way to facilitating an active learning process. Lectures can be rather unidirectional (teacher to student) and make the student a passive component to the teaching process. With PRS the communication becomes bidirectional requiring the student to be alert, register the knowledge being imparted and apply this knowledge to questions posed by the lecturer. This can enable the student to identify weak areas, reinforce/reassure them that they have understood the material and provide the lecturer with feedback to improve/identify points they may have failed to address adequately. The major bonus is the efficiency with which each of these points can be addressed – almost instantly within the classroom.
 - b. Allowed the lecturer to identify what avenue to take when multiple topics could be discussed; for example when the students wanted clarification about the GP assignments and there was not enough time to cover all the different assignments; those that most people wanted clarification over could be established through PRS and then the lecturer could be approached individually at the end of the session regarding those assignments selected by the minority. This selectability/variability/flexibility in teaching is transferrable to other teaching sessions and is a major plus point to using PRS as a teaching adjunct.

The PRS project specifically facilitated student learning at our centre:

- a) It enabled an assessment of student's clinical decision making skills and the confidence with which these decisions are made. This is of great importance in clinical medicine where one needs to be able to make decisions in pressured situations, and one ought to be confident about such decisions given that doctors are charged with the care of human beings whose life and death may rest with such decisions.
- b) It enabled situational judgement questioning possible; practical situations/conditions which occur in the workplace could be recreated in the lecture theatre. The students could learn important principles to be applied in future as a doctor. For example how to handle absenteeism of colleagues.
- c) It enabled the testing of clinical guidelines and pathways such as NICE recommendations where subtle differences in management for example of atrial fibrillation and COPD could be highlighted.

Furthermore, it allowed students to learn about the differential diagnoses for clinical presentations and then tested their to identify the most likely differential diagnosis and most appropriate treatment. These are common situations faced in the real world.

- d) It provided a good way to introduce the GP component of the course, revision of important topics such as back pain and also to allow the lecture to talk about areas of the attachment students were unsure about.
- 2) The PRS project benefitted me via two avenues; through participation as an audience member but also through having to construct questions for a session dedicated to clinical decision making within General Practice. As a student answering questions I felt that PRS was a great way of me being able to participate without feeling embarrassed of my answer. I have often felt inhibited in answering questions in large audiences and been shy of approaching the lecturer to answer my questions for fear of appearing inadequate; PRS has gone some way to bridging this gap in an anonymous way. Specifically it highlighted my weaknesses in reading ECG's accurately; I failed to recognise left ventricular hypertrophy and PRS threw light on my misconceived confidence in reading ECGs. This prompted me to direct my learning towards this topic and answer further multiple choice questions to consolidate the self directed learning.

Having to write questions for PRS enabled me to research and become familiar with important clinical presentations and management pathways. I became very familiar with the subtleties in management for example of atrial fibrillation, arrhythmias, vertigo and meniere's disease. The experience will help me in the future to identify and utilise guidelines to manage patients placed under my care. Furthermore, this work taught me how to construct single best answer questions using evidence based medicine. I am sure this work will enable me to strategically approach exam questions I will face as I am now familiar with the perspective of the examiner/question setter.

- 3) How has the PRS process developed my own understanding, awareness, knowledge, expertise in e-learning?

Through exposure to personal response systems I have witnessed how electronic learning can be used alongside traditional learning methods to improve the efficiency of learning. Electronic learning can enable features of the learning cycle as described by Kolb to occur within the setting of the classroom, whereas traditional methods of teaching such as lectures may have only provided one aspect to this learning experience mainly the generalisation/ abstract conceptualisation stage. E-learning, and in particular PRS, now allows students to actively experiment and form concrete experiences through simulated situations. This is especially relevant in medicine where doctors are routinely faced with situational judgements and critical decision making in the workplace.

I now understand therefore that e-learning is a useful tool along side traditional teaching but should not completely replace traditional teaching; they both hold advantages which should be fused to optimise learning. Additionally from this experience I have become more aware of situations where the personal response systems may be useful for example in revision for exams but also as a tool to

help the lecture focus the content of his lecture to the audience. I have learnt therefore that e-learning holds benefits for both the teacher and student.

In terms of the technology and my personal expertise in e-learning I have learnt that Microsoft Powerpoint can be integrated with the PRS system and its remote control devices to successfully perform surveys/assess student responses within teaching sessions. I hope to attain further experience in learning how to create and use the electronic surveys in powerpoint as my experience within this arena was limited.

4) Further use of the PRS system.

Within the medicine MBBS course I would propose use of PRS in the following general situations:

- General lectures – the UCL MBBS course uses mainly a didactic lecture based system of learning; to make this learning a more interactive dynamic two way process, PRS could be used more frequently by lecturers to promote student alertness in lectures but also to help the lecturer assess how well they are teaching. This could be done by setting 5 questions, ranging in difficulty from easy to hard, at the end of each lecture, assessing the core content delivered within the lecture. I think this would promote student attentiveness and provide instantaneous feedback for both student and lecturer.
- Focussed tutorials – as the delivery of teaching in the form of small group based discussion is limited at UCL use of such sessions should be maximised. PRS use prior to such sessions to establish what students would like to learn and then offering sessions within the most popular topic areas in the teaching curriculum would make effective learning. It would also provide course organisers with the likely number of students attending each session so that adequate room booking can take place.
- Revision - the nature of PRS in enabling students to select from a range of options makes it particular suited to multiple choice questioning; UCL frequently examines students using such questioning; hence PRS is an invaluable tool for use in any revision lecture.

Within the medicine MBBS course I would propose use of PRS in the following specific situations:

- Anatomy – the dissection room conducts pre-clinical spotter exams for medical students requiring use of multiple choice questioning. With anatomical pictures and slides PRS could quite easily be used to assess student knowledge.
- Professional development spine – this component of the UCL medical course encourages students to think like doctors; use of PRS here to simulate situations requiring making professional judgements and decisions using the law and professional guidelines would be extremely useful. I think PDS tutors would benefit from use of this system to establish how medical students think prior to their education regarding medical ethics/professionalism and would facilitate teaching to mould student thinking into line with recommended practice. It would also be a useful way in gaining student interaction from those who struggle or do not enjoy group based discussion.
- End of module feedback – instead of relying upon email/internet based feedback which suffer with poor response rates, use of PRS whilst students are within teaching sessions is likely to provide a

greater volume of feedback. However, the timing of such feedback should be planned to ensure students give honest and non-rushed answers; in my view this would be at the beginning of any session rather than the end.

- Medical speciality teaching – as there is limited space and time within the curriculum for teaching within the medical specialty areas of ophthalmology, radiology, oncology etc and that PRS is a particularly streamlined and efficient way of teaching; its use should be maximised here. It would raise awareness of the importance of learning these topics and provide students with an efficient way of learning the salient facts. In particular I feel radiology would benefit as this is a vertical component to the medical school course; PRS/MCQS in radiology offered in each module would serve as a valuable adjunct in teaching.