The virtual patient project: Using low fidelity, student generated online cases in medical education

Michelle Imison and Chris Hughes
School of Public Health and Community Medicine
University of New South Wales

Objectives: This paper reports on an in-progress study of low-fidelity virtual patients (VPs) created by and for medical students at the University of New South Wales. Its goals were to advance the diagnostic reasoning and patient management skills of all participating students.
Methods: Two groups of volunteers from among the University's fifth-year medical students were trained in the use of software programs that enabled them to produce virtual patients. The cases they subsequently created were then reviewed for accuracy by clinical specialists, and are soon to be trialled with more junior student readers.
Results: Student authors, who came to the project with varying levels of technical confidence and ability, were all able to create interesting and engaging cases. Thus far they have produced eleven VPs, and qualitative analysis indicates positive impacts for their confidence in diagnostic pathways, treatment options and consolidation of knowledge. Quantitative analysis of changes in their clinical reasoning abilities is ongoing.
Conclusion: Given the success of the project, it is highly likely that student-created virtual patients will become an optional assessment task for senior medical students in the future, with the added benefit that this will develop a bank of VPs for future use in the program.

Keywords: Medical education, virtual patient, peer learning, VUE, Labyrinth

Introduction

As the sophistication and availability of educational technology has increased in recent years, the 'virtual patient' has become both viable and pedagogically useful. VPs might be variously defined but, for the purposes of this project, they are what the American Association of Medical Colleges describes as:

> interactive computer programs that simulate real-life clinical scenarios in which the learner acts as a health care professional obtaining a history and physical exam and making diagnostic and therapeutic decisions. (AAMC 2008)

Choules (2007:213) notes that virtual patients generally go beyond what might be referred to as simply 'multimedia-enhanced patients' – such as video of a consultation that models good practice in history-taking – to applications that allow students to consider a full clinical scenario, often in narrative format and with degrees of difficulty that can be adjusted to suit learners' skill level. Such VPs are characteristically media-dense ('high-fidelity'), often incorporating video/animation and artificial intelligence features that allow for interaction with the 'patient', scope for physical examination and investigation of test results – a fitting application of technology for problem-based, authentic learning.

There are numerous arguments for including virtual patients in the medical curriculum. As rates of chronic disease in the developed world continue to rise, but outpatient care and shorter hospital admissions become the norm, exemplar cases are less readily available to medical trainees; VPs augment clinical observation and enhance the breadth and consistency of the educational experience. In addition, students report that they appreciate the 'safe' context and structured feedback that virtual patients provide (Bearman 2003:544). Almost all comparisons of media-rich VPs show that they are well-received as pedagogic tools, and at least as effective as standard teaching methods (D'Alessandro et al. 2004; Leong et al. 2003; Zary et al. 2006).

Traditionally virtual patients have been developed either commercially or by clinicians, but this project took a different approach. High-fidelity VPs are both time- and resource-intensive: cost estimates for professionally-created cases range from US$50 000 (Huang 2007:450) to over US$100 000 (Round 2007:20) – and the authors' prior experience demonstrates that medical professionals rarely have time to

source and finalise virtual patients. Hence our interest in low-fidelity VPs – consisting mainly of text and images, with some game-like features (such as scoring) and feedback – developed by students.

The Virtual Patient Project is about introducing and reinforcing for mid-level medical students the skill of diagnostic reasoning: the process of making clinical judgements about individuals' states of health. The project is necessarily limited in the scope of what it can teach about clinical reasoning, and constrained by the still-emerging technology. Its intent is to engage students at a level they can understand, and we hope that the cases they develop will form the basis of a 'bank' of VPs for future use in the medical program. Our twin hypotheses were that developing virtual patients would improve senior student authors' diagnostic reasoning and patient management, and that working through the cases would usefully augment clinical experience and support the development of diagnostic reasoning and patient management in junior student readers.

Methods

The Virtual Patient Project involved Phase 3 (P3: fifth-year) medical students in identifying and documenting suitable case(s) which were then developed into VPs. Two cohorts of volunteers were recruited via an email to P3 students undertaking Medicine, Surgery or General Practice rotations during the first half of 2008; the first group contained eight students (of whom one later dropped out of the project) and the second group five. After signing the appropriate releases and filling out a diagnostic reasoning inventory (DRI) they were trained by a Project Officer, either in small groups or individually, in the use of two software packages used to present virtual patients. They were also given guidance on how to source appropriate cases (with a focus on presentations encountered during Phase 2 (P2) training – that is, third and fourth years), and gain consent from both patients and treating doctors.

Once student authors had gathered their patient's history and (de-identified) copies of relevant test results and images, they were asked to create a decision tree using VUE (Visual Understanding Environment), a concept-mapping program created at Tufts University. The VUE diagram is a global overview of a case and how it fits together, the various elements and choices presented as a series of nodes and links.

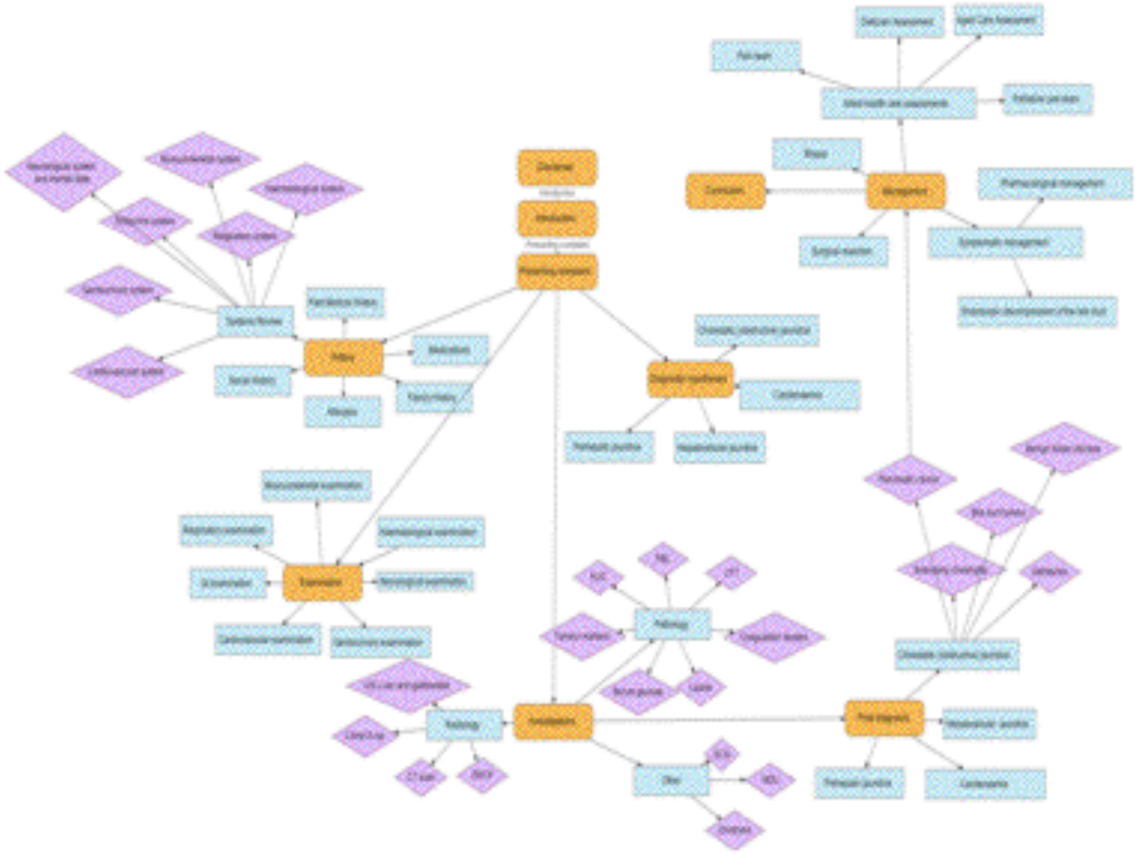

Figure 1: Screen capture of a VUE diagram from a student-generated VP presentation of jaundice

This diagram was then uploaded directly into Labyrinth, an experimental open-source educational pathway authoring and delivery system developed at the University of Edinburgh and now being used in

numerous clinical and educational institutions across the world. Labyrinth is a Web-enabled shell in which cases can be edited, supporting files (images and results) added, and a 'skin' chosen for consistency of appearance.

Completed VPs were reviewed by clinical specialists for accuracy and appropriate level of detail, and the authors instructed as to any necessary changes. The P3 students' participation in the project was brought to a close with evaluative debriefing sessions, and completion of a further DRI. A screen capture from a virtual patient is shown below.

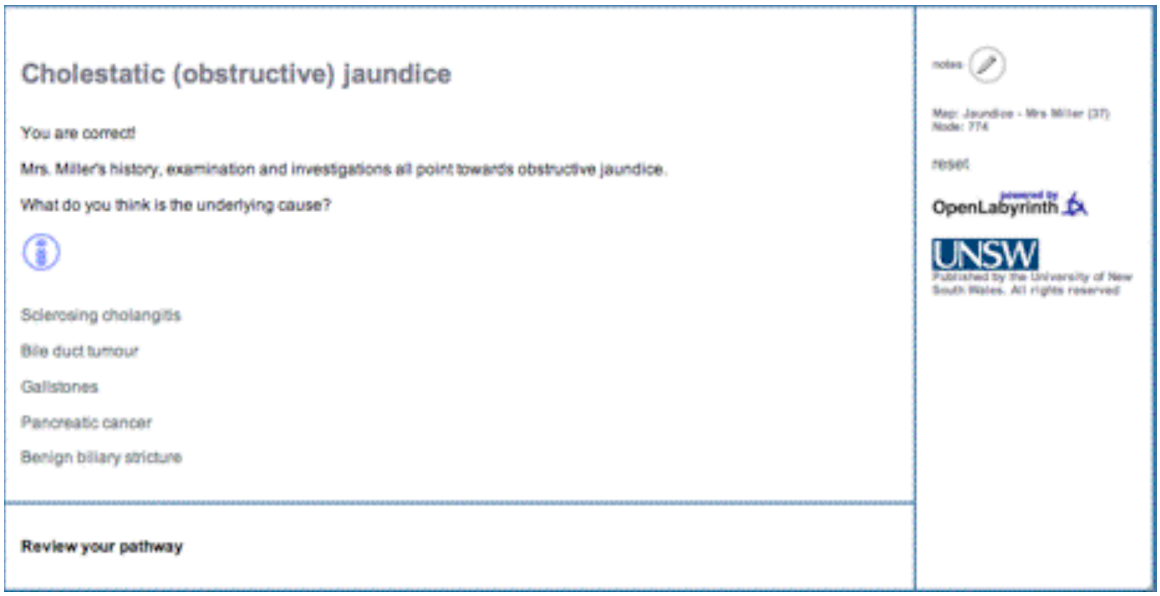

Figure 2: Screen capture from the VP generated from the above VUE diagram. The 'i' icon provides key indicators for the diagnosis of jaundice, and the list below this is a series of clickable choices

Upon completion of this appraisal and editing process by both cohorts of student authors, the VPs will be evaluated by two groups of volunteer P2 student readers (from among those on rotation in various teaching hospitals, and others currently conducting independent research projects). Each group will work through a number of cases – some in common, and several of individuals' own choosing – and then take part in a discussion session. The virtual patients will subsequently be released to all P2 students through their course website, with use assessed by monitoring number and length of session log-ins, and feedback captured through an online survey linked to the VP homepage.

Results

The second cohort of student authors is currently completing its virtual patients, so final results from the study are still pending. However, some emerging trends may be identified.

First, all participating students found the software easy to learn and to use; interactions with them following the training sessions indicated that they had been able to figure out or teach themselves any subtleties of the programs not covered at the outset. Several students noted various features of Labyrinth that had caused them difficulty – including limits on the size of, and ability to edit, graphics files, and the somewhat 'clunky' nature of the node-editing interface – but the program is constantly under review by the developers and most of these faults have now been rectified. In the period between the two cohorts of student authors creating their VP cases, we also made minor refinements to our content and process guideline for the project, based on feedback from participants. These instructions will be further adapted in line with comments from P2 students.

Second, the time and effort student authors invested in the production of their virtual patients, despite heavy classroom and clinical loads, was clear; several students produced multiple VPs and one student has proceeded to work on a further virtual patient after the conclusion of their formal involvement. (It should be noted that participation in this project was not officially part of the course, but may be counted toward students' annual assessment portfolio.)

Third, comments about both the process and outcomes from the students involved have been overwhelmingly positive: 'the whole experience of Labyrinth has been great. I've learned a lot from it'. They remarked that 'I got very confident in the diagnostic pathways and the treatment options because I covered [the case] in more detail' and 'it helped consolidate my knowledge', while mentioning that they had been conscious throughout of tailoring their work to suit the needs of P2 students. Most participants stated that they would recommend the development of virtual patients as a learning activity to their peers.

Conclusion

The Virtual Patient Project was devised with certain key features of the University's medical program in mind – specifically, that it is a student-centred, spiral design, iterative course with a strong focus on peer learning – and it extends these principles. Although the study presented here relates to the discipline of medicine, similar techniques could potentially be applied in any form of case-based learning (for instance, in management or law).

This is a small-scale work in progress, so it would be premature to draw firm conclusions. Nonetheless, given the project's success to date it is highly likely that student creation of virtual patients will become an optional assessment for P3 students in selected courses. This task will be supported by the development of online training packages for VUE and Labyrinth, and storage of required documentation (such as consent forms and intellectual property releases) on the Faculty's VP website, making the process viable and low-maintenance from an administrative perspective. Cases will require expert clinician review for quality control, but it is anticipated that their input will be minimised by thorough student pre-briefing. In time, these consistently-presented cases will become a substantial teaching resource, meaning that the virtual patient bank is also sustainable, and enriched by the work of subsequent cohorts of students.

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References

D'Alessandro, D., Lewis, T. and D'Alessandro, M. (2004). A pediatric digital storytelling system for third year medical students: The Virtual Pediatric Patients. *BMC Medical Education*, 4:10, http://www.biomedcentral.com/1472-6920/4/10 [viewed 27 Feb 2008]

Association of American Medical Colleges (AAMC). Virtual Patient Reference Center http://www.aamc.org/meded/mededportal/vp/start.htm [viewed 14 Mar 2008].

Bearman, M. (2003) Is virtual the same as real? Medical students' experiences of a virtual patient. *Academic Medicine*, 78(5), 538-545.

Choules, A. (2007). The use of elearning in medical education: a review of the current situation. *Postgraduate Medical Journal*, 83, 212-216. http://pmj.bmj.com/cgi/content/full/83/978/212 [viewed 19 Feb 2008]

Huang, G., Reynolds, R. and Candler, C. (2007). Virtual Patient Simulation at U.S. and Canadian Medical Schools. *Academic Medicine*, 82(5), 446-451.

Leong, S., Baldwin, C. and Adelman, A. (2003). Integrating web-based computer cases into a required clerkship: Development and evaluation. *Academic Medicine*, 78(3), 295-301.

Round, J. (2007) Creating your own virtual patients. *The Academy Subject Centre for Medicine, Dentistry and Veterinary Medicine Newsletter 01, no. 13*, 20-22. http://www.medev.ac.uk/newsletter/01.13.html [viewed 10 Mar 2008].

Zary, N., Johnson, G., Boberg, J. and Fors, U. (2006). Development, implementation and pilot evaluation of a Web-based Virtual Patient Case Simulation environment – Web-SP. *BMC Medical Education*, 6:10, http://www.biomedcentral.com/1472-6920/6/10 [viewed 27 Feb 2008].

Author contact: Chris Hughes. Email: c.hughes@unsw.edu.au

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