



## Case study 4: Developing professional practice using simulations

Peninsula College of Medicine and Dentistry, Universities of Exeter and Plymouth

### What this case study covers

- **Subject and level:** Year 4 higher education undergraduate dental students
- **Topic:** Extending learning opportunities by enabling students to practise hard-to-teach skills supported by detailed formative assessment feedback
- **Technologies used:** Bespoke web-based system using standard technologies such as HTML, PHP, MySQL, XML, Flash<sup>®</sup>, FMV Video, JavaScript<sup>™</sup> Video

### Background

The Peninsula College of Medicine and Dentistry (PCMD) is a collaborative initiative between the Universities of Exeter and Plymouth and the National Health Service for Devon and Cornwall.

The Peninsula Medical School opened in 2002 and was followed by the opening of the Peninsula Dental School in 2007, the first new dental school to open in the UK for 40 years. PCMD operates from ten different locations in Exeter, Plymouth, Truro, Torbay and North Devon. Facilities include centres in Devonport, Exeter and Truro where supervised services provided by dental students in training are available free of charge to patients.

PCMD offers a range of courses in clinical science, dentistry and medicine at undergraduate and postgraduate level. Research within PCMD focuses on four main themes: diabetes, cardiovascular risk and ageing; neuroscience (embracing both neurology and mental health); health services research; and environment and human health. The dental school has places for 64 students a year.

This case study focuses on the experiences of Year 4 dental students

## **Vision**

Undergraduate dental students at PCMD are developing their professional practice using interactive online simulations of real patient scenarios to help them master the specialised skills of treatment planning.

The Bachelor of Dental Surgery degree at the college has a focus on learning in a clinical context. Students are involved in community-based projects and undertake supervised work for the public. The introduction of the Dental Virtual Patient (DVP) suite was designed to augment and extend learning, not to replace real-life practice. It is used to support formative rather than summative assessment.

## **Transforming practice**

### **Augmenting real-life working and developing students' professional practice**

Treatment planning is an important part of the final year dental curriculum and is difficult to master. It is a competency that develops over time, requiring exposure to a range of different case studies. It is not uncommon for even qualified dentists to refer complex cases to specialist consultants for treatment planning. The senior academic member of staff responsible for year 4 students felt that it was essential that graduates from PCMD left with a good understanding of treatment planning and the foundation on which to develop their future practice.

In addition, students need to be aware of uncommon clinical scenarios, but may not always have an opportunity to engage with these at more than a theoretical level during training.

At PCMD, the e-Learning Support group presented research into the use of virtual patient systems within medical education to the Clinical Learning group. While the main focus of the PCMD is to encourage students to see as many real patients as they can, the dental clinical academic and learning technologists identified treatment planning as a curriculum area which offered an opportunity to explore the benefits of using a virtual patient system.

The virtual patient system was designed to extend and further develop students' professional practice using a series of complex clinical situations that students do not normally see until much later in their careers. The ability to provide this experience in a safe environment and without incurring risk to patients satisfies a particularly acute need in the medical and healthcare professions.

### **Collaboration between academic specialists and learning technologists**

The development of the DVP suite was a collaborative project involving academic staff and learning technologists in the college's e-Learning Support group. Both parties brought specialist skills and knowledge to the partnership that were essential to the ultimate learning design of the DVP suite, combining a detailed understanding of the curriculum and core learning concepts with technological possibilities.

After conducting a review of available systems (including commercial), the project team decided that a bespoke system was necessary to address the complexities of providing high-quality feedback in cases where multiple approaches to treatment are possible.

The DVP suite was built using standard browser-based technologies to present a series of five interactive scenarios to students. The user interface simulates interaction with virtual representations of real patients who have consented to be filmed, photographed and recorded. Information relevant to each case study is made available, for example CT scans, X-rays, bite moulds, diagnostic aids and patient notes. Examination results are included within the interface but only released to the students on request to encourage them to investigate thoroughly, and to introduce further realism in terms of cost and timescales.

Students 'examine' each virtual patient in detail by drawing on the information available before completing dental charts, making a diagnosis and developing their own treatment plans from scratch. Students who successfully diagnose the correct conditions and recommend an appropriate course of treatment are rewarded with a video summarising the treatment used in the actual case from the patient's perspective.

The system has been tested and refined many times in response to feedback from practitioners, students, learning technologists and assessment experts. The students' reactions are encouraging and indicate that they value opportunities to rehearse future interactions with patients.

A detailed user guide is available to download within the system and includes guidance to ensure students are working with the optimum settings for their hardware and software set-up.

## **Providing detailed feedback**

Assessment for learning rather than assessment of learning was a key design decision. The development team sought to provide a supportive and safe learning environment – safe for patients and safe from exposure in front of peers.

The DVP suite tracks students' use of the tool and enables tutors to monitor progress. The automated feedback is detailed and includes assessment of the patient-history-taking, charting, diagnostic and treatment-planning skills as well as prompts to facilitate reflection on learning.

Although the system allows students to revisit the case studies at any time, their first responses are recorded for later discussion on an individual basis with their tutors. A group plenary session is held to discuss any emerging issues, provide clarification on any aspect and/or to manage gaps in understanding.

## **Benefits**

Students are able to engage with a series of real-life scenarios in a sophisticated and realistic way. The use of video and detailed photographic, radiographic and pseudo-3D modelling information makes the experience immersive; users have commented on the realism and value of the virtual patients who 'answer' questions posed by users who choose from a series of pre-programmed questions. These types of encounters, which combine active learning with learning that is situated in a realistic context, are widely considered to provide valuable experiential learning opportunities.

The detailed formative assessment feedback and opportunities to revisit the scenarios support diagnostic practice – being able to go back to a scenario and adjust treatment plans and receive detailed feedback on each occasion is valuable and promotes analytical and reflective practice. The DVP suite also serves as an important revision tool.

The PCMD now uses a scalable 'template' approach that makes the process of interviewing patients, inserting video content and generating the data and assets for each patient case much quicker. This approach reduces the cost and effort of producing new scenarios and opens up possibilities to explore use in other disciplines where there is not necessarily one solution but there may be multiple valid solutions.

## Useful to know

- The involvement of the in-house e-Learning Support group has provided the advisory and development role, working with core dental academic staff as the content experts. The collaborative process has been critical to the success of the DVP suite, particularly in terms of technical support and in developing multiple routes through the material and robust feedback. Working with someone who did not have a dental background challenged the academic team to give deeper feedback and provided a better understanding of how approaches may work or fail and why. This contributed to the robustness of the final product. Objective reviews were also conducted with dental colleagues unfamiliar with the scenarios.
- All the subjects are patients known to the year 4 lead clinical academic member of staff, and they have given their full consent to the information, images, models and sound recordings being used. Further care over confidentiality may be necessary if resources are to be made more publicly available.
- The realism that videos and photographs affords appears to have made the learning more engaging for some students who found the human elements powerful. Feedback received indicated that students are able to relate more closely to the footage of real people than when using other simulated approaches such as 3D avatars or the Simulated Dental Learning Environment, a purpose-built suite of 34 dental chairs that allows students to learn how to deliver dental treatment in closely supervised simulated clinical surroundings.
- Ease of use was a key consideration. Students needed little or no support beyond the initial induction, although a help manual is provided. An introductory case has been created for the purpose of induction. The system is designed to work on low-specification machines.
- Senior management support and strong organisational buy-in has been instrumental in providing sufficient resources to aid development of the DVP suite. External interest has also come from the General Dental Council following a demonstration of an early prototype.

## Moving forward

The introduction of the DVP suite is enabling the college to extend the learning experience and develop student skills essential to professional practice.

The complex decision-tree approach, in which there is more than one right answer, has enabled the college to develop a sophisticated formative assessment tool. This tool may be applicable, with appropriate adaptations, within the medical programme to expose students to areas in which, for many reasons, it is difficult or impossible to

provide patient encounters, such as tropical diseases, mental illness and paediatric care. It may also provide a good vehicle for the further enhancement of PCMD's patient-centred learning approach.

The college plans to expand the DVP portfolio using the student-generated case studies that they compile during their final year, and to develop a series of less complex case studies to support year 2 students.

The potential to use the system to support professional updating for qualified dentists is also being explored; the DVP suite may provide a safe environment and overcome the fear of failure in front of peers that even qualified professionals sometimes experience.

### **Learner perspective**

Capturing students' feedback at all stages of the development of the DVP suite and thorough testing of prototypes have been strong features of the development process. Information about the experience of final year dental students has been gathered from observations, questionnaires and built-in feedback mechanisms within the system.

Comments from students reveal that the resource is well received:

*"A good way to quickly see many different cases and practise diagnosis and treatment planning."*

*"I find the VPs [virtual patients] a very useful learning tool and a good opportunity to treat patients I wouldn't otherwise meet."*

*"I liked the immediate feedback after completion and good feedback on what was right or wrong."*

*"It is really representative of real cases and the results are instant."*

*"Revised treatment planning and diagnosis is a really good concept."*

## **Tutor perspective**

Feedback was also sought from staff involved in other e-assessment activities, and all year 4 students and their tutors who are now using the system.

*“Use of the system has highlighted the need to pay attention to details of cases, charting etc. [This is] a very important lesson to learn and take forward into practice.”*

*Sally Hanks, Lecturer in Clinical Dental Education, PCMD*

## **Reflect and discuss**

The approach taken by PCMD was deliberately to focus on an approach that supported assessment for learning by placing this at the centre of the design of the DVP suite and by making the experience as realistic as possible.

- What opportunities exist in your own practice to extend or augment professional practice using carefully designed simulations?

## **Key words**

Assessment for learning, formative assessment, interactive online learning, professional practice, simulated learning, virtual worlds.

## **Links and further reading**

Peninsula College of Medicine and Dentistry [www.pcmd.ac.uk](http://www.pcmd.ac.uk)