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To cite this article: Thomas Dale MacLaine , Cornelia Juengst , David Harris , Catherine Fenn , Helen Gabathuler & Sue Davies (2020): The (future) doctor will see you now: Piloting a longitudinal virtual patient in medical education, simulating general practice, Medical Teacher, DOI: [10.1080/0142159X.2020.1853689](https://doi.org/10.1080/0142159X.2020.1853689)

To link to this article: <https://doi.org/10.1080/0142159X.2020.1853689>



Published online: 08 Dec 2020.



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## The (future) doctor will see you now: Piloting a longitudinal virtual patient in medical education, simulating general practice

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### ABSTRACT

**Introduction:** Virtual patients provide numerous learning opportunities for medical students, yet only support one-off patient interactions. To emulate general practice, allowing multiple encounters with a single patient, a new longitudinal virtual patient (LVP) was developed.

**Methods:** The LVP was integrated into 2nd year at a graduate-entry medical school, in the 2019/2020 academic year. Students were asked about their prior experience and expectations of LVPs, before they engaged with two consultations and one results session. Data were collected from this survey and from the engagement with the LVP. Feedback was collected and thematically grouped.

**Results:** Survey responses indicated that 1.7% (2/120) had previous experience with virtual patients, and the majority expected the LVP to make a difference to their clinical reasoning. Out of the 142 students engaged with the LVP, 53% completed over 75% of the work. Informal feedback arose around accessibility, professional learning and development, and engagement with the LVP module.

**Discussion:** The data indicate that LVPs are agreeable to medical students, with good engagement and positive reports of clinical learning.

**Conclusion:** Future work exploring reasons of engagement or lack of, will support refinement of the LVP to accommodate the learning needs of the medical students.

### KEYWORDS

General; clinical skills; patient management; methods; e-learning/ computers.

### Introduction

Virtual patients (VPs) are computerised simulated patients, intended to serve as an educational platform. VPs are often used to deliver medical training: history-taking (Deladisma et al. 2008), communication skills (Foster et al. 2016), professionalism, and physical examination (Deladisma et al. 2009).

Students find VPs engaging (Poulton et al. 2009) and improvements in clinical reasoning through VPs may be comparable to real patient encounters (Cook and Triola 2009). VPs facilitate students to frame their learning about clinical cases in their own time, without exposing patients to any educational mistakes. Currently, patient consultations are frequently performed as video and online consultations, especially in general practice (Greenhalgh et al. 2016). VPs provide opportunities to train students before exposing this learning curve to real-life patients. Limitations to VPs include reduced access to immediate tutor support, relies on students' technology access and skills, and students may require additional prompting to encourage engagement.

VPs are rarely longitudinal. In general practice, physicians will meet patients several times throughout their life, with variable frequency. There is need to consider longitudinal VP (LVP) encounters to emulate reality. LVPs are likely to have greater engagement when embedded into medical training. They especially support spiral curriculum integration, building more complex concepts onto previously understood knowledge (de Cates et al. 2018).

This article details an observational pilot study, reviewing students' expectations, engagement and feedback regarding a newly constructed LVP.

### Methods

Proposals for this work were ratified by the Learning and Teaching Committee, at Warwick Medical School (WMS) and received institutional approval. No funding was received for this work. The LVP was designed without specific VP software, instead exclusively using H5P and Moodle (Moodle PTY Ltd. 2020) – routinely used at WMS. This work was approved as a pilot for 2nd year students, as an optional component of the graduate-entry MBChB programme. Students voluntarily completed a pre-engagement survey, using Likert Scales and single answer multiple choice questions. Questions included previous experience with VPs and expectations of the LVP.

Posel's guidance on storyboarding (Posel et al. 2009) framed the development of the LVP, creating a sequence of episodes simulating a clinical case which identified key learning topics within the 2nd year. The episodes were quality assured by general practitioners, medical educators and a medical student. Episodes were released to 2nd year medical students once per month on Moodle, with test results and clinical communications being shared between episodes, simulating general practice.

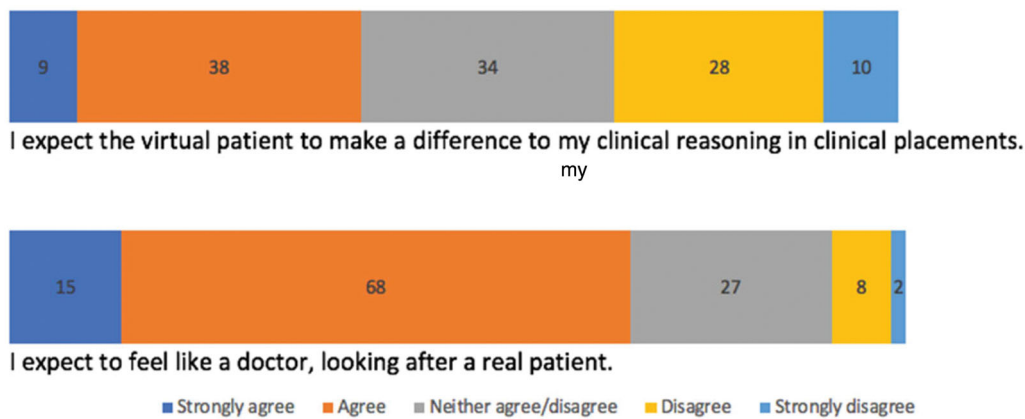


Figure 1. Responses to pre-engagement survey – expectations of longitudinal virtual patient.

Episodes were structured to encourage students to follow the Calgary-Cambridge consultation model (Kurtz and Silverman 1996). Throughout each stage of the consultation, questions aimed at developing students' critical clinical reasoning are proposed, with either occluded suggested answers or links to reliable resources available. Photos were embedded into the case to supplement learning, such as ocular findings in hypertension and graphs representing changes in blood pressure. Episodes conclude by highlighting covered learning objectives, clarifying how the encounter maps to the course curriculum. Institutional ethical approval was received. Data regarding percentage of episode completed and date of engagements were collected at 2-week intervals. Informal voluntary feedback from students to the team, conversationally or via email, indicates areas of interest for further exploration through formal evaluation.

Formal participant centred feedback, using combined qualitative questionnaires and interviews, will be collected at the end of the pilot. The primary focus will be to explore the effectiveness of LVPs as a learning tool, matched to Kirkpatrick levels (Kirkpatrick 1996).

## Results

Of the 120 responses to the pre-engagement survey, two students had experienced VPs before, three were unsure, one did not complete this question, and 114 had no previous experience. Students agreed that they expected the LVP to make a difference to their clinical reasoning and to feel like a doctor looking after a real patient (Figure 1).

At the time of this article, three encounters had been released: episode 1 (released 24 March 2020), results from episode 1 (8 April 2020) and episode 2 (21 April 2020). Due to unforeseen capacity and curricula changes as a result of COVID-19, evaluation of the currently available episodes was prioritised over the production of additional episodes. By 06 May 2020, 142/196 medical students had engaged with the LVP. 53% had completed 75–100% of all encounters, with only 4% having completed <25%.

Informal feedback centred around three main areas: accessibility, professional development, and engagement. Students enjoyed clinical reasoning questions and text response fields on a separate page to the suggested

answers. Students would like to have a summary care record available in each episode, similar to what is in General Practice. The clinical application and ability to test current knowledge was appreciated. Some asked for clarification on interpretation of national guidelines, investigations, and whether the episodes were mandatory.

## Discussion

WMS medical students are new to learning through VPs. Pilot data suggest students consider VPs to be an opportunity to improve clinical reasoning. Students were optimistic that they would feel like doctors looking after a real patient, which may be due to the nature of having a VP and limited experience with the platform.

This article details promising results, showing that the majority of the year engaged with the optional LVP course content. With over half of the course having completed over 75% of the LVP content, data suggest LVPs are agreeable learning aids.

Overall, informal feedback was very positive. The integration of the LVP into pre-existing and familiar software may have been the reason for the positive feedback and engagement. One limitation is that we have only received informal feedback. Future works include a thorough evaluation, including pre-test and post-test surveys, interviews and focus groups. We are improving the episodes in light of the informal feedback, in preparation for the future academic years' experiences.

There was positive engagement from the majority of 2nd year students. Students may prioritise mandatory course material over the LVP. They may have been delayed to complete the LVP, intending to engage after our evaluation cut off. These pilot data is limited by not including other academic years. It may be that engagement differs across different stages of the curriculum. Future work will aim to identify differences in engagement with LVP episodes across other years.

VPs are becoming prevalent in education, though are typically one-off encounters. These data indicate that students are eager to explore learning through LVPs, and whilst the students had limited experience with LVPs, they report the LVP is beneficial to their learning.

## Conclusion

This evaluation explored students' expectations with LVPs and their engagement with a newly developed LVP. Students were optimistic about the learning outcomes achievable from participating in the LVP. Preliminary results showed that the majority of students engaged with the material, and overall feedback was primarily positive. Future work needs to explore how to further improve engagement, provide additional accessibility options and to collect a wider dataset on perceptions of the LVP through qualitative research.

## Disclosure statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

## Author contributions

CJ, DH, CF, HG and SD developed the premise of the work.  
CJ, DH, CF, HG and SD wrote teaching episodes for the work.  
All authors participated in quality assurance of the work.  
TDM wrote the first draft of the article.  
All authors edited and commented on the versions for this article.

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