A Three Dimensional Virtual Medical Imaging Computed Tomography Suite: Innovation in Education

Therese Gunn, Deborah Starkey, Pete Bridge, Clare Berry, Vicki Braithwaite, Gaynor Mahoney, Pamela Rowntree, Kelly Wilson-Stewart

Medical Radiation Sciences
Queensland University of Technology

The Medical Imaging Training Immersive Environment (MITIE) Computed Tomography (CT) system is an innovative virtual reality (VR) platform that allows students to practice a range of CT techniques. This project has been made possible by funding from Health Workforce Australia: Simulated Learning Environments Initiative.

**Aim:**
The aim of this pilot study was to harvest user feedback about the educational value of the MITIE CT application to inform future pedagogical development. This presentation reports on the use of this technology for skills training and blurring the boundaries between academic learning and clinical skills training.

**Background:**
Computed Tomography (CT) is an expensive but widely utilized clinical imaging tool in both Medical Imaging and Radiation Therapy. This modality utilizes radiation to obtain “slice” information and produce high quality medical images from the large image datasets acquired. In the academic environment, students are currently able to use image viewing software to review and manipulate image datasets but do not have hands-on access to CT equipment, and therefore the image acquisition phase of the technology, until placement in the clinical setting.

**MITIE CT** is a 3D VR environment that allows students to manipulate and position a patient, set CT technical acquisition factors including IV contrast dose and dose rate in a safe but realistic setting. MITIE CT is desktop accessible and is available for students to use independently as either a 2D system or as a 3D system with the use of individual active 3D shutter glasses. As with VR initiatives in other health disciplines, the software mimics clinical practice as much as possible and uses 3D technology to enhance immersion and realism. The software was in development and was developed in 2013 by the Medical Imaging Course Team at Queensland University of Technology with funding from a Health Workforce Australia “Simulated Learning Environments” grant and the support of End2End Visuals and Siemens Australia.

Because of the radiation dose associated with this modality, it is important students have a good understanding of the technical CT acquisition approaches to ensure high quality acquisition with minimal radiation dose to the patient. The development of MITIE CT has focused on technical acquisition parameters including patient positioning and contrast injection timing. The virtual environment has provided a “safe learning environment” in students are able to explore approaches to acquisition and actively investigate the consequences of technical factor choices.

**Method:**
55 current 3rd year Mi students were asked to volunteer for a focus group session trialing the development phase on MITIE-CT. The cohort of students had completed the formal academic CT units of study, and also completed an intensive period of CT placement in the clinical setting. 12 students volunteered to participate in an individual immersion following by focus group discussions. The project was given ethics approval by Queensland University of Technology’s Ethics Committee (1300000005). Students followed a user guide and tutor instruction to work individually through a CT scan of a “Non Contrast Brain” - 45 minutes. Students were asked to provide feedback and a detailed focus group discussion with an independent facilitator followed. Feedback sought included student evaluation of: ease of use of the program, usefulness of the program, enhancement of CT understanding, correlation with clinical CT experiences, and impact, if any, on clinical CT skills. Data providing details on student perception of the use of MITIE CT as an immersive environment for undergraduate medical imaging student training was collated.

**Results:**
Of the 12 students that participated, the results yielded an overwhelmingly positive response, as highlighted in Table 1. Students were asked if they felt the program was enjoyable and easy to use, with 75% agreeing with these statements. Importantly, over 75% of the students perceive this learning resource to improve their clinical CT technical skills, whilst 83% felt it not only enhanced their understanding of the theory they had learnt by conventional pedagogy, but that utilizing MITIE as a learning resource would also increase their confidence in applying this skill clinically. The software is available in both 2D and 3D, and it was confirmed that for this particular application, students perceived 3D was of no benefit other than “a novelty”. The highlight of this particular feedback was 100% of the students agree with the statement that: “there is a good correlation between MITIE CT and clinical CT experience”. This premise forms the basis for successful virtual reality simulations as demonstrated in other studies including, but not limited to, endotracheal intubation, bronchoscopy and arthroscopic simulators.

**Direct Student Feedback:**
“It is a great resource, the future of learning”

“Now all puzzle pieces will fall together before going to clinical so students can be an asset to an often busy CT department”

“The CT room and patient positioning is a very good reflection of real life situations”

“It means more practice/repetition = more confident in clinical environment...able to focus on the patient than if they were having to concentrate on physical exam”

“Good stepping stone between lectures and clinical practice”

**Table 1: Student feedback on MITIE CT - pilot study**

<table>
<thead>
<tr>
<th>Focus group questions</th>
<th>5 yes</th>
<th>5 no</th>
<th>2 no</th>
<th>0 no</th>
<th>understand</th>
<th>total</th>
<th>comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to use?</td>
<td>X</td>
<td>75%</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>10</td>
<td>very useful</td>
</tr>
<tr>
<td>Enjoyed using?</td>
<td>X</td>
<td>75%</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>10</td>
<td>very enjoyable</td>
</tr>
<tr>
<td>Useful?</td>
<td>X</td>
<td>83%</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>10</td>
<td>Useful</td>
</tr>
<tr>
<td>Outside hours use?</td>
<td>X</td>
<td>87%</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>Outside hours use?</td>
</tr>
<tr>
<td>Enhanced understanding CT techniques?</td>
<td>X</td>
<td>89%</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>10</td>
<td>Enhanced understanding CT techniques?</td>
</tr>
<tr>
<td>Clinical CT skill improvement?</td>
<td>X</td>
<td>75%</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>10</td>
<td>Clinical CT skill improvement?</td>
</tr>
<tr>
<td>Increase clinical confidence?</td>
<td>X</td>
<td>92%</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>10</td>
<td>Increase clinical confidence?</td>
</tr>
<tr>
<td>Did you use 2D mode?</td>
<td>X</td>
<td>100%</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>10</td>
<td>Did you use 2D mode?</td>
</tr>
<tr>
<td>Did you use 3D mode?</td>
<td>X</td>
<td>100%</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>10</td>
<td>Did you use 3D mode?</td>
</tr>
<tr>
<td>Is there a positive correlation between MITIE CT and clinical CT?</td>
<td>X</td>
<td>100%</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>10</td>
<td>Is there a positive correlation between MITIE CT and clinical CT?</td>
</tr>
</tbody>
</table>

**References:**