

## Novel Integration of a Life-Sized, Immersive Virtual Instructor with a Mannequin-Based Procedural Simulator to Teach Central Venous Catheterization.

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**Background:** Mannequin-based simulators are increasingly used to teach a variety of clinical skills. We have previously reported the use of life-sized, interactive virtual patients in teaching and testing communication skills. In this study, we report a pilot effort to integrate a virtual instructor (VI), a life-sized projected avatar, with a mannequin-based procedural simulator to teach central venous catheterization (CVC).

**Methods:** Fourth year medical students (n=12) at the Medical College of Georgia (MCG) interacted with a VI who took the learner through the steps of CVC (Figure 1). Each subject completed a baseline survey to assess previous experience, preparation for and anxiety in performing the procedure. Subject knowledge of indications, contraindications, and anatomical landmarks for the procedure were also assessed. After interacting with the VI, participants attempted CVC through the right internal jugular vein using the CentraLine Man™ (Simulab Corporation). After the simulated procedure, subjects completed an exit survey to reassess their preparation and procedural anxiety and to test knowledge gained from the module. Outcomes were compared using paired t test,  $\alpha=0.05$ .

**Results:** The majority of students (58.3%) had never attempted CVC and felt anxious about performing the procedure. Of the 5 students (41.7%) who had attempted CVC, only one student (8.3%) had attempted an internal jugular vein CVC. After the simulated procedure, learners reported that they were more prepared to perform CVC and they scored better on the post-interaction quiz (Table 1).



Measure	Pre-simulation	Post-simulation	$\Delta$
Preparation <sup>1</sup>	2.17±1.19	3.67±0.78	1.50±1.38*
Anxiety <sup>2</sup>	3.58±1.00	3.25±1.06	0.33±0.89
Knowledge <sup>3</sup>	5.33±1.78	8.67±0.65	3.33±1.50*

<sup>1</sup>Likert scale 1=least prepared 5=most prepared.

<sup>2</sup>Likert scale 1=least anxious 5=most anxious.

<sup>3</sup>Score out of a possible 9.

\* p<0.05

**Conclusions:** Interaction with the VI and CentraLine Man™ increased student preparation and knowledge for performing CVC. This novel integration of a VI and a procedural trainer could be a useful tool for teaching CVC to novice learners and represents a prototype for the future integration of avatars and mannequin simulators.