

Basil room
4.10-4.25pm

AusCue: Cardiac Auscultation Simulator for Medical Training

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Cardiac auscultation is a basic and essential component of undergraduate medical students' training in the early clinical years. It provides insight into the diagnosis of patients with various types of heart diseases such as valvular heart disease or congenital heart disease (Chizner, 2008; Kagaya, et al. 2017). To achieve competence in cardiac auscultation, students and clinicians have to examine patients with a wide variety of cardiac conditions and encounter similar diagnoses frequently (Jones et al., 1997). With limited availability and accessibility of patients with cardiac problems, medical schools often use simulators such as Harvey® CPS (Harvey® Laerdal Medical, Miami, FL, USA) to teach auscultation. Harvey® CPS is one of the commonly used simulator and was being compared in 14 out of 18 studies in McKinney et al (2012) meta-analysis. Although the analysis demonstrated that simulators are an effective educational intervention for cardiac auscultation skills with consistent and positive benefits, there is a lack of studies looking at the instructional design features for effective simulators (McKinney et al., 2013). Therefore, in the present study, we demonstrate the shortcomings of existing simulator and a prototype that could potentially improve the learning experience of undergraduate medical students.

We analysed the Harvey simulator using the features of medical stimulation that led to effective learning by Issenberg et al (2005) and interviewed two anatomy professors from National University of Singapore (NUS) and four undergraduate medical students for insights related to Harvey (refer to Table 1). The three key findings are the need for feedback on locating the auscultation areas, accessibility of the simulator and option to learn with a group or instructor.

Table 1. Comparing Harvey to features of medical stimulations that lead to effective learning

Features for effective learning (Issenberg et al., 2005)	Harvey® CPS	Gaps for improve
Feedback		Dependent on instructor to provide feedback on auscultation areas and sounds
Repetitive practice		Limited access as simulator time is limited and setup requires training to operate simulator
Multiple learning strategies		Cumbersome for instructor centred format or small group discussion because everyone is listening to the electronic stethoscope
Range of difficulty level	10 patient cases	
Clinical variation	Covers 50 different heart conditions	
Controlled environment	Students can make, detect and correct errors without adverse consequences	
Individualised learning	Participate by auscultating	
Defined outcomes	Dependent on instructor and curriculum	
Simulator validity	Validated cases	
Curricular integration	Part of existing curriculum	

AusCue is a prototype designed by a group of industrial design undergraduate students and iterated with undergraduate medical students to improve the learning experience. For guidance on the auscultation areas, students can lift up the shirt on the simulator to read the guiding text (refer to Figure 1). Alternatively, students can explore the areas with the simulator's stethoscope. When the bell of the stethoscope is placed within the correct area, the indicator on the stethoscope will turn green and red if it is incorrectly placed (refer to Figure 2).

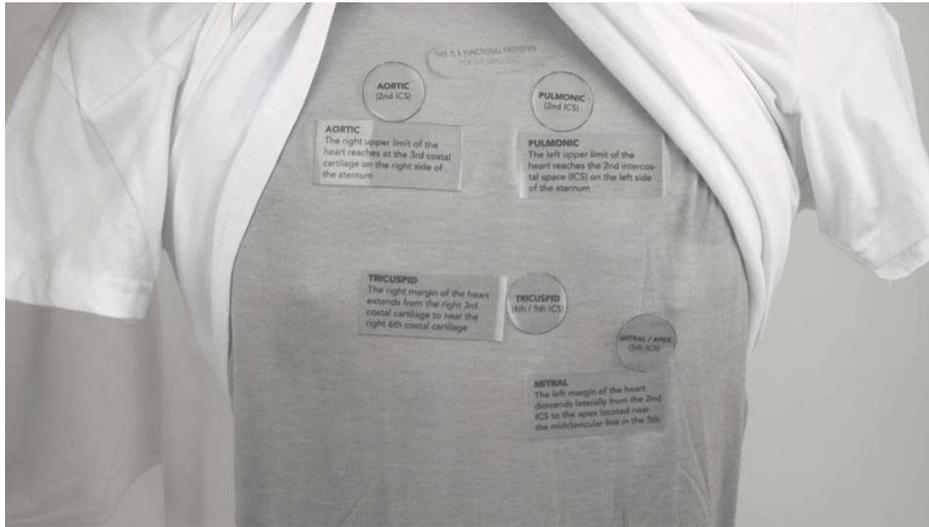


Figure 1. Text to guide students on the auscultation areas



Figure 2. Coloured indicator on the stethoscope to show correct or incorrect areas

To allow for repetitive practice, the system is made easy to set up and is portable. In addition, heart sounds are played over a speaker and not heard only on using a stethoscope, so as to enable discussions to take place. The feedback from the medical students and professors are positive and encouraging. Future studies and iterations could be done to improve the learning experience of cardiac auscultation training.

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Keywords

Simulation, medical education, cardiac auscultation, heart sounds

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