



Recognizing Heart Murmurs: Using Simulation-
Based, Self-Directed Learning for USMLE Step
One Preparation
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Medical Education Snapshots: Part 1
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Collaborative Team Members

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Rationale/Need

Rationale or need for the educational activity, such as:

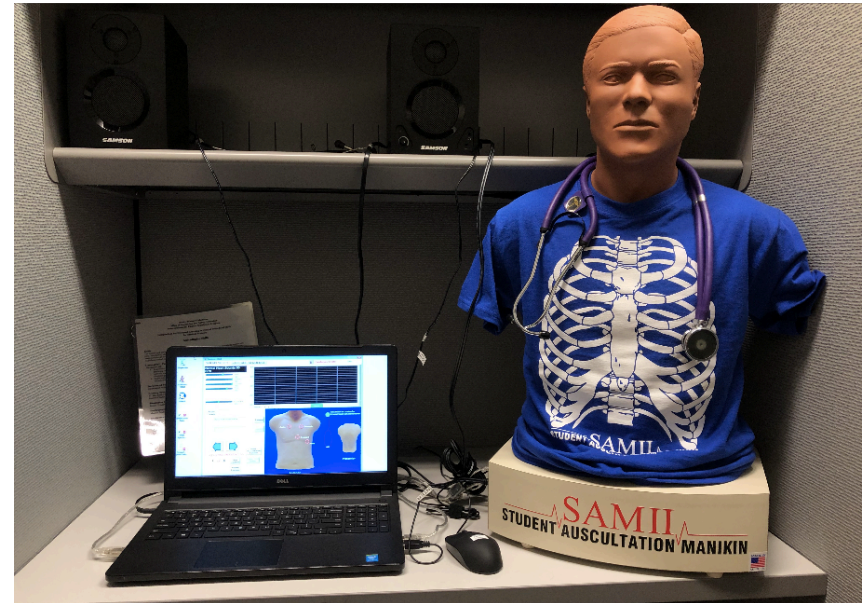
- **Education Gap:** Auscultation technique and identification in pre-clinical years
- **Population:** First and Second year medical students; possible expansion to other health sciences
- **Educational Strategy:**
 - Initial: Self-Directed Heart Murmur Auscultation Simulation using Cardionics II Simulator
 - Expansion: Heart Murmur and Congenital Heart defect Flipped classroom

Why Self-Directed Simulation?

- The integration of clinical simulation modalities into the basic science curriculum has been shown to improve retention of material and medical student satisfaction with their educational experience (Dyrbye et al., 2011).
- It has been shown that self-directed simulation has produced learning outcomes that are equal to faculty-directed simulations and actually take less time for the students to complete and are less burden on faculty (Brydges et al., 2013).

Methods: Materials

- First Aid, Boards and Beyond and USLME
- SAM II Student Auscultation Manikin (Cardionics) containing a sound library
- Auscultation Device: headphones or stethoscope provided



Methods

- 113 (65: 2019; 48: 2020) second-year medical students voluntarily enrolled in the study
- Students completed a pre-test consisting of auditory auscultation-based questions.
- Following the pretest, students studied murmur characteristics using the auscultation simulator and Murmur Series Handout
- Students completed a post-test once the auscultation modules were completed.

Evaluation

- Test scores were compared using a **paired t-test**.
- **Likert scale survey** to assess attitudes toward this self-directed learning experience.
- Future: **Likert Scale Survey** to evaluate students' perception of how this simulation affected their performance on USMLE examination

Results

- 113 (65, 48) Second year medical students from the Brody School of Medicine participated in the study.
- Prior to completion of the modules, students were only able to effectively recognize normal heart sounds.
- Comparison of Pre-test and Post-test mean scores produced a p-value <0.0001.

Murmurs	2019		2020	
	Pre-Test	Post-Test	Pre-Test	Post-Test
Normal Heart sounds	95%	100%	97%	100%
Aortic Stenosis	54%	86%	65%	90%
Aortic Regurgitation	38%	89%	40%	92%
Mitral Stenosis	34%	85%	39%	82%
Mitral regurgitation	34%	82%	31%	79%
Mitral Valve Prolapse	35%	83%	38%	85%
Patent Ductus Arteriosus	68%	98%	67%	99%
Ventricular Septal Defect	46%	94%	51%	96%
Mean	50.60%	89.60%	53.50%	90.38%

Survey Results

Survey Question:	Median Score
This educational modality was easy to use.	4.0
Working through education modules at my own pace improved the learning experience.	4.6
Using the auscultation simulator improved my ability to recognize cardiac murmurs.	4.6
The auscultation simulator improved my confidence in recognizing cardiac murmurs.	4.3
The educational modality will increase my ability to correctly answer USLME Step One Examination questions.	4.2
I am interested in other Self-directed Simulation modalities to prepare for Step One	4.5
This educational modality was easy to use.	4.0
Working through education modules at my own pace improved the learning experience.	4.6
Using the auscultation simulator improved my ability to recognized cardiac murmurs.	4.5

Challenges Encountered

1. Students not placing materials back in the correct location as stated by the protocol.

- I created a sign out check list and made it in all bold. The checklist included the correct locations to place the various materials and the correct order to turn in their pre- and post-test materials.

2. Technical difficulties.

- I ended up creating a manual of how to circumvent the glitch after I established a step-wise process of how to re-start the software.

3. Scheduling.

- Then I had to add petition to get the entire class badge access outside of 9a-5p hours. Ultimately it passed and we were able to gain 24 hr badge access but it was a process.

Next Step: Congenital Heart Disease and Cardiac Murmur Flipped Classroom

- Didactic CHD and cardiac murmur content was made available for students (1) PowerPoint files (Microsoft Office) and screen shots with associated voice over narration using Screencast-O-Matic version 2.3.9
- Word document with CHD objectives, key words, and textual didactic material
- Word document with a concise summary of murmur types and associated pathology. An
- Optional 50 minute classroom session was conducted with students split into groups of 6-8
 - Discussion of six unknown cases including patient presentation
 - Associated murmur (easyauscultation.com)
 - On-line 3-dimensional model of the defect (<https://sketchfab.com/3d-models>)
 - Demonstration of a human autopsy specimen for some defects

Future

- IRB approval to review grades of students who participated vs. classmates who did not on cardiac section of pathology exam and pathology shelf
- Yearly CHD and Cardiac Heart Murmur Flipped Classroom
- Continued feedback from students regarding perceived effectiveness for board preparation

Acknowledgements

- Other acknowledgements:
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