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### Improvements in Cardiac Auscultation Utilizing Multisensory Learning in Medical Students: A Preliminary Study

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# Improvements in Cardiac Auscultation Utilizing Multisensory Learning in Medical Students: A Preliminary Study

Harrison A. Patrizio, BS, Riley Phyu, BS, Bum Kim, BA, Nils V. Brolis, DO

## Objective

- Investigate the impact of combining multisensory stimuli with traditional education methods on cardiac auscultation teaching outcomes for first-year medical students.

## Methods

- Conducted a pilot randomized controlled trial at a simulation center
- Enrolled 32 first-year medical students from a single medical institution
- Randomly divided participants into two groups: control (traditional education) and intervention (multisensory stimuli)
- Control group (N=16) received a 10-minute pre-recorded slide presentation comprising 2D phonocardiogram visualization with narration and overlaid heart sounds (Figure 1)
- Interventional group (N=16) received the same 10-minute pre-recorded slide presentation, supplemented with simulated cardiac cycles of 3D cross-sectioned hearts and haptic synchronization. Printed phonocardiograms were provided for each heart sound as a tapping guide. These components created a multisensory environment incorporating visual, auditory, and tactile learning in the educational material. (Figure 2)
- Both groups were taught five different heart sounds: S1/S2, S3, S4, crescendo-decrescendo, and mid-systolic click.
- Participants' competency evaluated by administering a multiple-choice post-assessment exam
- Data analyzed using Mann-Whitney U test for statistical significance

## Discussion

Table 1: Mean competency scores, Mann-Whitney U tests, and effect size from the control and interventional groups.

Scores	Control Group (n=16)		Interventional Group (n=16)		p-value	Effect Size (d)
	Mean ± SD	Mean of Ranks	Mean ± SD	Mean of Ranks		
Diagnostic Accuracy	58.75% ± 1.77	13.09	85% ± 0.93	19.91	< 0.042*	0.93†
Knowledge Acquisition	46.25% ± 1.19	11.56	76.25% ± 1.11	21.44	< 0.031*	1.30†

\* p < 0.05, Mann-Whitney U test

† Cohen's d > 0.08, large effect size

- Incorporating visual, auditory, and tactile stimuli into traditional cardiac auscultation education significantly improved students' competency in auscultation.
- The multisensory approach could serve as an affordable alternative to costly simulators.
- Enhanced provider competency may lead to improved patient outcomes by allowing for more accurate diagnosis and treatment.
- Future research should involve larger sample sizes, multiple institutions, and assessment of long-term retention rates to further validate the effectiveness of this approach.

Multisensory approach to cardiac auscultation education is an effective way to enhance overall competency, which may improve patient outcomes



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### Midsystolic Click



Figure 1: Example of slide based traditional learning

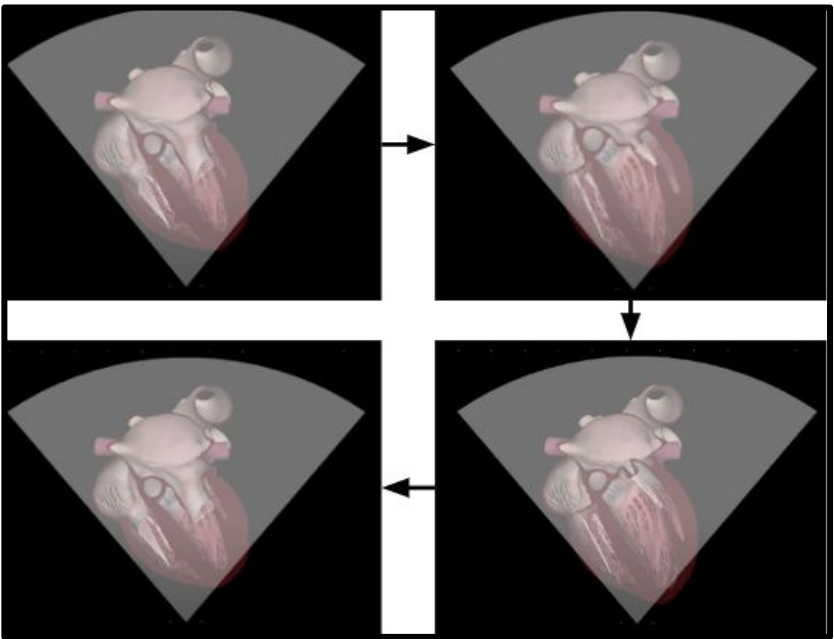


Figure 2: Example of 3D cardiac visual supplementation

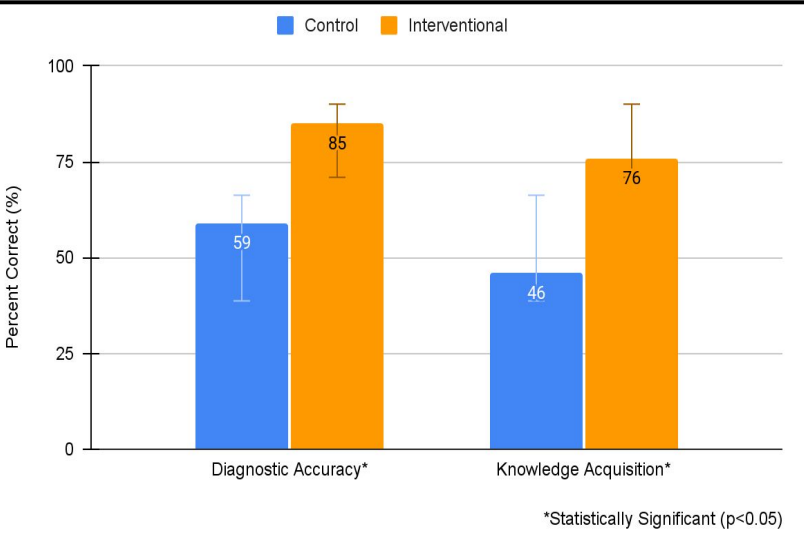


Figure 3: Competency Measures for each group