Testing the Limits of Innovation:
The Use of 3D Imaging to Teach Cardiac Arrhythmias

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Background

A recent report regarding learning environments by the Macy Foundation states that the learning spaces created by medical educators, "should ignite passion and drive to optimize learning." Although there are many opportunities for hands on learning during the clinical year of PA school, the didactic curriculum still relies heavily on traditional PowerPoint lectures for teaching core concepts. With the use of 3D interactive technology (ShareCare YOU) and focusing on teaching cardiac arrhythmias, we hope to fulfill this mission of transforming the learning environment to be more engaging, while still ensuring that the core cardiac competencies of the curriculum are met.

Methods

Students (n=59) were given an online survey prior to completing the cardiac unit of their Clinical Medicine course establishing their prior use of interactive technologies and 7 questions assessing their expectations of use (1-5 Likert scale). Students were then provided a series of prerecorded lectures created by program faculty using an interactive virtual 3D heart model to guide students through the cardiac arrhythmias unit, replacing all traditional PowerPoint lectures. Topics covered included: normal cardiac electrophysiology, heart blocks, bundle branch blocks, tachyarrhythmias, atrial fibrillation, atrial flutter, and reentry tachycardias. After completing the lectures, students gained access to the 3D interactive heart model to manipulate, impose the discussed arrhythmias and complete an interactive 10 question formative assessment. Students completed a post-survey asking the same 7 questions to gauge their actual enjoyment and ease of use. Paired t-testing was used to compare pre- and post-survey results.

Results

Survey response rate was 73% (n=43/59). Paired t-testing showed no significant differences in pre- and post-survey responses. Upon further analysis, it was discovered that student responses to the pre-survey questions were primarily 'agree' or 'strongly agree,' indicated they were anticipating enjoying the content, and these responses remained in these categories in the post-survey, accounting for no significant change. Post-survey results are shown in table 1. Although testing was not significant, the positive results are still important for curriculum design and technology integration. Despite high rates of enjoyment, multi-course application and a generally accepted ease of use gathered on the surveys, the "please provide any additional feedback" question subjectively provided the most valuable data. There were a few outliers on either end, providing statements such as, "this was amazing! What a resource!" and "more of this please!" counterbalanced with, "it was difficult to follow and required intensive notetaking." Feedback primarily fell somewhere in the middle; students stated their enjoyment of the lecture format and desire to see more, similar content but also requested a follow-up mini-lecture in a traditional format to accompany the 3D imaging.

Discussion

As virtual reality and other technological advancements begin to work their way into medical education, faculty must remain open to the implementation of these new resources. Rather than adding more content to the existing curriculum, this study fully replaced traditional content with computer imaging. The overwhelmingly positive student responses desire to see more, similar content and the enjoyment of these new lectures over traditional lectures allows us to continue pushing the limits of innovation and student engagement in the classroom. It is important, however, to recognize students' hesitation to full replacement of lectures as opposed to only partial replacement.

References

1. Josiah Macy Jr. Foundation. Improving Environments for Learning in the Health Professions.:2018.
2. Maresky HS, Oikonomou A, Ali I, Ditkofsky N, Pakkal M, Ballyk B. Virtual reality and cardiac anatomy: Exploring immersive three-dimensional cardiac imaging, a pilot study in undergraduate medical anatomy education. Clinical Anatomy. 2018;32(2):238-243. doi:10.1002/ca.23292.
3. AAMC. Medical School Year Two Questionnaire: 2017 All Schools Summary Report; 2018.

Table 1: Number and Percentage of Students Reporting 'Agree' or 'Strongly Agree' to Survey Questions

Survey Questions	Responses indicating 'agree' or 'strongly agree'
"I enjoyed cardiac 3D imaging over traditional lectures."	35/43 (81.4%)
"I would like to see more 3D imaging content included in the curriculum."	37/43 (86.0%)
"I intend to seek out ways to use 3D imaging in the future."	30/43 (69.8%)
"Cardiac 3D imaging reinforced what I have learned in other courses."	41/43 (95.3%)
"I have a stronger understanding of cardiac anatomy after interacting with the 3D model."	37/43 (86.0%)
"I found it easy to adapt to learning using cardiac 3D imaging."	37/43 (86.0%)
"I enjoyed interacting with the 3D cardiac model."	32/34 (74.4%)

"Inside view" of the heart including electrophysiologic pathway for atrial fibrillation and coagulation in the left atrial appendage (courtesy of ShareCare YOU).