Background:

- Teaching and learning of embryology are difficult due to complex four-dimensional changes.
- There are few virtual and 3D models, even though they are proven helpful. Typically, 2D illustrations are used as visual aids, but they ineffectively depict changes in 3D. (Figure 2)
- Heart outflow tract septation is exceptionally difficult to teach and learn due to the 3D complexity.
- This project aimed to: 1) create a 3D embryonic virtual heart (EVH) model demonstrating the normal and abnormal conotruncal septation, and 2) assess the educational impact and perception of the EVH.

Hypothesis:

- Interaction with the EVH during an active learning session will increase learning outcomes on the subject and positive perception of the resource in the first-year medical students.

Materials & Methods:

- The EVH was created using Carnegie Collection from the National Museum of Health and Medicine as reference for anatomical accuracy. (Figure 2)
- Spatial and temporal demonstration of complex developmental events are important in a virtual and interactive model such as EVH. Spatial and temporal changes in 3D.

Methods:

- Pre-work: Pre-recorded lecture + pre-test
- Synchronous Virtual Class: Control Group
- Randomized Experimental Group (Figure 4)
- Post-Test + Survey
- Quantitative Test Data: Kruskal-Wallis ANOVA + Anderson Darling test. (Figure 5)
- Quantitative Survey Data: Average, Mean, Median, Standard Deviation (Figure 6)
- Qualitative Survey Data: Thematic Analysis of the survey comments (Table 1)

Results:

- Students did not perform statistically better on the post quiz compared to the pre quiz: Kruskal-Wallis (P=0.4348, df=3). (Figure 5)
- The EVH was rated highly helpful in understanding embryonic heart development, spatial, and temporal changes. (Figure 6)
- Despite high EVH perception, students rated themselves low on their confidence level in the material after EVH interaction. (Figure 6)
- There was very limited time to interact with the resource, so I feel that I did not get to adequately evaluate the utility of the resource at the time of taking this survey.

Conclusions & Discussion:

- EVH did not enhance learning outcomes.
- EVH is perceived to be high in educational value.
- Spatial and temporal demonstration of complex developmental events are important in a virtual and interactive model such as EVH.
- Lack of sufficient time for EVH interaction was identified as an area of improvement.
- Other confounds related to virtual classroom environment should be considered in interpretation of study outcomes.

Future Aims:

- Further development of EVH with an added animation of the normal and abnormal blood flow and heartbeat in an app interface. (Figure 7)
- Confound reduction and increased allotment time for EVH interaction.

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