The heart is one of the most important organs in our body. It is very complex to understand the workings of the normal heart; however, if a student is able to grasp the mechanics of the heart, they are then able to understand when the heart malfunctions, recognize the appropriate usage of pharmaceuticals, and understand cardiology procedures. Most trainees have difficulty comprehending the various congenital heart defects. In our study we utilized The Stanford Heart, a virtual reality (VR) heart that offers interactions with several different congenital defects, as well as the normal heart. The students were able to spend time analyzing the exterior of the heart, the normal blood flow, as well as teleport inside the organ to see the oxygenated versus deoxygenated blood flow. A few of the models that students were able to delve into were congenital heart defects such as Ventricular Septal Defect (VSD) and Atrial Septal Defect (ASD). All of these were in the virtual heart defects and is an effective means for teaching students. In previous years, before VR, students could spend hours trying to visualize words from a textbook and still not understand the pathologies. As educators our pedagogical options we have available. Virtual reality and cardiac anatomy: Exploring immersive three-dimensional cardiac imaging, a pilot study in undergraduate based education in daily clinical practice. Students have also indicated a stronger familiarity and depth of understanding. The intent of this pilot study was to give students a visual learning tool in preparation for their cardiology studies to help aid in their visual-spatial learning.

Methods and Materials

Two didactic cohorts, Class of 2020 (n=42) and Class of 2021 (n=58), at Yale School of Medicine Physician Assistant Online Program under IRB 2000002396 were given access to The Stanford Virtual Heart. The 100 students who had not yet received their formal cardiac module training were given a pre-test prior to the use of the virtual heart. The students were told to answer to the best of their ability the questions related to normal heart anatomy and congenital heart defects. The students were then individually given access to The Stanford Heart for a period of 15-minutes. Based on class feedback, the second cohort was increased to 20-minute access. This gave the second cohort more time to be immersed in the virtual heart.

The Center of Teaching and Learning (CTL) at Yale University helped to facilitate this learning workshop. CTL provided the trainers to support the technical aspects of the software, the four gaming computers and the virtual heart software. Through these efforts, the students were able to spend 15 minutes with the virtual heart. Before VR students could spend hours trying to visualize words from a textbook and still not understand the pathologies. As educators our pedagogical options we have available. Virtual reality and cardiac anatomy: Exploring immersive three-dimensional cardiac imaging, a pilot study in undergraduate based education in daily clinical practice. Students have also indicated a stronger familiarity and depth of understanding. The intent of this pilot study was to give students a visual learning tool in preparation for their cardiology studies to help aid in their visual-spatial learning.

As noted previously, students did not have any prior formal physician assistant education in cardiology. All participants were required to complete the pre-test and post-test. Analysis of the overall data showed a slight improvement in student knowledge from pre-exposure to the VR to post-exposure. The average improvement was 1.24% from pre-test to post-test for the Class of 2020 (n=42). For the Class of 2021 the average improvement was 2.05% (n=58). Although the improvement may not be overwhelmingly significant, qualitative comments from the students indicated a stronger familiarity and depth of understanding. The intent of this pilot study was to give students a visual learning tool in preparation for their cardiology studies to help aid in their visual-spatial learning.

Results

Virtual Reality is a conclusive way to enhance visual learning about congenital heart defects and is an effective means for teaching students. In previous years, before VR, students could spend hours trying to visualize words from a textbook and still not understand the pathologies. As educators our pedagogical options we have available. Virtual reality and cardiac anatomy: Exploring immersive three-dimensional cardiac imaging, a pilot study in undergraduate based education in daily clinical practice. Students have also indicated a stronger familiarity and depth of understanding. The intent of this pilot study was to give students a visual learning tool in preparation for their cardiology studies to help aid in their visual-spatial learning.

Discussion

Virtual Reality is a conclusive way to enhance visual learning about congenital heart defects and is an effective means for teaching students. In previous years, before VR, students could spend hours trying to visualize words from a textbook and still not understand the pathologies. As educators our pedagogical options we have available. Virtual reality and cardiac anatomy: Exploring immersive three-dimensional cardiac imaging, a pilot study in undergraduate based education in daily clinical practice. Students have also indicated a stronger familiarity and depth of understanding. The intent of this pilot study was to give students a visual learning tool in preparation for their cardiology studies to help aid in their visual-spatial learning.

Conclusions

Studies show that VR is beneficial for students and patients alike. In utilizing The Stanford Heart, we found it to be an effective resource for introducing students to congenital heart defects. Incorporating VR into the curriculum is feasible and offers an immersive environment for teaching students to understand how complex congenital heart defects are formed. However, not all VR requires extensive investment in equipment. Students could be given access to the virtual heart software for free. Other institutions are utilizing computer based VR to study cardiovascular anatomy. Programs are even using VR to train students to have increased empathy for patients with Alzheimer’s, hearing and vision loss. Some studies have incorporated VR to the students’ curriculum and they have found increased student satisfaction, improved retention, and a decrease in anxiety.

Incorporating VR into the curriculum is feasible and offers an immersive environment for teaching students to understand how complex congenital heart defects are formed. However, not all VR requires extensive investment in equipment. Students could be given access to the virtual heart software for free. Other institutions are utilizing computer based VR to study cardiovascular anatomy. Programs are even using VR to train students to have increased empathy for patients with Alzheimer’s, hearing and vision loss. Some studies have incorporated VR to the students’ curriculum and they have found increased student satisfaction, improved retention, and a decrease in anxiety.

There are many options we have available. Virtual reality and cardiac anatomy: Exploring immersive three-dimensional cardiac imaging, a pilot study in undergraduate based education in daily clinical practice. Students have also indicated a stronger familiarity and depth of understanding. The intent of this pilot study was to give students a visual learning tool in preparation for their cardiology studies to help aid in their visual-spatial learning.