Applications of Virtual Reality in Medical Fields

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Abstract

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Applications of Virtual Reality in Medical Fields

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# Medical Education

Virtual medical education has the potential to be used anywhere in the world, by anyone, and at any time said Zajtchuk and Satava (1997). Salsabeel et al. (2018) also reasoned that medical students need to develop clinical skills before dealing with real patients.  Students can develop skills without the risk of harming a patient by working with artificial models. However, the current models need to be updated due to the changing complexities of Medical knowledge and student demand for modern teaching methods.  Virtual reality is a model that can be used and has already been being used to enhance medical education. Salsabeel et al. (2018) also explained that minimizing errors in medical learning is crucial for patient safety.  Virtual reality provides a way to measure learning outcomes to ensure students are ready to perform on real patients. Zajtchuk and Satava (1997) have already found Helene Hoffman of the University of California’s virtual courses in anatomy, pathology, and radiology to be effective learning experiences. The following sections are a summary of studies done to test virtual reality learning in the medical field.

## Anatomy

A study conducted by Salsabeel ect al. (2018) allowed students to interact with a realistic looking three-dimensional model of a heart in virtual reality. Students were able to dissect and explore different parts of the heart and access description about those parts.  These student also used the traditional method for learning about the heart so they would be able to compare the experience. After the student finished the run through, they were given a questionnaire to assess their experience. Twenty three of the questions asked the student to assess their experience with the physical model and twenty three other questions asked them to assess their experience with the virtual model.

Another study conducted by Jan-Maarten, Vorstenbosch, and Kooloos (2017) compared students ability to identify cross sections of the neck, which is used to identify cross-sections resulting from an x-ray or histological imaging. The study compared three methods for studying cross-sections of the neck. The first method had students immersed in a three-dimensional virtual environment with the ability to navigate a model of the neck. The second group could navigate the same model but in a two-dimensional environment. The third group was a control group allowed to explore a virtual sea world. Participants were given 150 seconds to navigate their environment. Participants were then given a test to assess their ability to identify cross sections of the neck.

Salsabeel et al. (2018) found that students felt like they learned more and preferred using the virtual reality model over the physical model.  This lead to the conclusion that virtual reality is an efficient teaching tool. However, Jan-Maarten et al. (2017) found no difference in assessment scores for any of the three test groups. Both studies found using virtual reality to lower overall teaching costs compared to the traditional teaching method of using dissection facilities.

## Emergency medical training

Simulation is an important training method for medical personnel says Ferracani, Pezzatini, Seidenari, and Del Bimbo (2015). However, unlike virtual reality, many of the simulations available are expensive and lack the ability to create diverse situations. Pezzatini et al. (2015) created an emergency medical virtual training system called EMERGENZA and tested its teaching abilities. Found not as real. EMERGENZA uses the KinectTM SDK to track participant body movements. However, the KinectTM SDK system was not accurate in tracking hand positions. The team found using a temporal Kalman filter increased tracking accuracy to basically 100%. For the experiment, four medical operators and 6 researchers used the EMERGENZA training system and evaluated their experience using a questionnaire. The evaluator’s results show they were highly engaged by the virtual experience.

## Manufacturing medical devices training

Ho, Wong, Chua, and Chee-Kong (2018) indicated that putting together hybrid medical devices is difficult and time consuming. Current training methods require an experienced instructor, long class room hours, and high training costs. To reduce costs, trainees share work cell with actual workers leading to potential contaminations or real products or safety risks within the work cell. Ho et al. (2018) created a virtual reality training program called VRAGTS to combat these issues. The VRAGTS is an intelligent, game based virtual reality training program. The VRAGTS provides the trainee with a virtual supervisor to help them know when they made a mistake and give hint to the next step in the procedure. A tutorial, practice and assessment phases were identified levels to maximize trainee learning. Trainees are required to pass each level based on a score they are given at the end of the level. They must repeat the level if scores are not high enough. After running experiments Ho et al. (2018) found the new virtual training to significantly decrease training time. They also found trainees preferred using the new system and were better trained on assembling the hybrid medical devices.

**Surgical training**

Zajtchuk and Satava (1997) explained that virtual reality allows surgeons to train on difficult procedures by performing the procedure on an virtual organ that move, behave and feel like real organs.  They only say that they do not currently look like real organs. Also further testing is needed to determine if this method improves learning.

All educations methods found cheapness and accessible material. Also good repeatable with many different situations. All found not realistic looking.

References

Ferracani, A., Pezzatini, D., Seidenari, L., & Del Bimbo, A. (2015). Natural and virtual environments for the training of emergency medicine personnel.*Universal Access in the Information Society, 14*(3), 351-362. doi:http://dx.doi.org.erl.lib.byu.edu/10.1007/s10209-014-0364-1

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Salsabeel, F. M. A., Falah, J. F. M., Alfalah, T., Elfalah, M., Muhaidat, N., & Falah, O. (2018). A comparative study between a virtual reality heart anatomy system and traditional medical teaching modalities. *Virtual Reality,* , 1-6. doi:<http://dx.doi.org/10.1007/s10055-018-0359-y>

Zajtchuk, R., & Satava, R. M. (1997). Medical applications of virtual reality.*Association for Computing Machinery.Communications of the ACM, 40*(9), 63-64. Retrieved from <https://search.proquest.com/docview/237045983?accountid=4488>

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Table 1

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