Virtual Reality Utilization in Health Care, It's Virtually Done

Barbara Medling
Perioperative Services Educator
Virginia Mason Medical Center
Seattle, Wa.

The growth of computer use in health care illustrates the dynamic nature of the industry. As the work environment continues to be infused with new technology, the challenge of teaching and training professionals increases in difficulty. The necessity to provide adequate hands-on skill training activities, as well as having less time to accomplish the needed learning experiences are representative of new challenges to all fields in the health care industry (Spector, 2003).

Over the past decade, computer-based simulation for training in health care has been developed and researched. The initial steps began with the use of compact disk read only memory media for basic instructional purposes.

The use of computers in health care educational activities illustrates a medium that can be used in a variety of ways (Rosser, 1996). Whether it is medical school, nursing school, or another health related support field, the use of computer technology for related educational endeavors is rapidly expanding. The student and instructor connection can be maintained and supported, regardless of the physical distance between them.

As the computer technological improvements continued to come to market, possible changes to educational formats were creatively envisioned. The introduction of three dimensional

technologies opened a door for health care into the use of the virtual reality technology for instructional needs. A new realm of health care instruction has been growing and developing ever since. The technology, when adequately utilized has the potential to revolutionize the traditional methods for acquisition of hands-on skills (Mahoney, 1999).

In order to discuss virtual reality training (VRT), we need to define it more clearly. The word virtual in itself describes something that has the appearance of being real, but in fact is not. It involves the computer generated simulation of the actual real-life activity. A variety of computer access devices may be used to provide an experience that is realistic in viewing, hearing and movement (Sorid, 2000). This may include sophisticated computers with sufficient graphic capabilities, software, adequate network capacity, joysticks or hand controls, and eye tracking devices (Virtual Research Systems, 1998).

VRT has been successfully utilized in other industries. Airline industry has a great deal of supporting evidence for providing this kind of training. The cost of training pilots is very expensive and time consuming. VRT flight simulators have been shown to help pilots learn motor and cognitive skills before actually flying a real airplane. Other data from NASA and airline industry linked airplane accidents with mistakes related to the ineffective management of available resources. In order to provide realistic, yet safe training sessions the use of required simulation practice sessions was implemented. The VRT practice has been shown to be effective in reducing errors (Colt et al., 2001), (Lighthall, et al. 2003).

In medical and nursing schools the assessment of student's clinical skills and competency has many demonstrated limitations. The improvements necessary for this area can be done with the use of VRT, similar to the airline industry. The interactions submerge the student in a visual and motor activity that greatly resembles the environment they would see in patient care situations. The practiced skills would help them to be better able to handle patient situations in reality (Kaufman, 1997).

The interaction with the computerized presentation has the look and feel of the actual situation represented. This characteristic of VRT gives it an advantage that other methods of practice do not suitably provide. The acquisition of the needed skills can be developed from repeated training practice utilizing the virtual reality devices. VRT should provide sufficient opportunities for practice in a simulated, low stress, secure environment (Sorid, 2000).

Lowry (1993) suggested that we develop training programs that build upon and utilize more artificial or simulated training methods. The trends supporting this direction were the need for skill labs that provided opportunities for students, whether medical or nursing, to practice without the stress on themselves or the patient. A simulated skills lab would provide computer based interactive practice programs for every student to use.

The research of Seymour et al. (2002), studied the effects of VRT on the acquisition of basic laporoscopic skills with surgical residents. Each of the candidates had comparative baseline motor skills. The attending surgeon each resident worked with was not aware of any training difference. Each resident was assigned

randomly to either the virtual reality group or the traditional educational group. The results of the study demonstrated that the use of VRT in obtaining skills for use in an everyday operating room was an improvement over the traditional training method. The VRT group was also shown to have fewer errors in actual hands-on operating room experiences when compared with the group trained in the traditional manner (Seymour et al. 2002).

In a similar study done by McCloy (2001), the use of VRT provides substantial advantages over traditional training methods. The advantages for practice and opportunity to view participant's skill levels before actively working with real-life patients in the operating room were substantial. The training for a surgical resident is expensive and the anxiety involved with attending surgeons training residents can be great. VRT, the preferable method of training, provides opportunities for repeated practice, which can be monitored, measured, and logged by the computer system (McCloy, 2001).

Tuggy (1998), studied the use of VRT on surgical residents learning to do sigmoidoscopies. This level of skill is considered difficult to learn for residents because of the hand and eye coordination involved. The results demonstrated a marked improvement in the motor skill activity. The amount of time to do the exam was also shown to be decreased.

One study by Colt, Crawford, & Galbraith (2001), compared VRT learned skills for bronchoscopy of novice residents with those of trained skilled surgeons. The results from this study established that subsequent VRT the resident's skills were equal to or better than the skilled surgeons. In a similar study done by

Bloom et al. (2003), the positive effects of VRT were also supported. It was proposed that the use of VRT could be a more cost effective use of skill practice when compared with expensive operating room time.

Another study that included residents and beginning critical care nurses developed simulation training for critical care patient emergency management. The process for participants included group activities involving talk through discussions on specific emergency case scenarios. This is followed by several simulated cases that involve the group working in a mock critical care situation. A programmable (MedSim Eagle Patient Simulator) was used in this study (Lighthall et al, 2003). This device can be programmed to present a variety of patient physiological changes and can progress through a variety of simulated emergency patient care scenarios. The group would come together and work collaboratively through the practice sessions. Each was followed with a debriefing sessions. The findings demonstrated a definite connection between the practice activity and the cognitive decision making in high anxiety situations. The comparison with aviation preparation for emergency situations was similar and the conclusion was that an increased simulated practice would decrease the number of errors in real patient care situations (Lighthall et al. 2003).

The use of VRT in training nurses is supported by Justham, (1999). The workload pressures and demands on nurses have continued to increase. The number of opportunities available for teaching and mentoring are decreasing because of demands on

the nurse's time. The amount of training necessary for new staff, new graduates and others before stepping into a new position can be very limited. The addition of a VRT skills lab was suggested as one method to provide a realistic, validated, and safe skill practice area, before actual patient contact.

A survey done by Souers (2002), incorporated virtual reality training, PowerPoint presentations, multimedia, video, and most patient scenarios in hands-on training activities. The use of the real-life training experience was shown to adequately allow the acquisition of a certain needed skill. The practice sessions were shown to have provided opportunity for the students to enhance their skills and be self-directed in their learning. In a similar study done by Nehring et al. (2002), the comparison between students technical skill acquisition by traditional methods and VRT strongly supported the use of VRT in all levels of nursing education.

The benefits that can be gained through the utilization of VRT for continuing education offerings for health care professionals were explored in an informational study done by Mantovani et al.,(2003). The lifetime for both doctors and nurses to practice as health care professionals requires a great deal of educational support. The use of VRT to educate and help learn new skills was supported by the authors. The challenges of introducing VRT into the health care profession are many. The need for life-like photo-realistic imaging, real-time interaction, and haptic, modeling illustrate several challenges for the computer industry as well as health care when designing future VRT modules (Yee, 1999).

As technology continues to advance we should see expanded

benefits in health care for training and for patient care. The new additions of high-tech touch capabilities called haptics are one example. One product presently available that has this capability is the “Phantom” technology and software developed by the SensAble company. This programming allows surgical students to practice and see what the patient’s skin feels like when making a surgical incision or suturing (Yee, 1999).

Another useful technological advance that should have many applications in the operating room is the virtual keyboard (Extreme Tech, 2002). This keyboard does not have problems with becoming dirty from bioburden aerosylization or contaminated hands in an Operating room suite, as it can be projected onto any flat surface. The surface area can be wiped cleaned and disinfected as needed without compromise to the keyboard. The advantages of this technology can be visualized in many different health care sectors.

The varying levels of computer literacy among health care professionals represent still another factor to consider. The increased use of VRT as well as other high technology in health care should help with acceptance. The increasing complexity of surgical devices and robotics, as well as the time constraints on instructors and students demands that we identify more effective methods for learning (McCloy, 2001).

The use of virtual reality simulators in actual health care environments today demonstrates their applicability and usefulness for needed hands-on skills training. It also allows for a more balanced and relaxed learning experience (Hebda, 2001, p 146).

Information technology has been shown to be a very useful

tool for teaching, learning, collecting data, and performing research. The capabilities for computer usage in health care go far beyond what we have even imagined. In the future of health care education, hopefully we can see everything, virtually done.

References

Bloom, M. B., Rawn, C. L., Salzberg, A. D., & Krummel, T. M. (2003). Virtual Reality Applied to Procedural Testing: The Next Era. *Annals of Surgery, 237*(3), 442-448.

Colt, H. G., Crawford, S. W., & Galbraith, O. (2001). Virtual Reality Bronchoscopy Simulation * a Revolution in Procedural Training. *American College of Chest Physicians, 120*(4), 1333-1337. Retrieved October 27, 03 from (A80157474).

ExtremeTech.com,(2003, Sept). Canasta says *"Virtual Keyboard" is a reality.* Retrieved November 1, 03, from http://web4.infotrac.galegroup.com/itw/infomark/39/102/42667155w4/purl=rcl ITOF 0_

Hebda, T., Czar, P., & Mascara, C. (2001). Information Systems Training. In Connor, M (Ed.), *Handbook of Informatics for Nurses and Health Care Professionals* (2nd ed., p. 146). Upper Saddle River, NJ: Prentice Hall.

Justham, D. (1999). Virtual Nursing. *Nursing Standard, 14*(8), 14-15.

Lighthall, G. K., Barr, J., Howard, S. K., Gellar, E., Sowb, Y., Bertacini, E., et al. (2003). Use of a Fully Simulated Intensive Care Unit Environment for Critical Event Management Training for Internal Medicine Residents. *Critical Care Medicine, 31*(10), 2437-2443.

Lowry, S. (1993). Medical Education: Trends in Health Care and Their Effects on Medical Education. *British Medical Journal, 306*(6872), 255-258.

Mahoney, D. P. (1999, October). Getting the Feel of Virtual Surgery. *Computer Graphics World*.

Nehring, W. M., Lashley, F. R., & Ellis, W. E. (2002). Critical Incident Nursing Management Using Human Patient Simulators. *Nursing Education Perspectives, 23*(3), 128-132.

Rosser, J. (1996). CD-ROM Multimedia. The step before virtual reality. *Surgical Endoscopy, 10*(10), 1033-1035.

Seymour, N. E., Gallagher, A. G., Roman, S., Obrien, M. K., Bansal, V. K., Andersan, D. K., et al. (2002). VRT Improves Operating Room Performance: Results of a Randomized, Double-Blinded Study. *Annals of Surgery, 236*(4), 458-464.

Sorid, D., Moore, S.K. (2000, July). *The Virtual Surgeon*. Retrieved October 31, 03, from http://www.spectrum.ieee.org/publicfeature/jul00/surg.html

Souers, C. (2002). Comprehensive Performance Review: Preparing Students for a Preceptor Experience. *Nurse Educator, 27*(1), 9-12.

Spector, R. (2003, June). *Futurists Spur Plans for Tomorrow's Approach*. Retrieved October 31, 03, from Stanford University Web Site: http://news-service.stanford.edu/news/2003/june4/symposium.html

Tuggy, M. (1998). Virtual Reality Flexible Sigmoidoscopy Simulator Training Impact on Resident Performance. *Journal of the American Board of Family Practice, 11*(6), 426-433.

Virtual Research Systems, Inc. (n.d.). *The Breitling Fighter Challenge*. Retrieved October 30, 03, from http://www.virtualresearch.com/applications.html

Yee, Amy, (1999). *Touchy Subject*. Inc. Magazine, Retrieved November 1,03, from http://www.inc.com/magazine/19991015/14250.html.