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Educational Note

From education to research: a journey of utilising virtual training

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Abstract

Background: London South Bank University (LSBU) has successfully implemented Virtual Environment for Radiotherapy Training (VERT) across the therapeutic radiography training curricula and are now supporting the use of VERT for patient education in clinical departments. A number of publications have reported on the use of VERT in education and training; more recent literature has focused on the use of VERT for patient education.

Materials and methods: The successful introduction of VERT before students' first clinical placements resulted in the development of a 'Pre-Clinical week' where students practice and improve their technical skills, using the hand controls without a patient present, leading to increased confidence in clinical practice. Other examples of VERT curriculum integration at LSBU focused on the use of VERT for anatomy teaching. The more recent innovation at LSBU relevant to VERT integration has been the design, development and implementation of collaborative research projects where the aims of the studies were to explore patients' perceptions of VERT as an information giving resource before radiotherapy delivery.

Summary: The introduction of VERT as education tool has enabled academic staff to develop a range of teaching methods to embed virtual training into the traditional classroom setting, demonstrating innovation and collaboration.

Keywords: education; skill development; teaching; training; VERT

INTRODUCTION

Virtual Environment for Radiotherapy Training (VERT) has been utlised since 2007 in clinical Radiotherapy departments and Higher Education Intuitions (HEIs) across the United Kingdom.[1] A number of publications have reported on the use of VERT in education and training; more recent literature has focused on the use of VERT for patient education.[2] This article aims to share the experiences of one HEI, London South Bank University (LSBU) that has successfully implemented VERT across the therapeutic radiography training curricula and are now supporting the use of VERT for patient education in a clinical department.

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BACKGROUND

In 2007, the National Radiotherapy Advisory Group (NRAG) identified a shortfall in both equipment and the qualified professional

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workforce to deliver optimal radiotherapy treatment in England.[3] As a result, Hybrid Virtual Environment (HVE) skills training facilities were initiated to increase clinical training capacity, reduce pressure on service departments and provide safe learning environments for students. It was anticipated that VERT would improve the clinical training experience and reduce the high attrition rates for first year therapeutic radiography students.[3] A VERT was developed by staff at the University of Hull, through collaboration with staff at the then Princess Royal Hospital, Hull and staff who have since formed a company known as Vertual Ltd. NRAG[4] recommended the introduction of VERT to ten HEIs and 51 associated NHS clinical sites delivering pre-registration therapeutic radiography training. In 2008 the Department of Health provided funding to install VERT in both HEIs and clinical sites across England.

THE USE OF A VIRTUAL SIMULATION FOR TRAINING IN HEALTHCARE

Virtual simulation makes use of computerised systems to increase the degree of realism and further enhance students' learning experiences.[5] Simulated experiences allow students to replicate substantial aspects of the real world in a fully interactive manner. The use of simulation in healthcare education has gained popularity in the last few years[6] enabling students to practice and gain skills in a safe environment based on real-life situations, without risk of adverse consequences to the patients.[7]

Technological advances have enabled the evolution of simulation, creating realistic training experiences for students.[8] Not only does virtual simulation allow students the opportunity to learn and practice specific techniques related to a particular healthcare profession, it also leads to increased patient safety and improved patient outcomes through enhanced communication, problem solving, decision making and teamwork skills.[4] Through the use of defined metrics virtual simulation allows students to undertake reproducible tasks, while the trainer/educator controls the complexity of training relevant to the knowledge of the student.[9,10]

Some literature suggested that simulation-based learning in healthcare education was inconclusive in providing that skills developed during these sessions could be transferred to the clinical department.[11] However, medical students have demonstrated longstanding use of simulation techniques in skills training and a recent randomised control trial study[12] showed that simulator-trained students scored significantly higher in their assessments compared with students that received traditional training. The authors suggested that practice in a simulated environment with individualised feedback was more effective than conventional education to develop clinical skills. Another randomised controlled trial[13] involving physiotherapy students revealed similar competency levels for groups of students who were trained in conventional methods compared with those who undertook simulated learning in less time, thereby concluding that clinical time can be replaced with simulator time without compromising student learning experience.

VERT

VERT is an example of a virtual simulator used for the training of radiotherapy students.[14] It is a virtual fully equipped radiotherapy treatment room except for the production of radiation; it enables students to learn controls and practice treatment set-ups without any possible harm to patients, students or clinical staff.[14,15] Movement and functionality is achieved through the use of real hand controls making the technology a HVE.[14]

LSBU was one of the first HEIs to install a fully immersive VERT system in 2008. The introduction of a VERT system at LSBU was met with mixed emotions by staff ranging from great excitement to levels of anxiety relating to the introduction of the concept in the classroom. The teaching team was faced with the challenge of embedding the tool within existing teaching sessions without much guidance of 'how to'. However, initial student experiences were positive and engaging; allowing staff to develop new training materials and workbooks for simulated training. The most promising first experiences at LSBU related to the use of the hand-pendants to allow students adequate time to get accustomed to

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using and manipulating the equipment. The successful introduction of VERT before students' first clinical placements resulted in the development of a 'Pre-Clinical week' as discussed in subsequent sections.

Some of the earliest studies indicated the need for radiotherapy students to develop technical skills such as spatial awareness and psychomotor skills in order to clearly perceive three-dimensional (3D) relationships accurately in positioning patients for treatment. A study[15] demonstrated how students' confidence in technical skills improved using VERT. This was reinforced in other studies when students reported that the use of VERT enabled them to practice and improve their technical skills, using the hand controls without a patient present, leading to increased confidence in clinical practice.[1] A more recent study focused on the skill development in relation to skin apposition techniques where respondents perceived that VERT helped both their confidence levels (89%) and skin apposition skills (80%).[16] Most of these studies acknowledge the need for further research to evaluate how technical skill development in VERT can be transferred to the clinical department.

THE USE OF VERT TO DEVELOP 3D ANATOMICAL SKILLS

The second phase of VERT curriculum integration at LSBU focused on the use of VERT for anatomy teaching. Earlier studies[15] reported mixed results in relation to the use of VERT in relation to anatomy skill development. Results[1] showed that VERT greatly enhanced student understanding of radiotherapy concepts and techniques; however, only 40% of respondents reported enhanced knowledge and understanding of anatomy. However, it is important to note that these results are based on self-reported perceptions through survey rather than actual knowledge scores. VERT enables students to easily visualise radiotherapy concepts such as target volumes and dose distribution in relation to the human anatomy.[1] Other authors[17] showed how accurate representation of spatial relationships in 3D was achieved by superimposing computerised tomography (CT) datasets onto treatment set-up and beam display.

The second phase purposive designed teaching session at LSBU incorporated the use of CT images displayed on the larger VERT screen in axial, sagittal and coronal planes. Each session was developed for a specific anatomical region: Head and Neck; Thorax; and Pelvis. Practical work sheets were provided and students were required to label structures accordingly. Discussions during these sessions focused on relational cross-sectional anatomy, critical structures and radiotherapy tolerance doses. 3D visualisation enabled students to retain information in preparation for clinical image viewing examinations, particularly in year 2 of study. Students reported positively on this development in their annual module evaluations, leading to the implementation of VERT sessions for year 2 anatomy review as part of the pre-treatment imaging modules.

THE USE OF VERT IN CLINICAL PRACTICE PREPARATION

The third phase of VERT curriculum integration at LSBU focused on utilising VERT in the pre-clinical induction weeks during which a range of activities were undertaken in preparation for student placements. Year 1 students were scheduled to undertake a clinical placement after 5–6 weeks of academic teaching at university. The week before first clinical placement was developed to focus on clinical practice radiotherapy skill development. Practical sessions included: hand dexterity with the pendant; gantry positions and field arrangements; understanding the relationship between couch movements and the digital scale; calculating and making isocentre shifts from the reference marks; reading source skin distance (SSD); practice setting up a patient together; moving imaging arms and avoiding a collision. A range of workbooks and activity sheets were developed to support and facilitate the sessions and designed to allow individual work, one-to-one tutorials as well as peer-supported group sessions including problem solving activities. Subsequent development for year 2 and 3 students included the use of VERT to evaluate treatment plans produced by individual students in the treatment planning laboratory and then transferred to VERT for

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group evaluation and critical reflection. Sessions were designed for small groups with a maximum of four to five students being present, allowing open discussion and debate. These sessions enabled students to take ownership of their work and were reported to improve confidence in plan interpretation and evaluation during new patient treatment set-up in the clinical department. Clinically acceptable plans were then incorporated into the Treatment Planning Workbooks as part of the summative assessments for final year students supported by literature and critical reflection.

Studies have demonstrated the importance of clear instructions and material to support the practical content of VERT sessions, especially where the simulation tools are being used to assess student performance.[18] The authors focused on the theoretical principles that underpinned the development of the workbooks and suggested that VERT enhanced decision making and teamwork skills through problem-based learning.

THE LIMITATIONS OF VERT

Many studies highlighted the advantages of using virtual simulation; however, limitations of use were less known.[8]

Reported limitations included possible adverse effects such as visual problems and headaches.[1] Other studies have provided conflicting findings in relation to the realistic nature of VERT, some first year pre-registration radiotherapy students reported high levels of realism[19] where other students preferred simulation-based learning using real linear accelerators.[20] It is suggested that such limitations may contribute to an overall negative perception of VERT[21]; however, it is acknowledged that VERT was intended as a simulation technique to enable students to gain valuable practice without burdening the clinical departments.[19]

The academic team at LSBU developed a health and safety information document that was given to students before the VERT session to make them aware of potential side effects such as dizziness, headaches or eyestrain. Students were advised to stop participating if they felt ill and immediately report to an academic member of staff. To overcome the negative side effect of 3D simulation the stereoscopic (3D) projection was, at times, switched off during viewing, which reduced the degree of immersion, but still allowed participants to view the images in 2D. Other limitations identified in the LSBU student feedback included the use of VERT for larger cohort sizes, limiting individual time. Academic VERT sessions were adapted to ensure cohort sizes did not exceed five students where practical work was undertaken. Some first year students reported anxiety and pressure in performing patient set-ups in front of their peers but later reported that this had been extremely helpful in preparing them for the clinical department where they were scrutinised by radiographers. Improved communicating and engagement was noted in year 2 and 3 student cohort sessions where they felt comfortable practicing in front of each other and evaluating or appraising work.

THE USE OF VERT AS PATIENT INFORMATION TOOL

A number of key studies around the use of VERT in relation to patient support and information giving have been conducted in the last few years. Limited published information exists on these studies; however, results from some of these studies were presented at the Annual VERT User Group Meetings.[22]

Sulé-Suso et al.[2] evaluated the use of VERT to improve patients and relatives' treatment satisfaction at University Hospital of North Staffordshire NHS Trust. Data collected via a questionnaire, designed to determine how well patients understood their treatment and side effects, from $n = 152$ patients receiving treatment for a range of cancer types. Results showed that both patients and relatives welcomed the opportunity to view their treatment information on VERT and that the information sessions should be given before the start of their treatment.

The most recent innovation at LSBU relevant to VERT integration has been the design, development and implementation of a collaborative research project with Barking, Havering

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and Redbridge University Hospitals NHS Trust Cancer Centre in 2014. The aim of the study was to explore prostate patients' ($n = 38$) perceptions of VERT as an information giving resource before radiotherapy delivery. Results from the study are currently being analysed and will be presented at an international conference in 2016 in Italy, Europe, however preliminary results are very positive. The team approach to the project was presented at the VERT international user group meeting in September 2015. The successful completion of this project has led to the development of two subsequent collaborative projects. The first in relation to the existing project where the Cone Beam CT data is used to measure patient compliance in relation to patient set-up and the second project proposes the use of Patient Education and Awareness with a Realistic Linac (PEARL)[23] as patient information giving tool for patients with brain tumours.

As a consequence of the plethora of research studies a VERT Research Special Interest Group has been convened, the inaugural meeting was hosted by LSBU in July 2015, with a subsequent follow-up meeting at the September user group meeting. The aim of the specialist interest group is to promote collaborative research across HEIs and clinical departments in the United Kingdom and to share areas of good practice in relation to VERT research.

CONCLUSION

The introduction of VERT as education tool has enabled academic staff to develop a range of teaching methods to embed virtual training into the traditional classroom setting, demonstrating innovation and collaboration. The use of VERT as information giving tool in the clinical department demonstrates the all-encompassing nature of a virtual tool in one setting. Studies and experience have shown that the use of simulation as an educational tool influenced learning and students were able to gain knowledge and develop skills through simulation-based learning. These skills included both interpersonal and technical skills. A limited number of studies have shown that VERT can be utilised for patient information sessions, therefore supporting the need for more research to gain a greater understanding of the effectiveness of patient information sessions using VERT.

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Conflicts of Interest

None.

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