Delivering World Class Radiotherapy NHS

Virtual Environment for Radiotherapy Training (VERT)

Final Project Report – Executive Summary

A Project funded by the Department of Health for England and the Cancer Action Team; and Managed by the Society and College of Radiographers

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1 Background

1.2 A Report in 2007 (*Radiotherapy: developing a world class service for England* Report to Ministers from National Radiotherapy Advisory Group) recommended the introduction of Hybrid Virtual Environment skills training facilities in the 10 education centres and 51 associated clinical sites delivering pre-registration radiotherapy programmes in England to address high attrition.

1.3 The Virtual Environment for Radiotherapy Training (VERT) system provides a virtual radiotherapy treatment room, including a life-size model of a fully-functional (except for the production of radiation) linear accelerator. It allows the user to interact with the virtual room, control the equipment and set up radiation treatments as if in the real world. The environment is a hybrid one in that the *virtual* linear accelerator is controlled using an *actual* hand-pendant.

1.4 Educational institutions use a system called 'Immersive VERT'. This employs rear projection and active stereoscopy requiring the user to wear LCD shutter glasses. A tracking system, which enables the image to be projected according to the user's position, further enhances the degree of 'immersion'.

1.5 'Seminar VERT' can be situated in seminar or meeting rooms without significant refurbishment and is the system used in radiotherapy and oncology departments. It features front projection using passive stereoscopy and requires the use of polarising glasses. User tracking is not provided.

1.6 Images and radiotherapy treatment plans in DICOM format can be imported to VERT, allowing 3-D visualisation of a wide range of simple and complex treatments and related anatomical information.

2 Purpose of the Project

2.1 The Department of Health and Cancer Action Team, as well as funding the costs associated with installation in England, funded an 18-month Project to manage implementation and initial evaluation of the impact of VERT. This Report presents the findings of the Project which was managed by the Society and College of Radiographers.

2.2 The aim of the 18-month Project was to assess the potential use and impact of the VERT technology on recruitment and retention; the student learning experience; and development of students' practical skills, confidence and knowledge.

2.3 The Report outlines the implementation and subsequent evaluation of VERT over the initial 18-month period of its introduction into 10 educational institutions and the associated radiotherapy and oncology departments providing clinical training and experience.

3 The Project

3.1 There were two phases to the Project:

(a) Implementation which included installation; training; incorporation of VERT experience into academic and clinical components of pre-registration radiotherapy programmes; and gathering information for dissemination and continued development based on user experience; and

(b) Evaluation of the impact of VERT on: the development of skills, confidence and performance from the perspective of students, academic staff and clinical radiographers; and recruitment and retention.

3.2 The timescale for introduction was short but the procurement and installation process was successfully completed in all 10 educational institutions and in 31 of 42 radiotherapy and oncology departments by July 2008. Installation of the remaining 11 funded Seminar VERT systems is expected by the end of 2010. The remaining nine of the 51 eligible radiotherapy and oncology departments did not install the system.

3.3 The following key findings are based on the review of records; analysis of data received in reports from educational institutions and radiotherapy and oncology departments; student and staff questionnaires during the Project; and a final evaluation survey distributed at the end of the 18-month period.

4 Findings from the Project

4.1 Procurement, Installation and Training

4.1.1 The procurement process was identified as challenging by the majority of institutions, primarily due to the extremely tight deadlines imposed by the funding process. The major problem encountered by both educational institutions and Trusts was identification of suitable physical space for the VERT installations.

4.1.2 The majority of installations were straightforward with few issues arising but where problems were identified they were usually resolved quickly through contact with the supplier, Vertual Ltd.

4.1.3 Vertual Ltd. provided a 2-hour training session for staff but a number of centres developed supplementary training packages for delivery to different groups of students and staff.

4.2 Management

4.2.1 Establishment of Regional and Local User Groups contributed to the successful management and development of VERT use across the sites, being particularly valuable where groups were multidisciplinary.

4.2.2 Multidisciplinary involvement facilitated acquisition of suitable treatment plans, contributing to the further development of high quality, more diverse VERT resources, enriched by the different professional perspectives of radiographers, dosimetrists, physicists and medical staff.

4.2.3 The role of institutional VERT Lead was identified as crucial to the management of the resource locally to: promote and extend VERT use; train staff; and develop the use of VERT for learning and teaching, staff development, recruitment and research.

4.2.4 Lack of available staff and/or staff time was identified as a barrier to effective use of VERT. The following were suggested as contributory solutions:

(a) problem-based learning sessions which require relatively limited direct supervision by staff also provide students with a valuable learning experience;

(b) use of final-year students to facilitate VERT sessions while providing students with the benefit of developing their own mentorship and supervision skills.

4.3 Use of VERT

4.3.1 VERT was used almost exclusively by pre-registration radiotherapy students throughout the course of the Project but many centres identified potential use of the technology for: postgraduate students; those re-entering the profession; training new staff in local techniques; staff development; evaluation of new or unusual techniques; and use with other staff groups.

4.3.2 Seminar VERT systems were under-utilised in most centres during the Project. Lack of staff; location of the VERT facility; and difficulty gaining access to the facility contributed to under-use.

4.3.3 Dosimetrists made substantial use of Seminar VERT to augment plan evaluation and, in some centres, integrated student learning within the process.

4.3.4 Widening access to other professional and student groups maximises use of VERT facilities, but the impact on pre-registration radiotherapy students needs to be considered.

4.4 Student Experience

4.4.1 Student experience of VERT was very positive with the majority reporting that they had enjoyed using VERT and found the experience motivating.

4.4.2 Student perceptions were that VERT had enhanced their knowledge, understanding, skills and confidence as well as enjoyment of the learning experience.

4.4.3 Limited individual hands-on time was identified as the most common problem experienced, with a majority considering that they had insufficient time in VERT prior to their first placement.

4.4.4 Students gained most benefit where they interacted individually; learned from mistakes made in a ‘safe’ environment; and received immediate, objective feedback on their performance via the software.

4.5 Development of Skills, Knowledge and Confidence

4.5.1 Clinical staff confirmed that pre-placement experience in VERT led to increased confidence and improvement in psychomotor skills; and that the skills developed were transferable to the clinical environment.

4.5.2 The general perception was that VERT, currently, had the greatest impact on students' knowledge and understanding of fundamental concepts, simple techniques and anatomy.

4.5.3 A study undertaken during the Project demonstrated that strategies for achieving good skin-apposition can be effectively learnt in VERT and thus use broadened to include preparation for more complex set-ups. The study also found a positive correlation between inherent spatial ability and performance in electron set-ups.

4.6 Adverse Effects

4.6.1 Adverse effects such as headaches, eye-strain and disorientation were reported by one quarter of students, the highest incidence being noted when 3-D glasses were worn for more than 30 minutes.

4.6.2 The most commonly reported symptoms were minor and detracted little from user experience. They were minimised by avoiding excessive manipulation of the scene during user interaction and limiting the length of exposure to 3D stereoscopy.

4.7 Access to Planning Data

4.7.1 Acquisition and transfer of suitable treatment planning data for Immersive VERT systems was identified as an issue throughout User Group discussions.

4.7.2 Difficulty in accessing the necessary treatment planning data resulted in some limitation in the use of Immersive VERT to demonstrate techniques and enhance plan evaluation in educational institutions without an in-house treatment planning system and associated CT data.

4.8 Recruitment, Retention and Attrition

4.8.1 It is too early to draw any significant conclusions regarding the impact of VERT on attrition in radiotherapy programmes. Although a reduction of 5.4% in student attrition was noted for the 2008/9 year it is impossible to attribute this to the introduction of VERT.

4.8.2 Educational institutions are using VERT to enhance recruitment processes but, again, it is too early to draw firm conclusions regarding its impact.

4.8.3 Feedback following use of VERT to support 'at-risk' students indicated that VERT had a positive impact on students continuing on the course and thus suggests that VERT may have a role to play in improving retention.

4.8.4 Enhanced enjoyment of the course and improved motivation, knowledge and understanding may also improve retention.

5 Summary of Recommendations

Recommendations regarding the implementation, management, current and future use of VERT were made throughout the Report. These are grouped below according to their primary focus.

5.1 General Recommendations

It is recommended that:

- local, regional and national user groups are established with a multidisciplinary membership wherever possible; and

- further research which eliminates the influence of intuitive view manipulation by experienced personnel is undertaken to determine the influence of user tracking on student performance in VERT scenarios.

5.2 It is recommended that Educators:

- integrate VERT into learning and teaching scenarios as early as possible in pre-registration programmes;
- ensure sessions are interactive and allow sufficient time for all students to engage individually where possible;
- limit session length where 3D stereoscopy is enabled, and consider disabling 3D stereoscopy where depth perception is not essential;
- use 3D stereoscopy and user tracking with caution, particularly where students are prone to vection-induced simulator sickness, headaches or visual disturbance;
- inform all users of the likelihood of symptoms prior to use of VERT; and minimise manipulation of the scene when a user is interacting with it; and
- include in pre-placement VERT sessions: an introduction to fundamental concepts underpinning clinical practice; essential practical aspects; a focus on anatomy; and practice with simple techniques that facilitate the confident development of psychomotor skills.

5.3 Recommendations for Educational Institutions

It is recommended that:

- use of VERT for the development of basic psychomotor/practical skills and to enhance confidence prior to initial clinical placements is continued;
- inherent spatial ability of students is assessed to assist identification of individuals who are likely to benefit most from VERT experience;
- a mentoring/'buddying' scheme whereby VERT sessions are facilitated by experienced students is considered; and
- funding for treatment planning systems for integration with the VERT technology is sought.

5.4 Recommendations for Radiotherapy and Oncology Departments

It is recommended that:

- centres develop suitable training packages to supplement training offered by Vertual Ltd. and cascade training to various user groups at a frequency appropriate to local needs;
- centres appoint VERT Leads and offer an appropriate level of protected time/workload allocation to ensure successful implementation and management of VERT;
- local VERT Leads encourage student engagement in the process where other groups of staff such as dosimetrists utilise Seminar VERT facilities;
- local VERT Leads encourage wider use of the facility while ensuring its availability to radiotherapy staff and students;
- in the medium term, more radiographers are trained to use VERT and afforded opportunities to facilitate teaching and learning sessions.

5.5 Recommendations for both Educational Institutions and Radiotherapy and Oncology Departments

It is recommended that:

- VERT installations are located as close as possible to the main work area;
- VERT facilities are booked on a regular basis and the time utilised in a meaningful way;
- pre-placement VERT sessions in educational institutions are supplemented by seminar VERT sessions during initial clinical placements to further enhance knowledge and skills;
- following use of VERT for pre-placement preparation, the aims of the initial placement are reviewed and consideration given to a change in emphasis from development of simpler psychomotor/practical skills to clinical and team working skills;
- staff consider using VERT to support 'at-risk' students where appropriate;
- VERT use is considered for the development of strategies in spatially complex set-ups at an early stage, particularly for those students with relatively poor spatial ability; and
- centres consider the use of problem-based learning in VERT.