



Radiation Therapy Patient Education Review and a Case Study Using the Virtual Environment for Radiotherapy Training System

Yobelli A. Jimenez, MHSc* and Sarah J. Lewis, PhD

Faculty of Health Sciences, The University of Sydney, Lidcombe, New South Wales, Australia

ABSTRACT

Introduction: The emergence of modern learning environments for radiation therapy (RT) education offers innovative opportunities for RT patients. This article presents a descriptive review of the current state of practice for two recently available tools, the “Virtual Environment for Radiotherapy Training” (VERT) and the “Patient Education And Radiotherapy Learning” (PEARL) systems. Subsequently, a case study summarizes the instructional design and development of an RT breast cancer patient education program, with the intention of providing a blueprint for further patient education initiatives that incorporate VERT.

Methods: A total of 278 articles were identified for the descriptive review, using academic databases and a grey literature search. After screening for descriptive accounts of patient education interventions using VERT or PEARL, five full articles were retrieved and coded using a data extraction protocol. This information was used to inform the subsequent development of a breast cancer education program using a three-step development model, encompassing (1) consultation process and literature review; (2) program content and instructional process; and (3) program evaluation plan. The VERT integration process within the second stage is the focus of the case study presented.

Results: The literature search found that methods for the design, delivery, and evaluation of the education programs varied across studies. Positive impacts of VERT and PEARL in patient education have been demonstrated. The development of the 1-hour education program was based on comprehensive, evidence-based learner literature and was designed with the intention of specifically engaging learners with the three-dimensional VERT system. In particular, the VERT integration process aimed to exploit VERT's range of visualization features and draw upon the multidisciplinary nature of radiation cancer care.

Discussion: VERT and PEARL offer innovative education opportunities and have been justly recognized as valuable tools for RT patient education. When aligned to an educational framework, rich visual displays offered by VERT and PEARL have the potential to support patient education programs and exploit the advantages of a virtual RT

environment. With the increasing accessibility of these tools, the data presented in this article offer information for educators interested in development and evaluation of future patient education programs. Feasibility and economic aspects need to be addressed within local departments, and further research is required to ascertain specific capability of VERT and PEARL in supporting psychological and health-related patient outcomes.

RÉSUMÉ

Introduction : L'émergence d'environnements d'apprentissage modernes pour la formation en radiothérapie ouvre des avenues d'éducation novatrices pour les patients en radiothérapie. Cet article présente un examen descriptif de l'état actuel de la pratique pour deux outils devenus disponibles récemment, les systèmes VERT (Virtual Environment for Radiotherapy Training) et PEARL (Patient Education And Radiotherapy Learning). Ensuite, une étude de cas résume la conception et le développement d'un programme d'éducation pour les patientes traitées en radiothérapie pour un cancer du sein, dans le but de fournir un plan pour d'autres initiatives d'éducation des patients faisant appel au système VERT.

Méthodologie : Au total, 278 articles ont été recensés pour cet examen descriptif, à partir d'une recherche dans les bases de données universitaires et la documentation parallèle. Après un premier tri permettant de conserver les descriptions d'interventions en éducation des patients à l'aide des systèmes VERT ou PEARL, cinq articles complets ont été retenus et codés à l'aide d'un protocole d'extraction des données. Ces données ont ensuite été utilisées pour étayer le développement d'un programme d'éducation sur le cancer du sein selon le modèle de développement en trois étapes, comprenant 1) un processus de consultation et d'examen de la documentation, 2) le contenu du programme et le processus d'instruction et 3) un plan d'évaluation du programme. Le processus d'intégration VERT utilisé dans la deuxième étape fait l'objet de l'étude de cas présentée.

Résultats : La recherche documentaire a permis de constater que les méthodes de conception, de présentation et d'évaluation varient

* Corresponding author: Yobelli A. Jimenez, MHSc, Faculty of Health Sciences, The University of Sydney, PO Box 170, Lidcombe, New South Wales 1825, Australia.

E-mail address: Yobelli.jimenez@sydney.edu.au (Y.A. Jimenez).

selon les études. L'effet positif des systèmes VERT et PEARL dans l'éducation des patients a été démontré. Le développement d'un programme d'éducation d'une heure a été fondé sur la littérature d'apprentissage complète, centrée sur le patient, et a été conçu dans le but explicite d'engager les apprenants au moyen du système tridimensionnel VERT. En particulier, le processus d'intégration VERT visait à exploiter l'étendue des caractéristiques de visualisation VERT et à s'appuyer sur la nature multidisciplinaire du traitement du cancer par la radiation.

Discussion : Les systèmes VERT et PEARL offrent des occasions d'innover en éducation des patients et ont avec justesse été reconnus comme des outils valables pour l'éducation des patients en

Keywords: Radiation therapy; patient education; VERT; PEARL; virtual learning environment

Introduction

Although many traditional methods are used for radiation therapy (RT) patient education, the emergence of modern learning environments for this purpose offers opportunities not technically possible before. Two recently available education tools in RT are the “Virtual Environment for Radiotherapy Training” (VERT) and the “Patient Education And Radiotherapy Learning” (PEARL) systems. The three-dimensional (3D) immersive VERT system, in conjunction with 3D glasses, allows users to interact with a virtual RT treatment room and linear accelerator on a large wall-sized screen, although the system can also be viewed in two-dimensional (2D) mode. The virtual linear accelerator model can be operated with an authentic hand pendant to replicate realistic movements and sounds of the gantry, collimator, and treatment couch. A radiation beam can also be made visible. Computed tomography (CT) data and RT treatment plans are transferable into the VERT system in Digital Imaging and Communication in Medicine standard format, thereby supporting demonstrations of treatment techniques, patient anatomy, tumour volume, and dose distributions [1, 2]. Similarly, the PEARL system includes a virtual patient and treatment room environment, with many of VERT's display features. However, as PEARL was developed specifically for patient education, and it has limited functionality and display options compared with VERT, whose target learning audience encapsulates learners with expanded education needs, such as student radiation therapists (RTs) [3]. **Figure 1** shows views of the VERT room and display.

Currently, there is a growing evidence base for the use of VERT and PEARL in patient education. This momentum was supported by the initial positive experience of VERT for student training in the United Kingdom [4] and the growing availability of VERT and PEARL in other countries, such as Australia and New Zealand [5, 6]. The drive for patient education is broad, encompassing the supportive role in decision-making before consent and the potential psychological and physical benefits during patients' cancer care journey [7, 8]. Although patient education guidelines exist, they do not

radiothérapie. Dans le contexte d'un cadre de formation, les présentations visuelles riches offertes par les systèmes VERT et PEARL ont le potentiel de soutenir les programmes d'éducation des patients et d'exploiter les avantages offerts par un environnement de radiothérapie virtuel. Avec l'accessibilité croissante de ces outils, les données présentées dans cet article offrent de l'information aux éducateurs intéressés par le développement et l'évaluation de futurs programmes d'éducation des patients. La faisabilité et l'aspect économique devront être traités localement par les différents services, et d'autres recherches seront nécessaires pour établir les capacités spécifiques des programmes VERT et PEARL pour appuyer les résultats liés à la santé psychologique et physique des patients.

specifically address virtual learning environments for this purpose [9, 10]. Advantages of virtual environments for patient education can facilitate audio-visual demonstration of the RT treatment room and equipment, thereby reducing the time demands on clinical equipment for education purposes. The virtual RT environment is also ideal for RT concepts that are not visible in real life, such as radiation, patients' internal anatomy, radiation dose distribution, and how the radiation field relates to internal anatomy and treatment planning volumes.

Education using VERT or PEARL requires specific resources and considerations for program planning. Given that VERT and PEARL are relatively new approaches for RT patient education, there is limited literature guiding the development of patient education resources using these tools, hence best practices for design, development, implementation, and evaluation are currently unclear. To address this gap in knowledge, this article presents the results of a literature review with the purpose of identifying the current practice as it relates to the design, development, implementation, and evaluation of patient education using VERT or PEARL. Secondly, a case study is presented, which outlines the instructional design and development of a VERT-based breast cancer patient education program. Key stages are described, with a focus on the integration of the VERT system.

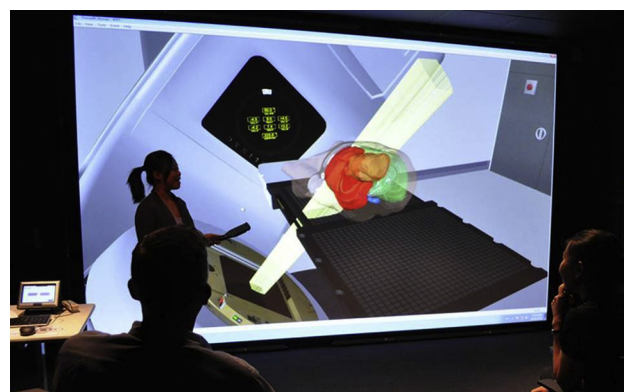


Figure 1. View of the Virtual Environment for Radiotherapy Training room and display.

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