

BEYOND THE CLINIC: THE VR EVOLUTION OF IRCLEP FOR RADIOTHERAPY EDUCATION

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Introduction

Traditional methods in radiotherapy education rely heavily on clinical placements, which are often limited by hospital schedules, patient safety concerns, and limited access. To address these limitations, the Immersive Radiotherapy Clinical Learning Experience Prototype (IRCLEP) was initially developed as a PC-based software, though it lacked realism and interactivity. Virtual Reality (VR) has been increasingly applied in health education, where it improves engagement and confidence compared to screen-based learning. Hence, this study investigates whether IRCLEP-VR enhances students engagement and perceived realism compared to the earlier PC-based version.

Methods

The VR development upgrade involved reconstructing 3D clinical environments and patient interaction workflows using Blender™, Microsoft Visual Studio®, and Unity™ with VR integration features. Educational content was aligned with the Radiotherapy Treatment Planning (RTP) course of the Diagnostic Imaging and Radiotherapy (PDR) programme at Universiti Kebangsaan Malaysia (UKM). Key elements like patient identification, immobilisation device selection, patient positioning, and CT scanning were remodelled with higher fidelity to optimise VR interaction. Navigation and user interfaces were redesigned for intuitive learning with VR headsets.

Following development, beta testing was conducted through an online survey adapted by Cicek et al. (2021), completed by 46 participants (lecturers, clinicians, and students), yielding a response rate of 50.35%. Data were analysed using descriptive statistics (percentages) to evaluate user engagement and adoption of IRCLEP-VR.

Results

The IRCLEP-VR recreated a high-fidelity radiotherapy department, enabling realistic tasks such as patient identification, positioning, and CT simulation. The VR system gave a more immersive and interactive experience compared to the earlier PC-based version. From the 46 respondents, over 89% of agreed VR motivated further exploration, and around 84% felt it removes the limits of passive learning. However, 21% reported feeling overwhelmed by full immersion, suggesting a need for guided use in academic settings. Table 1 illustrates these findings, supporting the claim that VR enhances engagement.

Table 1. Findings from Beta Testing

Items (paraphrased)	Percentage (%)				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
"VR motivates further exploration and learning"	0	2.2	8.7	41.3	47.8
"VR removes the limits of passive screen learning"	0	2.2	13	34.8	50
"Full VR immersion can feel overwhelming"	28.3	23.9	26.1	4.3	17.4

Discussion

Transitioning IRCLEP to VR enhanced realism and comprehension, with high satisfaction reported by the PDR community. However, 21% found full immersion overwhelming, likely due to cognitive load. Limitations including modest sample size, self-reported survey data, and lack of long-term outcomes. Despite these constraints, IRCLEP-VR shows strong potential as a supplementary training tool to enhance radiotherapy education. Future work should include larger evaluations, curriculum integration, and exploration of long-term impacts, with possible extension into patient education via Advanced Educational Radiotherapy Immersive System (AERIS).

Keywords: Radiotherapy education, virtual reality, immersive learning, clinical training, digital education, VR development