Development of VR Situation Room Operating Training Content for Radiation Emergency Medicine

Hyungwoo Nam, Kihoon Kim Minsu Cho*
Korea Institute of Radiological and Medical Sciences
namhw@kirams.re.kr

***Keywords : Radiation emergency, VR/AR educational content, VR situation room operating training**

1. Introduction

The occurrence of nuclear technology-related accidents, such as the Fukushima nuclear power plant accident, has increased the demand for safety measures in the event of a radiation accident. Under Article 36 of the Act on Physical Protection and Radiological Emergency (Radiation Disaster Prevention Education), the Korea Institute of Radiological & Medical Sciences plans and conducts radiation emergency medical education for radiological emergency medical personnel from 31 hospitals nationwide, which are designated as radiological emergency medical institutions.

Traditional radiation emergency medical education has limitations in realistically depicting radiation emergency situations and is subject to spatial and temporal constraints. To overcome the limitations of traditional radiation emergency medical education, a virtual/augmented reality (VR/AR) training simulator for radiation emergency response was developed. VR/AR technologies are being used in various fields, and according to Edgar Dale's cone of experience, experiential learning through actual experiences or simulation based multisensory stimuli results in the retention of 90% of learned content [1].

This study developed a VR situation room operating training content to train the decision-making process at the Joint Radiation Emergency Medical Center, which is established according to the National Radiological Disaster Prevention Plan in the event of a radiation accident.

2. Development of VR situation room operating training content

The VR situation room operating training content is a decision-making training program to perform the distribution of multiple casualties who have undergone triage. The training is conducted as individual or team training, and the educational content is designed to allow 1 to 4 trainees to participate in the education and perform the roles of the situation room captain and the situation team members in charge of each on-site radiation emergency clinic.

Trainees in the VR situation room operating training collect situational information from ERIX, K-REM, and the comprehensive situation board, and perform decision-making for dispersed patient reception through appropriate medical resource allocation.

2.1. ERIX (Emergency Response Information eXchange system)

ERIX is an inter-agency information exchange system that is activated in the event of a radiation disaster drill or nuclear accident and shares situation information and response status between major organizations (Nuclear Safety and Security Commission, Korea Institute of Nuclear Safety, KIRAMS, local governments, etc.).

2.2. K-REM (KOREA-Radiation Emergency Medicine)

K-REM is a radiation accident response application operated during emergency medicine. It is a system developed to enter the information and triage results of the injured at the field radiation emergency clinic and transmit them to the situation room.

2.3. Comprehensive situation board

The comprehensive situation board is a system that provides real-time bed information nationwide, operated by the National Emergency Medical Center of the Korea National Medical Center (NMC), and supplies information such as remaining bed availability by hospital function.

To develop the VR situation room operating training content, virtual situational information for ERIX, K-REM, and the comprehensive situation board was constructed. To construct the virtual accident scenarios and inter-agency response status presented in ERIX, radiation disaster drills at each site were referenced. To construct the injured patients' information and triage results presented in K-REM, 60 simulated patient information sets were developed. To organize the virtual bed information that appear on the comprehensive situation board, the status of the radiological emergency medical institutions and specialty hospitals located near the trainee's selected site was investigated. Figure 1 shows the VR situation room operating training content.

Fig. 1. VR situation room operating training content UI

3. Results and analysis of the pilot operation of VR situation room operating training content

The pilot education operation of VR situation room operating training was conducted with 21 radiological emergency medical personnel from the KIRAMS. During the operation of VR/AR-based education, the trainees' pre- and post-education proficiency was evaluated using proficiency assessment tools. The maximum number of simultaneous trainees is limited to 15, considering the maximum number of VR devices available and the safety of trainees.

Table 1 shows the results of the pre- and post-education proficiency assessment for trainees in the VR situation room operating training.

Table I. Results of pre- and post-training proficiency assessment in VR situation room content

Questionnaires	Score (pre-)	Score (post-)
Familiar with medical response to radiation emergencies (white/blue/red situations).	3.67	4.24
Familiar with the types of patients that may be involved in a radiation incident.	3.62	4.29
Familiar with hospital beds information that can be utilized in the event of a radiation incident.	3.29	4.05
Capable of handling the dispersal reception of patients that may occur in a radiation incident.	3.52	4.19
Capable of performing tasks conducted at the Joint Radiological Emergency Care Center.	3.48	4.19

When the evaluation results of 21 trainees for the 5 questionnaires constituting the proficiency assessment tool were averaged, the scores increased from 3.67, 3.62, 3.29, 3.52, and 3.48 pre-education to 4.24, 4.29, 4.05, 4.19, and 4.19 post-education, showing an increase in proficiency after education in all questionnaires. Among the 5 questionnaires, “I'm familiar with hospital beds information that can utilized in the event of a radiation incident” shows the highest increase in proficiency.

This study demonstrated that consistent application of VR/AR educational content in radiation emergency medical education will contribute to the development of skilled radiological emergency medical personnel, enhance domestic radiation emergency medical capabilities, and ultimately promote public safety.

REFERENCES

[1] Dale E, Audio-Visual Methods in Teaching, NY; Dryden Press; 1946