Journal of the Korea Academia-Industrial cooperation Society
Vol. 25, No. 8 pp. 604-615, 2024

https://doi.org/10.5762/KAIS.2024.25.8.604
ISSN 1975-4701 / eISSN 2288-4688

MetaVerse-Based Mandatory Military Base Facility Relocation Training and Implementation in the Republic of Korea Army

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MetaVerse 기반 대한민국 육군의 의무적 군사기지시설 이전 훈련 및 실시

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Abstract This study explores the utilization of a metaverse-based training system as an innovative approach to enhance the training and execution of military medical units' operational duties. The primary objective is to investigate the potential for addressing the complex challenges faced by medical units responsible for treating friendly forces in actual combat scenarios and similar situations through training in virtual environments. This approach aims saves costs and time while improving soldiers' preparedness for real-world situations, allowing them to adapt effectively to a variety of challenges in virtual environments that closely mimic real-world conditions. It also provides military personnel with the opportunity to train and accumulate experience in situations closely resembling actual combat scenarios. Enhancing the flexibility of military training by simulating diverse environments and scenarios in a metaverse helps soldiers develop the ability to respond swiftly to various situations. To achieve these goals, this research proposes the establishment of metaverse training teams within military medical units, and proposes development of an innovative educational and training framework for military operations and medical system management. This pioneering metaverse-based training is expected to contribute to improving national defense capabilities and ensuring the safety of military personnel.

요 약 본 연구에서는 군 의무부대의 작전 임무 훈련 및 실행을 강화하기 위한 혁신적인 접근 방식으로 메타버스 기반 훈련 시스템의 활용을 탐구한다. 주요 목표는 가상 환경에서의 훈련을 통해 실제 전투 시나리오 및 유사한 상황에서 아군을 치료하는 의무부대가 직면한 복잡한 문제를 해결할 수 있는 가능성을 조사하는 것이다. 이 접근 방식은 비용과 시간을 절약하는 동시에 군인들이 실제 상황에 대한 대비 능력을 향상시켜 다양한 과제에 효과적으로 적응할 수 있도록 하는 것을 목표로 한다. 실제 조건과 거의 유사한 가상 환경에서 교육을 수행하면 효율적인 비용과 시간을 절약할 수 있다. 또한 군인들에게 실제 전투 시나리오와 매우 유사한 상황에서 훈련하고 경험을 축적할 수 있는 기회를 제공한다. 메타버스에서 다양한 환경과 시나리오를 시뮬레이션하여 군사 훈련의 유연성을 높이면 군인들이 다양한 상황에 신속하게 대응할 수 있는 능력을 키울 수 있다. 이러한 목표를 달성하기 위해 연구에서는 군 의무부대 내에 메타버스 훈련팀을 설립하고 군 작전 및 의료 시스템 관리를 위한 혁신적인 교육 및 훈련 프레임워크를 개발할 것을 제안한다. 이번 선구적인 메타버스 기반 교육훈련은 국방능력 향상과 장병의 안전 확보에 기여할 것으로 기대된다.

Keywords : MetaVerse, Military Medical Units, Military Base Facility, Relocation Training, Korea Army

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email: 45295@naver.com
Received June 3, 2024 Revised August 1, 2024
Accepted August 2, 2024 Published August 31, 2024

1. Introduction

The COVID-19 pandemic has caused an unprecedented healthcare crisis worldwide, and a technology that has gained attention for military training and education amid this crisis is the Metaverse [1]. In the military as well, there was a need to establish medical systems for responding to infectious diseases in new environments, in addition to existing healthcare systems. During this process, the absence of information and experience led to numerous trial and error attempts. Moreover, there was no time for addressing these issues, and the situation was extremely challenging, requiring rapid real-time solutions. Building medical systems during emergency situations presents even more limitations. Coping with large-scale chaos due to combat, a continuous influx of patients, destroyed infrastructure, and transportation disruption caused by refugees are among the harsh conditions that had never been experienced before. To ensure effective medical support in various situations, whether in peacetime or wartime, practical training and validation are essential.

The fundamental purpose of the military is to always be able to achieve victory when war breaks out or in similar situations. Therefore, what is prioritized above all is military education and training. However, practical training like real combat comes with various challenges, including financial constraints, regional limitations, and environmental factors. The most effective solution to address these challenges in military education is the Metaverse [2]. The Metaverse is an advanced scientific technology that has emerged, particularly with the development of ultra-fast 5G networks alongside the commercialization of technologies such as Digital Twin, Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) [3]. The U.S. Department of Defense is also actively conducting research by collaborating with universities and businesses to address the issues of recruiting faculty for training medical personnel and the associated costs. They are utilizing Augmented Reality (AR) technology for education and providing medical practitioners with the opportunity to practice treating casualties through various combat trauma scenarios. This approach is expected to offer an exceptional learning experience cost-effectively [4]. In 2021, an 'AI-based Mental Resilience Education Platform' was implemented for certain forward-deployed units, and it resulted in a very high satisfaction rate of 85% among servicemen [5].

The Metaverse is a system that is gaining prominence as a core keyword in the IT industry. By utilizing a training system based on the Metaverse, it will be possible to conduct diverse environmental simulations and training exercises in minimal physical space. This technology enables immediate deployment to tasks similar to real-world scenarios through virtual reality (VR) learning experiences. The Metaverse not only allows individuals to experience tasks that may be impossible or non-existent in reality but also facilitates indirect exposure to real-world situations through experiential learning [6]. This is because the Metaverse, in addition to being similar to the real world, has the capability to include spaces that do not exist in reality, allowing for a wide range of activities in areas such as society, economy, and culture [7].

Particularly, the Ministry of National Defense is prioritizing the cultivation of an AI technology powerhouse based on the 4th Industrial Revolution's scientific technologies, including artificial intelligence (AI), big data, unmanned systems, and robotics. The primary objective is to transform the military into a force that can prevail in battles through the adoption of AI and scientific technologies [8].

The research aimed at planning and implementing the Metaverse-based training for the relocation of military medical facilities is expected to serve as foundational data for establishing and applying AI-based scientific training systems. To carry out the Metaverse-based new area deployment training concept and content tasks, the following tasks need to be performed:

1. Development of VR Content with 3D Models: Create VR content that includes 3D models of military medical facilities, equipment, and resources. These models should be highly detailed and accurate to provide realistic training scenarios.
2. Training Content for Resource Allocation Proficiency: Develop training content specifically focused on resource allocation proficiency. This should include scenarios that require personnel to efficiently allocate medical equipment and resources in a virtual environment.
3. Simulated Experience of Field Medical Facilities: Create content that allows trainees to simulate the establishment and operation of field medical facilities. This could involve setting up field hospitals, arranging medical equipment, and managing patient flows.
4. Development of Instructor Control Software: Build software that enables instructors to control and monitor training exercises within the Metaverse. This software should allow instructors to adjust scenarios, introduce challenges, and evaluate trainee performance.
5. Post-Training Analysis Software: Develop software for analyzing trainee performance and the effectiveness of the training program. This software should provide insights into areas for improvement and help refine future training content.
6. Metaverse-Based Teamwork Training Features: Design and implement features within the Metaverse platform that focus on teamwork training. This could involve collaborative medical scenarios where trainees must work together effectively to address medical emergencies.

These tasks represent the core components required to implement a Metaverse-based training system for medical facility deployment. They encompass content creation, software development, and analysis tools necessary to ensure the effectiveness of the training program.

2. Research Methodology

This research was conducted as part of the '21 Daejeon XR Convergence Content Production and Verification Support Project, organized by the Daejeon Information & Culture Industry Promotion Agency. It received approximately KRW 150 million in government budget support and was confirmed to develop and operate a program in December 2021 at the Korea Armed Forces Medical School. The aim of this research was to establish a MetaVerse-based education and training system, focusing on the internal structure and various forms of field medical units, and to further apply an expanded training system that reflects changing operational environments and tactical concepts.

By transitioning the existing education and training paradigm, this research enables self-directed learning through VR-based interaction. It expands the training domain from one-way education and training to multi-party collaborative education and training. The research methodology involved the following steps:

First, detailed requirements for VR content and software necessary for training were explained to soldiers and instructors. The study identified what types of training are required within the medical units and assessed equipment and material placement requirements. Second, 3D modeling and texturing were performed to virtually recreate environments such as field treatment centers and patient wards. Functionalities for user interaction within the VR environment were implemented using appropriate development tools and software. VR content was then tested and operated. Third, the study involved the creation of training content for equipment and material placement proficiency, as well as simulation content for field treatment center experiences. Scenarios were developed in which users could arrange equipment and perform related tasks. Fourth, software for instructor control and post-training analysis was developed. This allowed instructors to monitor and control training while tracking progress. Data collection and analysis were conducted to assess training outcomes and identify areas for improvement. Finally, the study enhanced teamwork education and training within the metaverse-based environment. This encouraged collaboration and communication among users. All programs were integrated and tested using scenario-based simulations to conduct the training effectively.

3. Main Content

Title: MetaVerse-Based New Area Deployment Training Operation Concept and Content Task Execution

A virtual education and training system refers to advanced education and training that enhances the necessary performance capabilities for tasks by combining information and communication technology that connects virtual environments with the expertise and knowledge of experienced professionals. Depending on the purpose, it can be applied diversely, providing advanced technology-based practical training that allows for immersive virtual training. Unlike one-way educational methods, virtual reality training integrates the acquisition of knowledge with practical experience from actual work environments. By utilizing advanced technology, it supplements and enhances industrial training, shifting from theoretical and equipment-based learning to experiential and practice-oriented education and training that promotes active learning and enhances the learning effect.

MetavVerse-based training systems operate in three phases (planning/preparation, execution, analysis). The planning/preparation phase involves setting up the plan to allow trainees to perform various training scenarios through instructor-managed trainee management, content management, training environment management, and scenario management. In the execution phase, trainees perform field hospital experience and medical equipment placement training in a virtual environment based on scenarios planned by instructors. The analysis phase collects and analyzes the results of the training conducted in the execution phase and allows instructors to conduct analysis/evaluation and provide feedback to trainees.

MetaVerse-based training consists of instructor control and MetaVerse training areas, and the network environment is configured wirelessly. The instructor control area is equipped with control software (training control, training environment management, scenario management, etc.) and post-analysis software (training result collection/ analysis, feedback, etc.) on a control console operated by instructors. The MetaVerse training area is equipped with visualization equipment (PC and HMD) that visualizes trainees and virtual spaces, along with MetaVerse field hospital simulation content (field hospital site tour experience, medical equipment placement training).

The research methods include VR content application 3D modeling, medical equipment and material placement proficiency training content, field hospital site simulation content, instructor control software development, post-analysis software development, and MetaVerse-based teamwork education and training function development. The VR content application 3D model applies 3D modeling of mandatory equipment and materials required for field hospital site training, such as field hospitals, command and control rooms, and patient rooms, to VR content (Fig. 1, Field Training Manual Operation - 3-3, Chapter 5, Rear Area Operations, Section 4, Important Facility Protection

Operations Reference) (Fig. 2).

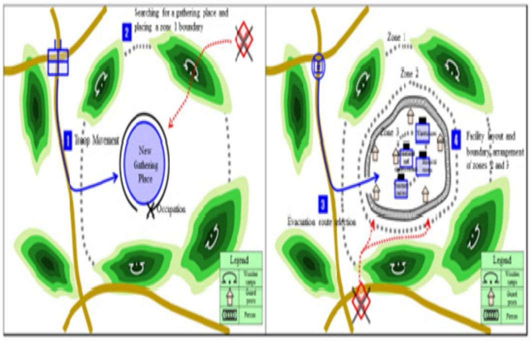

Fig. 1. Medical unit facility layout (example)

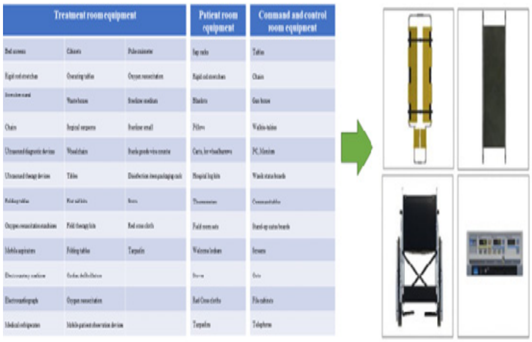

Fig. 2. VR Content Applied 3D Model

The medical equipment and supplies placement proficiency training content allows trainees to perform arbitrary facility rearrangement training in virtual spaces (metaverse) based on various areas such as emergency and non-emergency patient care rooms, surgical areas, command centers, and wards, which are differentiated for field hospitals. Trainees can freely arrange equipment and supplies in these virtual environments (metaverse) to conduct facility rearrangement training (Fig. 3).

The Field Hospital Facility Simulation Content" involves both instructors and trainees exploring and discussing the treatment facilities within the virtual environment (Metaverse). They examine established facilities, including tents, containers, and school buildings, and engage in discussions and additional practical training regarding the current setup (Fig. 4).

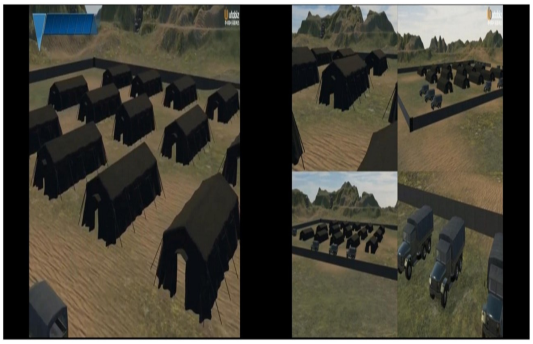

Fig. 3. The new area deployment training model

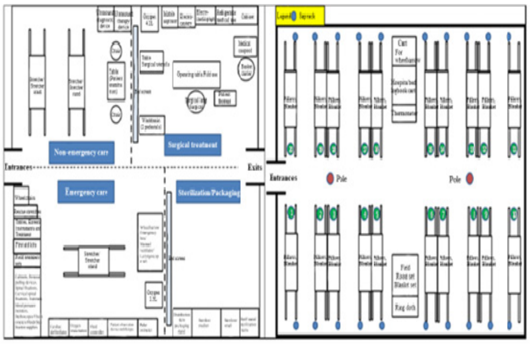

Fig. 4. Field hospital facility practice at the military medical school

This enables instructors to offer an overview of the training situation and control trainees within the virtual space. Data such as learning outcomes, procedure execution, and scenario processing generated during training are collected to build a database for analysis.

Based on the analyzed data, the system visualizes the results in the form of 2D and 3D graphs and charts. This allows for a visual representation of training outcomes, performance metrics, and related information.

Furthermore, the system utilizes the collected information from the training sessions to support the replay of training scenarios and conduct evaluations by instructors. Instructors can provide feedback on areas of improvement and address any shortcomings identified during the training. This capability is facilitated by the development of post-training analysis software.

In addition, the development of the MetaVerse-based teamwork education and training function incorporates a multi-collaboration framework among trainees, enabling them to work together in group training exercises(Fig. 5)

Fig. 5. Multi-collaboration between trainees for metaverse- based teamwork

As the review of current literature reveals, while advancements in Metaverse technology offer significant benefits for virtual training environments, several challenges and limitations persist. To address these issues comprehensively, it is crucial to examine the specific limitations associated with military applications of Metaverse technology and explore potential improvements.

One major issue is the lack of realism, which hinders users' ability to immerse themselves completely in the virtual space and results in interactions that fall short of real-life experiences. To overcome this, enhancing realism is crucial. This can be achieved through the integration of high-resolution displays and advanced haptic technology, which together can make virtual interactions more lifelike and engaging.

Another challenge is the need for high-performance hardware to create an immersive environment. The requirement for such hardware can be a barrier to widespread adoption. To address this, leveraging cloud-based computing support can alleviate the dependency on high-performance hardware, making the Metaverse more accessible while maintaining performance standards.

Security concerns also pose a significant challenge, particularly in protecting personal data and confidential documents used during training. Implementing robust security measures is essential, such as separating military networks from external internet networks and employing blockchain technology to ensure data integrity and transparency. These measures will help address major security concerns and support the safe and effective use of Metaverse technology in military applications.

4. Cost-Benefit Analysis (CBA) for Implementing a Metaverse Training System(CBA: Cost-Benefit Analysis)

To further substantiate the practical advantages of Metaverse-based training, a detailed cost-benefit analysis has been conducted. This analysis evaluates the financial implications and effectiveness of introducing a Metaverse training system, providing a clear picture of its economic feasibility.

The project implementation period is three years, with an initial investment cost of 2.3 billion KRW. Without the introduction of metaverse training, the training costs amount to 8.1 billion KRW. The benefit-cost ratio (B/C Ratio) is calculated as (8.1 billion KRW - 2.3 billion KRW) / 2.3 billion KRW = 2.521. This indicates an anticipated benefit of 152% with the implementation of metaverse training, suggesting that the project is economically viable.

To realistically simulate the training scenario, the costs for deploying various assets are calculated as follows: the evacuation of casualties from battalion-level vehicles, support from decontamination vehicles from the chemical and biological support unit, and the mobilization of brigade-level combatants for scenario enactment. The associated costs include vehicle fuel and hourly labor costs for pre-training preparation.

Brigade-Level Training Costs		
	Labor Costs	
1	Brigade-Level Training Personnel	1,500 individuals
2	Hourly Wage (Minimum Wage)	9,860 KRW
3	Preparation Period	5 days (40 hours)
4	Training Duration	1 day (8 hours)
5	Number of Brigade-Level Training Sessions	3 sessions
6	Subtotal	1,500 individuals * 9,860 KRW * 48 hours * 3 sessions = 2,129,760,000 KRW (approximately 210 million KRW)
	Vehicle Operating Costs	
7	Average Fuel Efficiency	5 km/l
8	Distance Traveled	Average of 20 km
9	Number of Vehicles	AMB: 3 vehicles
		2.5-ton trucks: 6 vehicles
		sprinkler trucks: 2 vehicles
10	Fuel Cost	1,700 KRW/l
11	Subtotal	1,870,000 KRW
	Total	**2,131,630,000 KRW**

The cost of conducting three training sessions during military service amounts to approximately 2.1 billion KRW, resulting in a training expense of 700 million KRW per session. With the introduction of metaverse training, excluding the initial setup costs, only the cost of charging VR equipment is incurred. Consequently, the cost of VR training is minimal. Therefore, each session of large-scale casualty training or brigade-level training in a wartime scenario can be valued at 700 million KRW based on the accumulated training proficiency achieved.

5. Discussion and Conclusion

Through the Metaverse system, a digital world that replicates reality, where one can engage in all activities, the military faces challenges in providing immersive training due to financial constraints and logistical and environmental issues, among others. Given the size and nature of military organizations, there is a tendency for them to become large and rigid. However, to operate a highly scientific, technological, and specialized military capable of adapting proactively and flexibly to changing times and requirements, it is crucial.

This research has explored various aspects such as VR content application with 3D models, proficiency training in the deployment of medical equipment and supplies, simulated experiences of field hospitals, the development of instructor control software, post-training analysis software, and the creation of teamwork training functions based on the Metaverse.

In light of the ongoing occurrence of novel infectious diseases such as novel influenza, MERS, Zika, and COVID-19, there will continue to be a need for the establishment of new healthcare systems at the national level. The traditional healthcare system focused primarily on outpatient care, surgeries, and inpatient treatment. However, the new healthcare system places greater emphasis on preventing the spread of infectious diseases and treating a large number of patients simultaneously. This involves measures to contain viruses and the simultaneous treatment of numerous patients. Furthermore, as seen in the medical response to COVID-19, the ability to quickly establish an optimal healthcare system, taking into account factors such as the movement and routing of medical staff and patients, the provision of medical equipment and supplies for patient care, and the allocation of resources, is essential[10].

There have also been significant changes in healthcare facilities for patient treatment. In order to accommodate the increasing number of patients requiring isolation, not only were existing medical facilities equipped with the necessary equipment and facilities, but also public facilities such as schools and sports arenas were repurposed as treatment centers.

Given their original purposes, these facilities often presented various challenges when used for medical purposes, and there was a learning curve associated with their conversion.

The form and location of medical facilities for the treatment of suspected infectious disease patients, such as screening centers, tent facilities, negative pressure containers, and airport quarantine facilities, need to be assessed, often considering the number of patients involved. The priority of key considerations varies depending on the purpose of use. For instance, when setting up a screening center, it may be installed in an outdoor area before entering the emergency room, or a separate facility within a medical institution may be designated. The routing of patients using the screening center should be separated from that of regular emergency patients. Screening centers should be equipped with masks and hand sanitizers, and temporary negative pressure facilities or air purifiers with HEPA filters should be installed to prevent the spread of airborne contamination.

Medical equipment and supplies are significantly higher in cost compared to typical equipment and materials. They require extensive maintenance and servicing after initial installation, and their setup typically demands specialized personnel, consuming a considerable amount of time. Moreover, relocating medical equipment can result in gaps in medical services, making it challenging to prepare for emergency situations. Consequently, practical training involving actual equipment is limited.

The Korean Peninsula features a distinctive topography characterized by its North-South and East-West mountain ranges. Approximately 70% of the land is mountainous terrain, primarily formed around mountain ranges. Particularly, the northern and eastern regions are abundant in high mountainous areas, while the western and southern regions consist of low hills and plains. The mountainous areas adjacent to cities and villages in North Korea have been largely desolated due to deforestation and land development, resulting in mostly barren hills. In contrast, the mountainous regions in South Korea are densely covered with forests.

North Korean roads are mostly unpaved, with limited traffic due to the poor road conditions, except for highways and major roads. The environment is challenging, with most roads restricting cross-traffic. In South Korea, both longitudinal and latitudinal roads, bypass roads, and forest roads are well-developed. Urban areas have various buildings on the surface and numerous facilities underground, such as subways and underground parking lots. However, during full-scale warfare, many buildings and roads are likely to be damaged, making their use limited. To ensure protection, preparations must be made to utilize underground facilities if necessary. According to the North Korean military manual titled 'Group Army (Corps) Divisional Training,' in Chapter 2, Command Security, Section 2, Organization, it operates reconnaissance units at the divisional and corps levels to carry out target identification and fire control missions in the rear command posts, support facilities, and operational areas[11]. During offensive and defensive operations, divisional artillery units are employed to conduct fire attacks on acquired targets identified by reconnaissance units. Divisional alert troops are utilized as assault units to carry out attacks using anti-tank weapons and incendiary devices on key facilities and equipment within the operational area.

Medical units must consider the battlefield situation for unit movement, as described in Field Manual for Medical Units - 6-52, Chapter 6: Tactical Operations, Section 2: Unit Movement and Placement. They should prioritize timeliness, swiftness, and unit survival in medical operations. Typically, they are positioned as part of higher-level units, and their relocation and placement are determined together with the new area of operation.

However, in certain situations, medical units may need to move and deploy independently to areas where protection from combat units is available, and in restrictive conditions, they must establish their own protection plans.

When considering the placement of medical units, several factors should be taken into account:

First, positions should be arranged to facilitate command and control headquarters, treatment centers, and other departments for easy coordination and cooperation. Second, similar functional areas such as emergency rooms, operating rooms, patient wards, pharmaceutical dispensaries, and drug storage areas should be integrated to minimize the movement of personnel, equipment, and supplies while enhancing the convenience of patient care. Third, locations that offer natural concealment and cover in similar situations must be secured. When selecting new locations, considerations should include areas that are easily concealed and fortified against enemy attacks and observations. These areas should have stable foundations, good drainage, ample space for ambulance rotations, suitable access roads, and parking areas.

The road network should be in good condition and easily accessible. Areas with minimal communication blind spots should be preferred. Locations suitable for helipad installation and with clear access routes should also be considered.

Furthermore, medical units typically have a large stock of medical facilities and equipment. Due to their vital role in medical operations, they are vulnerable to exposure in similar situations. Especially when the formation of border units is insufficient, medical units should collaborate with responsible local units to establish protection plans. These plans should aim to enhance survival conditions against threats such as enemy infiltration, attacks, and other risks[12].

Additionally, medical assets and support materials should be dispersed in available facilities such as patient transport vehicles and warehouses to prevent mass casualties. During relocation, whenever possible, local facilities in the new area should be utilized for storage. When storing in field conditions, tents or covers should be set up in concealed and controllable areas, and materials should be dispersed as much as possible within the controlled area to enhance survival conditions and operational functionality.

Due to the specialized nature of medical equipment and supplies, practical training is limited. For instance, during the preparation of a COVID-19 response hospital, there were situations where the installation of negative pressure units fell short of the required standards due to a lack of information regarding the hospital's facility system (such as whether it can provide separate exhaust) and isolation room compliance conditions. This resulted in some limitations in the operation of the hospital even after installation.

The facilities designated for mobilization according to the contingency operation plan include schools, private hospitals, and others. Most of the equipment in these facilities is not normally owned and the lack of resources hampers training. Practical training is limited due to the difficulty of mobilizing these resources. In some cases, only partial terrain reconnaissance is conducted for reviewing the operation plan, and even this may not be carried out properly during infectious disease outbreaks.

Additionally, the medical equipment used in hospital facilities is also restricted in terms of training because moving this equipment for training purposes is challenging. Acquiring training equipment is costly, making it limited to establish an exercise operating database (DB) through actual deployment training in arbitrary locations.

Due to these limitations, it is difficult for medical units to conduct a variety of realistic training in different environments during peacetime and wartime, making it challenging to produce specifications. To overcome this, current practices involve conducting reduced training using the unit's training grounds and open areas. The Medical School conducts simulated training using charts and blank tactics to improve doctrinal development and practical skills in standardized medical facility construction.

In the case of operational units, they must be able to relocate from their current facilities to a new assembly point when the operational plan or current station becomes unusable. This is particularly important for medical units as they need to establish a medical environment at the new assembly point for patient care. Planning involves considering various factors such as the placement of medical equipment and supplies, the availability of power, security measures, patient capacity, and transportation routes in the changed operational environment. Practical training based on this planning is essential.

Medical units must assess the volume of supplies based on the classification criteria considering mission requirements when loading materials. Additionally, the planning for personnel and material loading should involve prior assessment within the scope of available transportation assets, taking into account factors like volume and weight. However, due to the nature of medical units, which must maintain a constant emergency medical support posture, actual material movement and deployment training are limited.

Prior simulations are crucial in the medical field to consider various factors and derive the most suitable facility layout requirements. Trial and error in the medical field can have a direct impact on the lives of patients and medical personnel. From the perspective of healthcare professionals, it is essential to pre-determine the most ideal approach, taking into account factors such as personnel and material flow, by considering various facility layouts for establishing the optimal medical environment for patient care. For example, in the case of preemptive isolation ward adjustments and operations at the Armed Forces Capital Hospital for pneumonia, preparations were made in advance, such as the installation of mobile negative pressure units and the conversion of existing inpatient wards into preemptive isolation wards with the installation of equipment like negative pressure units and the division of the wards into contaminated and clean areas. In situations where the intended use of existing facilities needs to be converted and operated, utilizing a VR-based training system to simulate the medical environment based on the original use could help identify issues in advance. This could potentially lead to more efficient reductions in terms of personnel, costs, time, and other resources.

Using metaverse-based training can be highly cost-effective compared to traditional training methods. Instead of building and operating actual facilities and equipment, conducting training in a virtual environment can result in significant cost savings. Additionally, utilizing the metaverse allows for the creation of various combat and medical scenarios in a virtual setting, enabling soldiers to train in environments similar to real-life situations.

Metaverse-based training enhances the flexibility of military training by providing the capability to simulate diverse environments and scenarios. This helps soldiers adapt quickly to various situations. Training in a virtual environment enables instructors and trainers to monitor soldiers' performance in real-time and provide feedback, supporting individual improvement.

Metaverse technology breaks down the boundaries between reality and the virtual world, offering a more immersive learning experience. Furthermore, leveraging advanced technologies like the metaverse promotes military innovation and allows for the integration of 4th industrial revolution technologies such as AI, big data, and robotics in military operations. Metaverse-based training is expected to enhance the capability of medical units to reorganize their medical systems and facilities efficiently. It can also help mitigate limitations encountered in real-world situations, leading to more effective operations in medical units.

To implement metaverse education and training, it's essential to establish suitable training environments and explore methods for developing various competencies. For this purpose, within the medical units of the mandatory service, a metaverse unit operation team is required. This operation team should design an education and training system that can be conducted within a simulated environment similar to facilities like the Korea Combat Training Center (KCTC).

Metaverse-based education and training have the potential to bring significant innovative advancements in military training and healthcare system management. It can enhance defense capabilities and contribute to the safety and preparedness of military personnel.

The most realistic approach to simulate the scenarios that medical units in the military must deal with in wartime and similar situations is by utilizing a training system based on the metaverse. Through this, mandatory service personnel who will be performing medical operations in wartime can receive substantial assistance. Furthermore, ongoing efforts should continue to identify challenges where metaverse-based training systems can be applied in military education. This will contribute to improving the practical skills of field units in fulfilling their missions in the future.

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