ORIGINAL RESEARCH

Successful emergency medical service training with virtual field trips using video during the COVID-19 pandemic: the Official Development Assistance Project in Uzbekistan

Ki Jong Kim[1], Yoo Bin Lee[2], Woo Chan Jeon[1], Ji Sook Lee[3], Hoon Kim[1], Minkyung Oh[4] and Bo Young Yoon[5,6]

[1]Department of Emergency Medicine and [2]International Development Cooperation Center, Inje University Ilsan Paik Hospital, Goyang, [3]Department of Emergency Medicine, Ajou University School of Medicine, Suwon, [4]Department of Pharmacology, Inje University College of Medicine, Busan, [5]Department of Internal Medicine, Inje University Ilsan Paik Hospital, Goyang, and [6]Innovation Center for Medical Education, Inje University College of Medicine, Busan, Korea

Purpose: The coronavirus disease 2019 pandemic saw many restrictions on the provision of emergency medical service (EMS) training through actual field trips (AFTs), requiring a search for alternatives. This study aimed to assess trainees' reactions to virtual field trips (VFTs) and determine the characteristics of instructional design for successful VFTs using edited videos and expert interviews.

Methods: This study evaluated Uzbekistan trainees' reactions to the VFT of EMS training using questionnaires in three categories: satisfaction, relevance, and engagement. Factors of satisfaction and dissatisfaction were identified through open-ended questions.

Results: A total of 286 trainees responded to the survey during 15 educational sessions conducted from 2020 to 2022. The trainees' responses to the VFT were positive. Overall mean scores were 4.65±0.49, 4.63±0.50, and 4.63±0.50 out of 5 points for satisfaction, relevance, and engagement, respectively. The trainees reported that the most interesting and helpful videos concerned the introduction of an EMS training curriculum and the observation of training facilities, such as the simulation centers of educational institutes. The leading causes of satisfaction were (1) authenticity of the VFTs, (2) easy-to-understand content, and (3) relevance to the job. The trainees suggested that Uzbek or Russian voice-overs would be better than subtitles in the video clip for focusing on VFT.

Conclusion: In situations where AFTs are not available, VFTs using edited videos and expert interviews are a good alternative to EMS education. Based on these results, it is possible that AFTs could be replaced by VFTs using qualified videos with designed instructions as a distance learning method under specific conditions.

Key Words: Emergency medical service training, Virtual field trip, Video, Reaction, Instructional design

Introduction

Krepel and DuVall [1] defined a field trip as a process in which trainees interact with the setting, displays, and exhibits to obtain experiential learning about ideas, concepts, and subject matter for educational purposes. Field trips are an essential educational strategy for student learning in various fields such as science, social studies, pre-service teacher education, higher education, and

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Corresponding Author: Bo Young Yoon (https://orcid.org/0000-0002-9635-4799)
Inje University College of Medicine, 75 Bokji-ro, Busanjin-gu, Busan 47392, Korea
Tel: +82.51.890.6324 Fax: +82.51.895.1864 email: byyoon@paik.ac.kr

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continuing adult learning [2-7]. Guided field trips promote deep learning and real-world problem-solving skills [6]. Learners are easily immersed and engaged because actual field trips (AFTs) can invoke positive interests and emotions in them [7]. Although traditional AFTs are strong methods for authentic teaching and learning, they raise concerns about time, logistics, finance, learners' physical and emotional distress, and safety [4]. Another educational concern is that AFTs cannot provide a standardized curriculum or can cause schedule overload. Therefore, virtual field trips (VFTs) are increasingly being recognized as an effective field trip method as an alternative to AFTs with the development of new technologies and increasing demand for overcoming several issues that AFTs raise [2]. With technological advances, VFTs have expanded to international long-distance field trips, geohazard areas such as exploding volcanoes or earthquakes, and extraterrestrial environments such as moons or Mars [2,8]. In addition to these special circumstances, it remains debatable whether VFTs can fully replace traditional AFTs [3].

Korea Foundation for International Healthcare (KOFIH) has been conducting invitational training courses since 2007 through the Dr. Lee Jong-wook (LJW) Fellowship Program (currently the LJW School) to continue the late former World Health Organization Secretary-General LJW's efforts to foster health and medical personnel in developing countries [9]. Investigators conducted projects to strengthen the capacity of medical professionals in the emergency medical service (EMS) system in Uzbekistan, KOFIH, from 2019 to 2023 [10-13]. Originally, this invitational training program provided special lectures, simulation-based skills training, and AFTs to the emergency centers of university-affiliated hospitals, simulation centers of medical schools, departments of emergency medical services, and the national fire and disaster headquarters.

One year after starting the Uzbekistan project, in early 2020 all face-to-face educational activities, including skills lab training and site visits for invitational training programs, were stopped due to the coronavirus disease 2019 (COVID-19) pandemic. The judgement that the pandemic would not end soon led to a search for online education, from primary to higher education. Countries worldwide, not just Korea, quickly adapted to online education with the development of technology and Internet accessibility [14]. The project manager decided to conduct online or hybrid training programs. Lectures were readily available online. Simulation-based skills training was not easy, but was possible because the trainees were already experienced professionals in emergency medicine (EM), and the training of trainers (ToT) model was intended to be used in this project. However, field trips are essential educational strategies for situated learning in higher education, including EMS. Without hands-on training during field trips, emergency medical personnel cannot provide effective emergency medical care to communities in real-world situations. Therefore, the most critical factor in achieving training outcomes was creating VFTs to replace the traditional AFTs that constituted the essential learning activity in the current invitational training project.

The investigators created VFTs using edited videos and expert interviews following the instructional design process and used them as field trips virtually within the entire emergency medical training (EMT) course in Uzbekistan for 3 years. Our research questions are as follows: (1) How satisfied are learners with well-designed VFTs? (2) What should be considered in the instructional design of VFTs to promote learners' engagement? Based on these research questions, this study verified trainees' reactions to VFTs for EMT course and identified the factors that promote trainees' engagement and interrupt immersion in VFTs.

Methods

1. Study participants

The participants were 286 EM physicians who participated in advanced training programs from 2020 to 2022 to empower EMS system in Uzbekistan. The demographic characteristics of the respondents are presented in Table 1. In Uzbekistan, EM doctors, feldshers, and nurses, as a team, ride in ambulances to patients and decide their severity. The patients are then treated onsite or transferred to a hospital by the ambulance. The new EMT course is for EM physicians who accompany ambulances, and is an advanced program for those who have completed basic training. All participants were EM doctors with an average clinical experience of 10.23±10.75 (mean±standard deviation) and ambulance experience of 6.96±8.39 years (Table 1). Compared with those in 2020, trainees in 2021 and 2022 in the EMS training were significantly younger and had shorter clinical careers.

2. Study procedures and instrument

According to the training outcomes, reinforcing EM health professionals in Uzbekistan, the investigators planned the curriculum of an advanced EMT course using the instructional design process. First, the current competencies of Uzbekistani EM physicians and their ability to respond to EMS emergency situations were analyzed. Second, the investigators verified the desired performance and generated testing methods such as quizzes, multiple-choice questions, and objective structured clinical examinations. In the development phase, we prepared learning resources for lectures, replenished the equipment in the simulation center, trained local trainers, and produced video clips for the VFTs.

To maximize the sense of realism while cooperating with the government's quarantine rules, 10 trainees from Uzbekistan were selected and trained intensively. Despite the pandemic, they were invited to Korea and trained in a ToT program for a new, advanced EMT course in 2020. The ToT program consisted of lectures, simulation-based training (SBT), and AFTs. The EMT course was nearly the same as that of the ToT program, except for the AFTs (Appendix 1). AFTs had been replaced by VFTs in advanced EMT courses implemented in Uzbekistan. Seven different institutions were recruited to film the VFTs. After trainees acquired knowledge through lectures and skills from practice and simulations, they virtually experienced Korean EMS and educational institutes.

The educational content of VFTs can be broadly classified as follows: (1) advanced EMS, including emergency calls and patient transport (situation room-ambulance-hospital); (2) facilities and initial intervention of emergency centers; and (3) emergency medical educational curriculum, facilities, and equipment in Korea (Appendix 2). The investigators tried to create VFTs using videos of institutions that made trainees feel as if they

Table 1. Demographics of Trainees Participating in the 3-Year Emergency Medical Service Training Program

Characteristic	Project year			Total	p-value
	2020	2021	2022		
No. of participants	64	101	121	286	
Gender					0.7023
Male	52	79	100	231	
Female	12	22	21	55	
Age (yr)	40.22±11.18	37.50±12.41	37.33±49.08	38.04±33.13	<0.0001
Clinical experience (yr)	15.83±10.93	10.58±10.70	6.98±9.43	10.23±10.75	<0.0001

Data are presented as number of participants or mean±standard deviation.

were visiting an actual site related to EMS in Korea and interacting with experts. In particular, the video was filmed from the perspective of a visitor using an action camera so that the trainees watching the video could feel as if they were visiting the site in person. Every video clip was subtitled in Russian to enhance the foreign trainees' understanding.

Ten trainees selected from Uzbekistan served as local trainers for the 286 new trainees, using lectures, SBT, and VFTs in 15 additional sessions over 3 years. A few Korean trainers visited the site during the COVID-19 pandemic to help local trainers and facilitate trainees, and most Korean trainers answered the trainees' questions synchronously on the video conference.

After a 1-week training program, all trainees responded to an online survey on VFTs and video quality. The total number of survey questions was 16. The answers to the 12 questions on satisfaction, relevance, and engagement were rated on a 5-point Likert scale. The questionnaire also asked which two videos were the most interesting and helpful from the perspective of their relationship with their current job and the reason why they chose the items using open-ended questions.

3. Statistical analysis

Data are presented as mean±standard deviation for continuous variables and counts for categorical variables. The Kruskal-Wallis test was conducted for comparisons among years. The Wilcoxon rank-sum test was used to determine the mean differences in trainee satisfaction according to clinical and ambulance staff experience. All p-values less than 0.05 were considered as statistically significant. All analyses were performed using SAS ver. 9.4 (SAS Institute Inc., Cary, USA). After coding open-ended questions according to the themes, descriptive statistics were used to count the number of answered themes.

4. Ethical approval

This study was approved by the Institutional Review Board of Human Research at Inje University Ilsan Paik Hospital (ISPAIK 2021-08-041-008). The Board waived the requirement for informed consent.

Results

The trainees' reactions to the VFTs were positive. The investigators decided that a score of 4 or higher on the Likert scale should be considered satisfactory before implementing the EMT course. The total mean score for every questionnaire item was over 4.5 (Table 2). When the reactions were divided into satisfaction, relevance, and engagement, the overall satisfaction and relevance were very high at 4.5 points or more in all years. The scores of engagement items also showed a high score of 4 points

Table 2. Trainees' Reaction to Virtual Field Trip Sessions in the Emergency Medical Service Training Program

Items	Project year			Total	p-value[a)]
	2020	2021	2022		
A. Satisfaction	4.58±0.55	4.68±0.46	4.66±0.50	4.65±0.49	0.4647
Overall, I am satisfied with the institutional visit video.	4.56±0.59	4.69±0.54	4.72±0.52	4.67±0.55	0.1187
The contents of the institutional visit videos were generally easy to understand.	4.63±0.55	4.69±0.56	4.62±0.65	4.65±0.60	0.5609
The time allotted to each video was adequate.	4.50±0.71	4.62±0.63	4.68±0.57	4.62±0.63	0.2248
After watching the video, I was well motivated in my field of work.	4.66±0.78	4.66±0.55	4.67±0.61	4.66±0.63	0.7384
The video training met my expectations prior to participation.	4.58±0.66	4.72±0.51	4.64±0.65	4.65±0.61	0.3761

(Continued on next page)

Table 2. (Continued)

Items	Project year			Total	p-value[a]
	2020	2021	2022		
B. Relevance	4.53±0.57	4.63±0.49	4.69±0.47	4.63±0.50	0.1201
The institutional visit video was appropriate for the educational subject.	4.58±0.56	4.58±0.57	4.70±0.56	4.63±0.56	0.0903
The contents of the institutional visit videos were helpful in improving my skills.	4.44±0.81	4.61±0.63	4.69±0.68	4.60±0.70	0.0343
The contents of the institutional visit video were helpful to apply to my work.	4.38±0.85	4.60±0.62	4.74±0.52	4.61±0.65	0.0031*
C. Engagement	4.47±0.55	4.62±0.50	4.73±0.45	4.63±0.50	0.0010*
The contents included in the video were interesting.	4.63±0.58	4.69±0.52	4.75±0.50	4.70±0.53	0.2398
I was able to feel the sense of reality of each institution well through only the video.	4.48±0.67	4.63±0.64	4.74±0.50	4.64±0.60	0.0199*
The Russian subtitles and speed were adequate.	4.39±0.68	4.56±0.62	4.72±0.52	4.59±0.61	0.0013*
The trainers in the video explained the contents in an easy-to-understand manner.	4.38±0.81	4.60±0.57	4.72±0.50	4.60±0.62	0.0089*

Data are presented as mean±standard deviation.
*p<0.05 (statistically significant). [a]By Kruskal-Wallis test.

Table 3. Differences in Trainees' Reaction to Virtual Field Trip Sessions by Duration of Clinical Experience or Ambulance Staff Experience

Items	Clinical experience		
	<10 yr (n=183)	≥10 yr (n=103)	p-value[a]
A. Satisfaction	4.59±0.53	4.76±0.41	0.0360*
Overall, I am satisfied with the institutional visit video.	4.63±0.58	4.76±0.47	0.0646
The contents of the institutional visit videos were generally easy to understand.	4.56±0.66	4.81±0.42	0.0013*
The time allotted to each video was adequate.	4.54±0.69	4.76±0.45	0.0150*
After watching the video, I was well motivated in my field of work.	4.62±0.63	4.75±0.62	0.0310*
The video training met my expectations prior to participation.	4.62±0.61	4.72±0.60	0.0817
B. Relevance	4.58±0.53	4.72±0.46	0.0279*
The institutional visit video was appropriate for the educational subject.	4.60±0.57	4.70±0.54	0.0998
The contents of the institutional visit videos were helpful in improving my skills.	4.56±0.74	4.69±0.63	0.1645
The contents of the institutional visit video were helpful to apply to my work.	4.60±0.65	4.64±0.65	0.5601
C. Engagement	4.59±0.54	4.72±0.41	0.1875
The contents included in the video were interesting.	4.63±0.57	4.83±0.42	0.0008*
I was able to feel the sense of reality of each institution well through only the video.	4.57±0.65	4.77±0.47	0.0119*
The Russian subtitles and speed were adequate.	4.57±0.62	4.63±0.59	0.3838
The trainers in the video explained the contents in an easy-to-understand manner.	4.58±0.62	4.64±0.61	0.3530

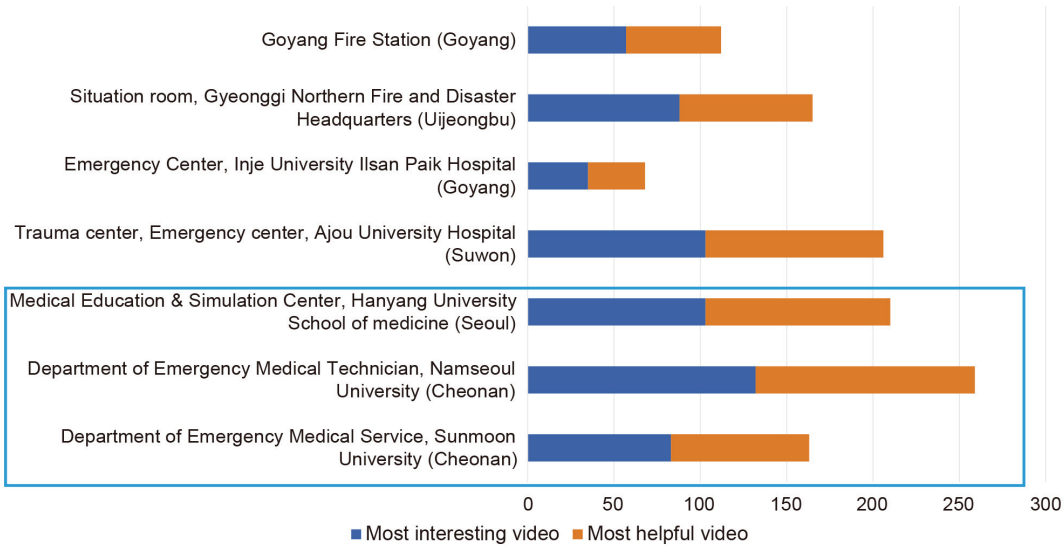
Data are presented as mean±standard deviation.
*p<0.05 (statistically significant). [a]By Wilcoxon rank-sum test.

or more (standard of satisfactory), but statistically significant differences were observed by year.

The 286 trainees trained in 15 different sessions over 3 years were divided into two groups, those with more than versus less than 10 years according to their clinical experience. Satisfaction and relevance scores were significantly higher in the more than 10 years group than in the less than 10 years group. Engagement showed similar results for both items (Table 3).

When asked to choose two interesting videos and two helpful videos for their jobs in VFTs, they generally tended to choose the same videos as interesting and helpful. VFT locations can be classified into three groups: (1) EMS, (2) emergency centers, and (3) educational institutions (Appendix 1). Many trainees found the emergency medical educational curriculum, facilities, and equipment of the

Fig. 1. Most Interesting and Helpful Video Clips Included in Virtual Field Trips



The trainees could select the top two videos for each question. Blue box indicates educational institutions. EMS: Emergency Medical Service, MESH: Medical Education and Simulation Center, Hanyang University

university interesting and helpful (Fig. 1). The most interesting and helpful video was from the Department of Emergency Medical Technicians at Namseoul University (n=132 and 127, respectively).

Through the open-ended questions, trainees indicated that the VFTs were interesting and helpful because (1) the video showed real things, (2) the contents were easy to understand, and (3) the contents were related to their job (Appendix 3). Trainees stated, "I was impressed with the simulation training facility composed of an environment similar to the actual field," "Video contents had a sense of reality," and "It was a good opportunity to experience state-of-art emergency medical system and education system in Korea." Trainees also stated, "The contents of the lecture were structured in an easy-to-understand way" and "It was a practical help because it was composed of contents that could be applied to my work." Trainees also requested voice-overs in Russian or Uzbek instead of Russian subtitles in the video clips. Another suggestion was for the VFTs to be available for watching again later.

Discussion

AFT, an important element in invitational training programs, illustrates the Korean context, advanced facilities, and operational methods, because trainees in official development assistance (ODA) project are currently working as experts in their country. However, the COVID-19 pandemic made us find an alternative pedagogy. It was determined that it would be most useful to apply the ToT model, which educates local trainers on training local health professionals. Another pedagogical change was the conduct of VFTs by related institutions and organizations in South Korea.

There are several elements to successful education using VFTs [7]. Authenticity is the core attribute of a field trip. Alignment with the curriculum, interaction with experts as part of the field trip, provision of guidelines, and debriefing for deep knowledge can enhance the authenticity of field trips [15]. We designed the EMT course in the following order: knowledge, skills, and experience. Trainees acquired knowledge and skills before entering the VFTs. Moreover, VFTs are related to trainees'

knowledge, skills, and prior their own experience. These alignments enabled the VFTs to seem real (Appendix 3). Experts from institutions and organizations in Korea were synchronously connected with the Uzbekistan trainees through video conferencing. After VFTs, interactions with others, such as teachers, experts, or peers, can enhance authenticity and deepen learners' learning experience [7,16]. High satisfaction scores were obtained because we faithfully followed the conceptual model of authentic VFTs with ToT model-guiding onsite and debriefing sessions with a Korean expert in this study.

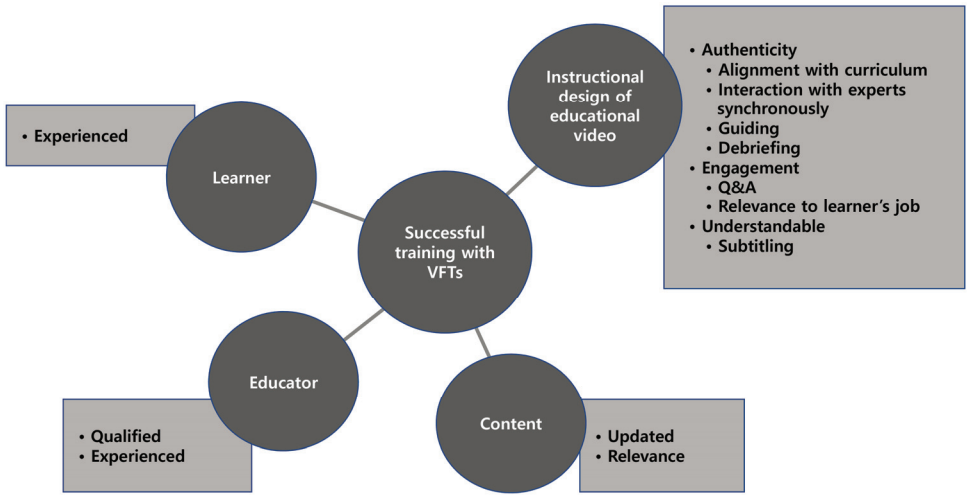
In the EMT course, VFTs were produced using audiovisual media. As video-based delivery methods make learners passive, active elements of learning must be added to the instructional design to keep them engaged. Strategies to promote active learning from educational videos include packaging videos with interactive questions and guiding questions [17]. VFTs are only a part of the EMT course. Investigators can make videos into active learning tools by applying instructional design that includes questioning and guidance in the course.

The next consideration for maximizing trainee learning from educational videos is trainee engagement. Engagement can be induced by shortening the length of the video, using conversational language, speaking relatively quickly and enthusiastically, and emphasizing the relevance of their work to the course [17]. In this study, more experienced trainees tended to feel more satisfied, find the training more relevant to their job, and are more engaged with the VFTs. We suggest that experienced trainees could understand cutting-edge content, be better engaged, and feel more satisfied than inexperienced trainees because the content of VFTs was authentic EMS involving advanced training methods with updated facilities and equipment in their field.

The trainer's ability is also a critical factor in successful learning. ToT is widely used as an efficient and effective method for overcoming the lack of healthcare professionals in low- and middle-income countries [18]. Although younger, less experienced trainees participated in the EMT course in 2021 and 2022 than in 2020, there was a statistically significant increase in the evaluation score. As the local trainers' experience as educators increased, their understanding of educational content and their role as facilitators or guidance increased. It seems that the improvement in the local trainer's competence as an educator overcame the inexperienced trainees' negative traits regarding learners' reactions. Most trainees were interested in educational institutes that had updated simulation centers with facilities and equipment (Fig. 1). All trainees were EM physicians and leaders of an EM team. Given that they are educators in their teams and need simulation centers to train together as a team, they were of course interested in the VFTs of educational institutes.

Language barriers, especially in international conferencing and education, usually weaken educational effectiveness. This is a common problem in ODA projects. Thus, interpreters are used to overcome this challenge or a common language such as English is used. When both trainers and trainees do not speak a common language such as their mother tongue, communication difficulties arise and affect the quantity and quality of learning. We prepared video clips with Russian subtitles to address the language barrier problem. However, the trainees asked for a voice-over rather than Russian subtitles. Research on subtitles, dubbing, and voice-overs in foreign films report that the general comprehension of film content and visual scene recognition are achieved equally through subtitling and dubbing [19]. Contrarily, some investigators have suggested that the attention paid to subtitles in the visual channel could divert attention from the audio channel. If there are important clues only in the audio channel, learners cannot pay due attention to it if they are attending

Fig. 2. The Elements of Successful Training with VFTs



VFTs: Virtual field trips, Q&A: Question and answer.

to subtitles [20]. In our study, some trainees preferred voice-overs because reading subtitles distracted them from focusing on the audio-visual information. Further research is required on video-based e-learning in foreign languages.

The elements for successful training with the VFTs obtained in this study are summarized in Fig. 2. Although we can consider learners, educators, and content domains, the instructional design of videos is a more flexible domain. Several elements should be considered and adopted in the production of educational videos. In this study, trainees were fully satisfied and engaged because of the successful instructional design.

This study has some limitations. As this was not a comparative study of AFTs and VFTs, we cannot determine whether VFTs can replace AFTs in healthcare professional training programs. If further studies show that VFTs are more cost-effective or similar in effectiveness to AFTs, they can be applied to ODA educational projects, even after the COVID-19 pandemic ends. If so, it would be possible to improve the quality of health professionals in more partner countries and provide more opportunities for qualified education within the same budget. This will further accelerate the sustainability of local healthcare systems.

Another limitation is that this study focused only on learners' reactions. To evaluate VFTs that induce effective learning, it is necessary to evaluate the learner's level of achievement in addition to the learner's satisfaction. It was difficult to design a reliable learner assessment for a one-week training program that included lectures, skills training, and field trips. To measure the educational effectiveness of VFTs, it is necessary to measure behavioral changes and self-directed learning after returning to work.

In conclusion, it seems that an EMT course that includes VFTs can be a good alternative to EMS training in situations where AFTs are difficult. It is possible to replace AFTs with VFTs by using qualified videos. Successful VFTs must maintain the rules of instructional design to promote learners' satisfaction, engagement, and learning.

ORCID:

Ki Jong Kim: https://orcid.org/0009-0003-5688-7894;
Yoo Bin Lee: https://orcid.org/0000-0002-7442-3175;
Woo Chan Jeon: https://orcid.org/0000-0003-2674-3593;
Ji Sook Lee: https://orcid.org/0000-0002-0522-1350;

Hoon Kim: https://orcid.org/0000-0001-6620-2447;
Minkyung Oh: https://orcid.org/0000-0001-7584-5436;
Bo Young Yoon: https://orcid.org/0000-0002-9635-4799

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References

1. Krepel WJ, DuVall CR. Field trips: a guide for planning and conducting educational experiences. analysis and action series. Washington, USA: National Education Association; 1981.
2. Jolley A, Kennedy B, Reyna N, et al. Virtual field trips in tertiary science. Wellington, New Zealand: Ako Aotearoa; 2018.
3. Puhek M, Perše M, Šorgo A. Comparison between a real field trip and a virtual field trip in a nature preserve: knowledge gained in biology and ecology. J Balt Sci Educ. 2012;11(2):164-174.
4. Kenna JL, Potter S. Experiencing the world from inside the classroom: using virtual field trips to enhance social studies instruction. Soc Stud. 2018;109(5):265-275.
5. Turkan S. Lessons learned in providing field experience opportunities for future teachers of emerging bilinguals during the COVID-19 pandemic. In: Ferdig RE, Pytash KE, eds. What Teacher Educators Should Have Learned from 2020. Belfast, UK: Association for the Advancement of Computing in Education (AACE); 2021:91-100.
6. Rasiah RR. Assessing the impact of a guided field trip in enhancing students' learning. Paper presented at: the 7th Annual SEAAIR Conference on Sufficiency and Sustainability in Higher Education: September 5-7, 2007; Bangkok, Thailand.
7. Radke AM. The value and importance of field trip experiences to adult learners in continuing higher education [dissertation]. Platteville, USA: University of Wisconsin-Platteville; 2016.
8. Morgan H. Best practices for implementing remote learning during a pandemic. Clear House. 2020;93(3):135-141.
9. Korea Foundation for International Healthcare. KOFIH Web Site. https://www.kofih.org/en. Accessed August 5, 2023.
10. Inje University Industry-University Cooperation Foundation. 2019 Project to strengthen the capacity of medical professions for the emergency medical system in Uzbekistan: results report (outsourcing-1-2021-14). https://www.kofih.org/notice/performance-report/. Published March 2020. Accessed August 5, 2023.
11. Inje University Industry-University Cooperation Foundation. 2020 Project to strengthen the capacity of medical professions for the emergency medical system in Uzbekistan: results report (outsourcing-1-2021-14). https://www.kofih.org/notice/performance-report/. Published April 2021. Accessed August 5, 2023.
12. Inje University Industry-University Cooperation Foundation. 2021 Project to strengthen the capacity of medical professions for the emergency medical system in Uzbekistan: results report (outsourcing-1-2022-7). https://www.kofih.org/notice/performance-report/. Published March 2022. Accessed August 5, 2023.
13. Inje University Industry-University Cooperation Foun-

dation. 2022 Project to strengthen the capacity of medical professions for the emergency medical system in Uzbekistan: results report (outsourcing-2023-29). https://www.kofih.org/notice/performance-report/. Published March 2023. Accessed August 5, 2023.
14. Crawford J, Butler-Henderson K, Rudolph J, et al. COVID-19: 20 countries' higher education intra-period digital pedagogy responses. J Appl Learn Teach. 2020;3(1):1-20.
15. Stoddard J. Toward a virtual field trip model for the social studies. Contemp Issues Technol Teach Educ. 2009;9(4):412-438.
16. Zhang D, Zhou L, Briggs RO, Nunamaker Jr JF. Instructional video in e-learning: assessing the impact of interactive video on learning effectiveness. Inf Manag. 2006;43(1):15-27.
17. Brame CJ. Effective educational videos: principles and guidelines for maximizing student learning from video content. CBE Life Sci Educ. 2016;15(4):es6.
18. Mormina M, Pinder S. A conceptual framework for training of trainers (ToT) interventions in global health. Global Health. 2018;14(1):100.
19. Perego E, Del Missier F, Porta M, Mosconi M. The cognitive effectiveness of subtitle processing. Media Psychol. 2010;13(3):243-272.
20. Sepielak K. The effect of subtitling and voice-over on content comprehension and languages identification in multilingual movie. Int J Sci Basic Appl Res. 2016;25(1):157-165.

Appendix 1. Research Flow and the Placement of VFT Sessions within Entire EMS Training Programs

Instructional design of advanced EMT course training

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Institution recruitment for filming VFTs

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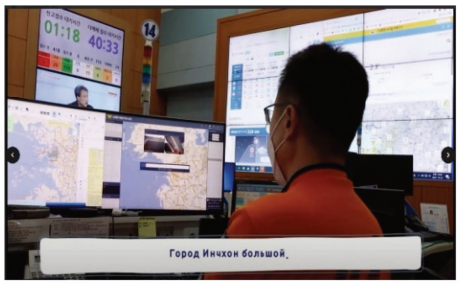

VFTs production

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	Day1	Day2	Day3	Day4	Day5
9:00-9:30	Registration	Registration	Registration	Registration	**VFT Session #4**
9:30-10:00	Introduction	Narrow QRS Tachycardia	Pediatric advances life support	Practice & Simulation	**VFT Session #5**
10:00-10:30	Pre-test		Neonatal resuscitation program		**VFT Session #6**
10:30-11:00	EKG preliminary lecture	Wide QRS Tachycardia	Home delivery		**VFT Session #7**
11:00-11:30		Myocardial Infarction			Debriefing - Post-test for VFTs - Satisfaction and education evaluation
11:30-12:00			Pediatric emergency	**VFT Session #1**	
12:00-12:30	Lecture for the new guidelines of 103 system in Tashkent	Q&A	Q&A	**VFT Session #2** **VFT Session #3**	Q & A Closing remark
12:30-13:30	Lunch				
13:30-14:00	EKG block and arrest	CPX: Chest pain & Dyspnea	Trauma lecture	Debriefing	
14:00-14:30		Neurologic Examination	Becoming a good instructor (KALS)		
14:30-15:00					
15:00-16:00	Wrap up and DIY	Wrap up and DIY	Wrap up and DIY	Wrap up and DIY	

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Survey for evaluating trainees' reaction to VFTs

VFT: Virtual field trip, EMS: Emergency medicine service, EKG: Electrocardiogram, Q&A: Question and answer, CPX: Clinical performance examination, KALS: Korean Advanced Life Support, DIY: Do it yourself.

Appendix 2. Participating Institutions and Their Respective VFT Learning Contents

Classification	location	Learning contents
Advanced EMS including emergency call and patent transport	Situation room, Gyeonggi Northern Fire and Disaster Headquarters (Uijeongbu)	• Call taking dispatching • Introduction to emergency patient classification (fire, first aid, rescue) • Description of the ambulance • Excellent navigation in ambulance • Medical guidance and consultation • Classification and selection of transfer hospitals • Information sharing system between situation room, ambulance, and hospitals
	Goyang Fire Station (Goyang)	• Organizational structure of Goyang Fire Station • Know-how for quick on-site arrival • Web pad system • Description of the ambulance • Description of dispatch log • Equipment care and ambulance disinfection process • Dispatch simulation assuming a cardiac arrest patient
Facilities and initial intervention of emergency centers	Trauma center, Emergency center, Ajou University Hospital (Suwon)	• Introduction to structure and function of Ajou University Hospital Emergency Center (screening clinic, isolation unit, treatment room, resuscitation room, EICU, KTAS triage, X-ray room, CT room, pediatric emergency room) • Introduction to the structure and function of the Trauma Center at Ajou University Hospital (operating room, various equipment)
	Emergency Center, Inje University Ilsan Paik Hospital (Goyang)	• Introduction to structure and function of Ilsan Paik Hospital Emergency Center (screening clinic, isolation unit, treatment room, resuscitation room, KTAS triage, X-ray CT room)
Emergency medical educational curriculum, facilities, and equipment	Department of Emergency Medical Service, Sunmoon University (Cheonan)	• Introduction to Education Curriculum (lectures, hands-on training) • Practice facility (classrooms, BLS simulation rooms,) • Educational equipment
	Department of Emergency Medical Technician, Namseoul University (Cheonan)	• Introduction to Education Curriculum (lectures, hands-on training) • Practice facility (classrooms, BLS simulation rooms, virtual emergency room, virtual operating room) • Educational equipment
	Medical Education Simulation Center, Hanyang University School of Medicine (Seoul)	• Hanyang University School of Medicine MESH facilities • Lecture room, simulation room, practice room, CPX main control room, PBL room • Introduction to education curriculum • State-of-the-art training equipment

VFT: Virtual field trip, EMS: Emergency medical service, EICU: Emergency intensive care unit, KTAS, Korean Triage and Acuity Scale, CT: Computed tomography, BLS: Basic life support, MESH, Medical Education and Simulation Center for Hanyang University, CPX: Clinical performance examination, PBL: Problem-based learning.

Appendix 3. The Result of Thematic Classification of Open-Ended Questions Why the Video Clips of Virtual Field Trips Were Interesting or Helpful

Theme	Sub-theme in detail	Frequency
Authenticity	Organized, updated equipment in simulation centers	10
	Outstanding training methods in simulation education	5
	Advanced workflow in emergency medical center	3
	Structured transfer systems	3
Easy to understand	Understandable explanation of qualified instructors	6
Relevance	Relevance to trainees' work	2