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Review of K-12 Metaverse Safety Education in Korea :Ministry of Education Official Program

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Abstract

To enhance safety in dangerous situations, it is essential to provide practice-oriented safety education. However, direct experiences can be limited, and thus, metaverse-based safety education is emerging as an alternative. In this study, we analyzed the first official metaverse safety education program of the Korea Ministry of Education, mainly focusing on its title, objectives, content, and results using the Revised PRISMA framework.

The program concentrates on "life safety" for "fire safety," "disaster safety" for "earthquake safety," and "first aid" for "abrasions, burns, fractures, cardiopulmonary resuscitation, and the use of AED." We classified the objectives of the entire program and its three sub-programs, and identified the knowledge, main practice tasks, and their results.

The aim of this study is to promote an understanding of the main cases of national-led metaverse safety education and infer the practical safety education contents emphasized to Korean school-age students.

Keywords: *Safety education, Metaverse, Virtual Reality, ZEPETO, Fire Safety, Disaster Safety, Life Safety*

1. INTODUCTION

The purpose of safety education is to cultivate comprehensive Knowledge, Skill, and Attitude(National Fire Agency. 2015). Based on this learning, the purpose is to achieve a habit of safety and ultimately to take safety actions in dangerous situations. However, form two main perspectives, safety education has difficulties for school-age students. First, Disaster is not reproducible, so it is difficult to experience it practically. Second, unlike the industry, there are limitations in teaching aids(tools) and equipment due to needs of budgets problem in the educational community, which makes it difficult to promote safety education in school.

Therefore, attempts to apply Virtual Reality(including metaverse) have been made in various ways, and its effectiveness also known as existed(Perera et al. 2012). There are two primary methods for utilizing virtual reality technology: augmented reality and immersion in virtual worlds, which includes the metaverse.

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Research has shown that safety education using virtual reality, specifically in virtual worlds, can have a significant impact on students' behavioral changes (McComas et al., 2002). Additionally, safety education using augmented reality, such as a fire extinguisher simulator, has been found to be effective in terms of improving safety knowledge and behavior (Jang and Kong, 2023).

In response to this trend, the Korean Ministry of Education has encouraged the implementation of experience-oriented safety education using new technologies, with the aim of shifting the focus of safety education towards risk-reducing education. The previous metaverse safety education program placed its emphasis on evaluating the effectiveness and addressing the needs of students using tools created and sold by independent researchers and companies. On the other hand, the new metaverse program is significant because it was created by the government.

This paper targets a review of the official announcing metaverse safety education program by MOE in Korea, 2023. so that the perspective and direction of central government agencies are implicated in the metaverse education programs that are currently overflowing for school-age Education.

2. ANALYSIS OF PROGRAM

2.1. Research Subjects

The program used in this research was developed by the Ministry of Education and Korea School Safety and Insurance Federation in 2022 and will be applied to the school field in earnest in 2023. This educational program was produced using 'ZEPETO', which is used by more than 100 million people metaverse platform and consists of three main safety themes. This program was visited and experienced by more than 25,000 users before the official distribution of the guides and will spread to the all K-12schools in country from 2023.

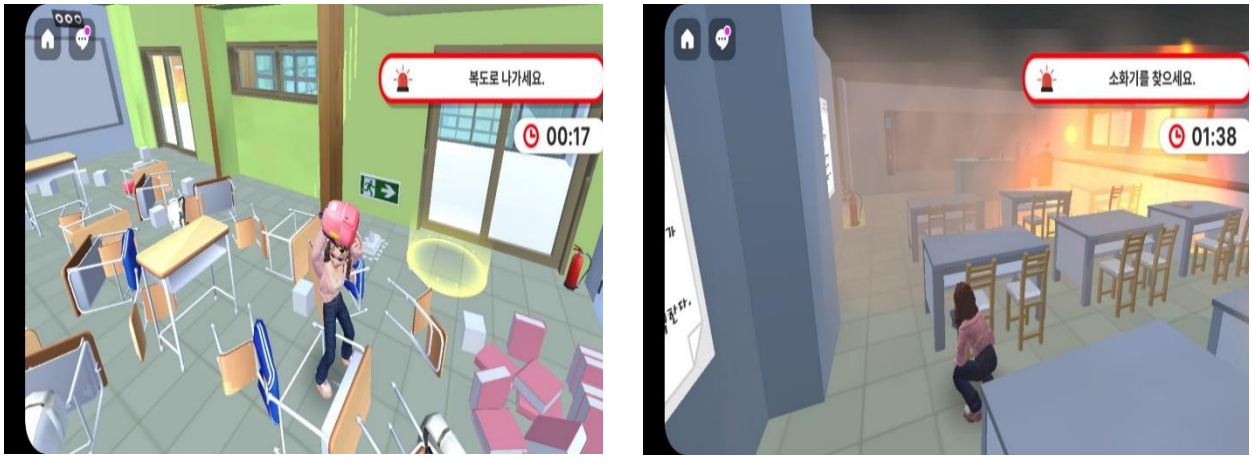

Figure 1. Metaverse Safety Program

2.2 Research Problem and Framework of Analysis

The objective and methodology of this research entail the analysis of program metadata. A system atic analysis is conducted to determine the titles and themes developed by the Korean government, t he items featured, and how the results were implemented. The aim of this study is to provide globa l scholars with information on the metaverse program for school-age students produced by the Kore an government for academic purposes.

To outline the Metaverse safety education in K-12, we selected a framework for conducting analysis. Currently, the most widely used framework for systematic Reviews and Meta-Analyses is THE PRISMA Statement developed by Moher. Et al(2009). And The PRISMA method can be applied as a method of analyzing school-age education using Virtual Reality(Pellas et al., 2021).

However, this paper needs to transform and utilize existing frameworks as a review of one education program, not as a study of individual studies and meta-analysis. In this study, a new type of analysis framework was applied by selectively modifying items suitable for analyzing a single program in PRISMA method by consensus among researchers.

Table 1. Applied in Program using PRISMA Statement(Revised for program)

Sections / Topic	Checklist Item
TITLE/ Title	Identify the sub-topic in program
INTRODUCTION / Objectives	Provide an explicit statement of questions being addressed
METHODS/Data Item(Content)	List and define all variables
RESULTS /Results of Individual	For all outcomes considered, present, for each sub-topic program

3. RESULT AND DISCUSSION

3.1 Title

The educational program we are discussing is formally known as the "School Safety Experience" program, with sub-topics covering "earthquake," "fire," and "first aid." The Korean Ministry of Education has highlighted the importance of seven major safety education fields and has emphasized the organization of safety education programs, with a minimum of 51 hours per year included in the school curriculum. The Metaverse safety education program has been developed under the themes of the "Life Safety field," "Disaster Safety field," and "First Aid field."

3.2 Objectives

In this program, we observed the existence of separate objectives for the entire metaverse safety education program and its individual sub-programs. This finding is closely associated with the Korean national curriculum (2015). We presented the objectives for the program in Table 2 to inform our academic discussion.

Table 2. Objectives for Metaverse education program

Program	Objectives
Entire Program	Learn earthquake and fire evacuation tips and basic knowledge of first aid Overcome the disaster situation within the virtual space and evacuate safely
Sub 1-Earthquake	Learn and practice how to behave properly in the event of an earthquake in classrooms and corridors Learn the location and characteristics of the earthquake zone and how to evacuate in the event of an earthquake
Sub 2-Fire	Learn how to evacuate properly in the event of a fire at school Understand the volume change of the gas according to temperature and learn the correct evacuation method in the event of fire
Sub 3-First aid	Learn the types of emergency situations that can occur at school and how to take first aid

3.3 Data items (Content)

There are two main categories of learning data: educational content (knowledge content) that guides individual programs, and performance task content to be completed within the program. In metaverse-based safety education, the aim is to provide indirect experiences that can be used as an alternative to the difficulties of direct practice. As such, while theoretical knowledge and educational content are important, it is even more important to analyze the practical tasks

First, there are three learning topics related to earthquakes, and a total of six knowledge elements related to these topics. These include examining the history of earthquakes, basic knowledge related to earthquakes,

indoor behavior during an earthquake (such as being careful of falling objects and protecting one's head), and proper movement during an earthquake (such as moving away from windows and avoid

Second, the metaverse safety education program covers three topics related to fire safety, Second, the Metaverse Safety Education Program covers three topics related to fire safety, each consisting of six knowledge elements. The topics are that emergency response in the event of a fire, such as respiratory protection, low posture assumptions, evacuation, and the use of wet towels in smoky conditions. and deals with the concept, management methods, and use of fire extinguishers.

Third, three learning topics and eight knowledge elements related to first aid are as follows. Understand that there are abrasions, burns, fractures, and cardiac arrest for the types for injuries that may occur in fire situations. Next, learn firs aid methods for abrasions, burns, and fractures in relation to first aid in injury situations. Finally, theoretically examine how to cope with arrest patients and how to use AED in cardiac arrest situations.

Table 3 displays practice tasks that correspond to experiences and behavioral factors that are closely related to the Metaverse safety education program.

Table 3. Practice tasks

Program	Tasks
Earthquake	1. Read the text on the blackboard about the earthquake 2. Look for potentially dangerous objects in the classroom 3. Hide under a desk during an earthquake 4. Find an items to protect own's head and go down the hallway 5. Quiz while walking away from windows (Prohibition of using elevator) 6. Earthquake background knowledge Qui (Circum-pacific belt, Ring of fire, epicentre, and hypocentre)
Fire	1. Obtain a towel in the science lab 2. Wet the towel and lower posture 3. Find a fire extinguisher 4. Put out of the fire with fire extinguisher and go downstair 5. Finding a safe emergency door
First aid	1. First aid for abrasions patient 2. First aid for burn patient 3. First aid for fracture patient 4. CPR for patient with cardiac arrest 5. Use AED

3.4 Results of Individual (Learning Outcomes)

The Earthquake Safety Education Program aims to educate participants on how to deal with earthquakes indoors and to take precautions when moving. The goal of the program is to guide participants to carry out safe behavior while moving in the direction of the stairs, leading to evacuation to a safe place. In the Fire Safety Education Program, students can indirectly experience how to properly respond to evacuation and use a fire extinguisher in case of a fire situation. The program guides participants to open the emergency door of the fire shutter after going down to the floor and then to evacuate outside. The First Aid Education Program aims to enable participants to treat three emergency patients in order in the health room. Participants learn how to perform CPR and successfully evacuate by moving to the central entrance. The overall conclusion of these programs is to equip participants with the ability to escape from school within an appropriate time in a complex disaster situation.

4. CONCLUSION

This study analyzed the first official K-12 metaverse safety education program created by the Ministry of Education in Korea in terms of fields, objectives, content data, and results. The program involves a scenario where participants must solve tasks sequentially and safely escape from school in case of a dangerous situation in the classroom, using gamification elements to engage students of all ages.

As a result, the seven safety areas that Korean students want to learn from the country's first official government led Metaverse safety education program are: life safety, disaster safety, and first aid, specifically related to earthquakes, fires, and CPR. The core performance behaviors(Practical tasks) expected from Korean students through this metaverse safety education program include hiding under desks in the event of an earthquake, moving to the hallway to look for tools to protect their heads, wetting a towel in case of fire, lowering their posture, finding a fire extinguisher and turning off the fire, and opening the emergency door of the fire shutter. Additionally, students should learn how to perform accurate first aid and CPR.

This paper is significant in that it examines major cases of safety education for K-12 students using metaverse technology and analyzes the types and contents of practical safety education emphasized by the Korean government for school-age students. Previously, most virtual reality-based safety education programs were developed by individual researchers and companies and were demonstrated for small groups of people. However, in 2022, the Korean government launched a government led Metaverse safety education program, which is more universal and will be able to as objectively applying to many students.

This study examines the title, subject, content, behavioral tasks, and learning outcomes of the Metaverse safety education program, providing educators with valuable insights into the latest trends in metaverse safety education in Korea. However, verification of the effectiveness of the Metaverse safety education program remains a future task.

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