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Analysis of School Safety Education Utilization with Educational Game Elements

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Abstract

In order to create and utilize experiential equipment that can be effectively used in school safety education, this paper uses the Korean Safety Education Association's CPR simulator to utilize the elements of educational games: goals, rules, competition, challenge, fantasy, safety, and fun. When the content that combines game elements with general educational equipment was utilized in school education sites, significant results were obtained on the effectiveness of education with active participation of students.

Keywords: Simulator, Educational games, School Safety Bridge

1. INTRODUCTION

The 2014 Gyeongju resort collapse and the Sewol ferry disaster, as well as other safety incidents, have raised awareness of safety accidents across the country and led to deep consideration of the importance of systematic safety management and safety education. As a result, local governments, organizations, and related companies are expanding disaster experience centers and developing educational contents for effective safety education. However, it was found that the Gwangnaru Safety Experience Center, a representative experience center in Seoul, received only about 190,000 visitors per year from 2016 to 2017[1]. This is less than 2% utilization rate in proportion to Seoul's population of 10 million people, and the issue of insufficient educational contents and various experiences at the experience center itself was raised in 'MBC Current Affairs Magazine 2580' (2016)[2].

According to the study, everyone can agree on the importance and effectiveness of experiential education, and students who actually receive education also evaluate it as their favorite way of education. However, in order to visit an experiential museum at school, one must follow a field trip schedule, and a study by Park (2015) pointed out that such field trips may minimize experiential activities due to excessive operational guidelines[3][4]. Chang-hee Lee (2010) found that elementary school students are the age group where safety education has the greatest impact on safety awareness, and mentioned that safety education that meets the students' eye level is necessary from elementary school to middle school, when they are more sensitive than adults [5]. However, many schools still use educational media such as educators' words, texts (especially PPT), and videos, and in the case of CPR, there is a lack of their own hands-on education tools or educator supply system [6] [7].

This study analyzes the use cases of applying educational game elements to safety education in school safety education sites where educational tools, educators, and environments are poor, focusing on CPR education, and suggests ways to use them in schools while creating future safety education contents.

2. Theoretical background

2.1 School Safety Education

Safety education is an education that teaches knowledge, skills, and attitudes to prevent unexpected incidents such as daily events, accidents, and disasters from occurring, and to protect the body and life of oneself and others after an accident occurs, and to develop a proper attitude toward safety and the ability to cope with it[8][9][10].

2.2 CPR

Cardio-pulmonary resuscitation (CPR) can be categorized into basic life support (BLS) and advanced life support (ACLS). In general, CPR refers to BLS, which is a first aid technique for artificially maintaining breathing and blood circulation when breathing or heartbeat has stopped [11][12].

2.3 Educational games

Educational games can be categorized by their purpose and typology as functional games ("Serious Games"). It is an educational medium that promotes the intellectual, definitional, and physical development of learners, and is a computer program designed to make learning enjoyable and to acquire specific skills. Clark Abt defines it as "a game that provides enjoyment with an educational purpose rather than entertainment"[13][14].

2.3.1 Setting goals

Educational games can be categorized by their purpose and typology as functional games ("Serious Games"). It is an educational medium that promotes the intellectual, definitional, and physical development of learners, and is a computer program designed to make learning enjoyable and to acquire specific skills. Clark Abt defines it as "a game that provides enjoyment with an educational purpose rather than entertainment"[13][14].

2.3.2 Rule elements

The rules element defines acceptable behavior and restrictions within the game. It is important to recognize that these rules are artificial, and that they are a product of the imagination, even if they mimic the real world. Rules should be designed to make the game interesting and challenging, and to ensure that users are treated fairly. They should also be computer-implementable and designed to anticipate and account for user behavior [15].

2.3.3 Competitive factors

Games have elements of competition with humans, computers, oneself, chance, and time, and these elements are combined and used within the game. The competitive element is one of the most powerful characteristics of games, and sometimes this competitive element is why teachers tend to avoid games in children's learning [15].

2.3.4 Challenging elements

A challenge is a process that must be overcome or succeeded in order to reach a goal. It is a distinct concept from a goal, and according to the principle of challenge for motivation proposed by Malone and Lepper, learners can adjust the level of difficulty as they progress [15].

2.3.5 Illusion Elements

Games typically rely on motivational fantasies, and these fantasies tend to be more realistic for adults and more imaginative for children [15].

2.3.6 Safety factors

Games are typically analogical representations of activities that take place in real life, while providing a safe pathway to engage in more risky real-world activities, such as combat games or business investment games. This allows learners to find alternatives under the idea that no one will actually get hurt or killed if they fail, and that even in the worst case scenario, they are just losing the game [15].

2.3.7 Fun factor

Most games provide entertainment. Learning games seek to promote the acquisition of new knowledge and skills, but utilize the fun factor to motivate and enhance learning [15].

2.4 Status of School Safety Education in Korea

Safety education in schools is a crucial time in a child's life to form an overall foundation for safety. This is very important because it is most affected by safety awareness, and according to Lee Chang-hee (2010), safety awareness is more affected by the younger the age [5]. In 2016, the Ministry of Education released the "Finalized and Announced Standards for School Safety Education," which stipulates the time, number, content, and methods for implementing the seven standards of safety education more specifically and efficiently. This includes the requirement to conduct at least 51 hours of experience-based safety education per year. However, only 12.9% of elementary school teachers comply with this mandatory training time, and 81.9% of them replace training with watching materials such as videos and PPTs instead of hands-on training[16][17].

Table 1. Number of hours of student safety education by grade level

		Life Safety	Traffic Safety	Violence Prevention and Protection	Prevent drug and cyber addiction	Disaster operations	Occupational Safety	First aid	Total
Training Hours	Kindergarten	13	10	8	10	6	2	2	51
	Elementary school	12	11	8	10	6	2	2	51
	Middle School	10	10	10	10	6	3	2	51

High School	10	10	10	10	6	3	2	51
Count	More than 2 times per semester	More than 3 times per semester	More than 2 times per semester	More than 2 times per semester	More than 2 times per semester	More than once per semester	More than once per semester	

Park (2015) mentioned that teachers tend to be reluctant to conduct field trips and experiential learning due to excessive operational policies. He also pointed out the lack of tools and educators for safety education in schools [4][7]. Accordingly, efforts are being made to improve these issues by providing annual safety education to teachers and relevant training to the head teacher in charge of safety.

3. CPR safety education utilization analysis with educational game elements

We will analyze the training case by utilizing the CPR safety training tool "Korea Safety Education Association CPR Simulator," which is a CPR safety training tool with educational game elements. We chose to analyze this tool as a case study for the following reasons.
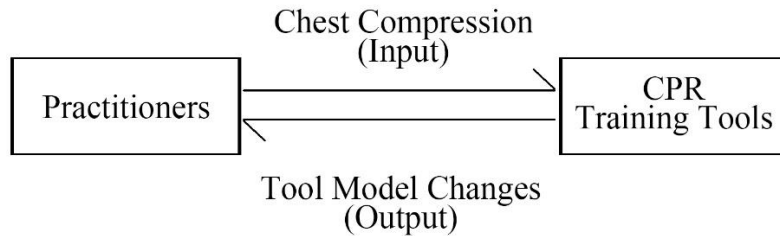

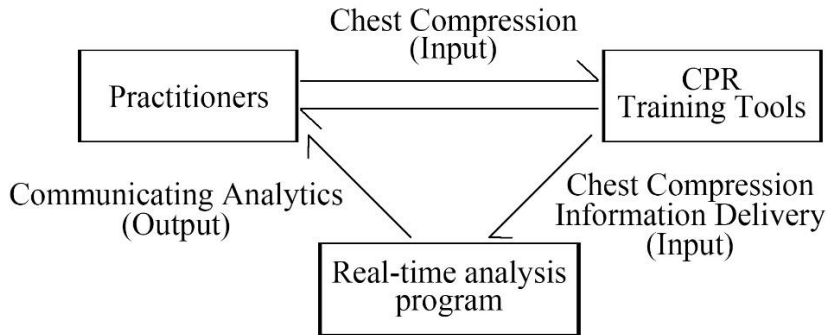**Figure 1. General CPR tool outline**

Figure 2. Overview of the Korean Safety Association CPR Simulator

The Korea Safety Education Association CPR Simulator attaches a sensor near the chest compression to the function of a typical CPR training tool, sends and receives signals to a computer program as shown in Figure 2, analyzes the status of the trainee's chest compression, and visualizes it as shown in Figure 3. This is a new type of tool, in contrast to the existing tool, which has no way to objectively check whether the trainee is

compressing at a constant speed and the correct depth of compression. In addition, the shortage of safety education educators in schools can be solved to some extent through computer real-time automatic analysis, and Ryu (2017) stated that students prefer experience-oriented education and need effective teaching and learning methods centered on experience and interest. Therefore, this simulator can induce competition among students by introducing game elements and maximize their interest to induce active participation in education, and was awarded the Ministerial Award at the 2017 Safety Technology Awards for its contribution to the revitalization of the safety industry (18)(19).

Figure 3. Korea Safety Education Association CPR Simulator Transmission Screen

3.1 Analyzing Educational Game

Table 2 Korea Safety Association CPR Simulator Training Game Element Analysis

General Elements	Korea Safety Association CPR Simulator
Goals	While the main goal is to learn CPR skills to improve your ability to respond in an emergency, sub-goals include understanding the rules such as speed, intensity, and consistency to achieve rescue success faster than the learners around you.
Rules	This gamified framework emphasizes the importance of sticking to a consistent pattern. Adhering to the rules regarding speed, intensity, and consistency is critical to the gradual progression of the mission gauge. Conversely, deviating from these rules can result in stagnation or regression of the mission gauge, as well as jeopardize the overall success of the mission. Participants can gain a deep sense of accomplishment and boost their confidence by closely following the set guidelines.
Competition	In the initial phase, six learners begin working simultaneously, separating the results into distinct categories of success and failure. A successful execution sorts participants into ranks from first to sixth, creating a competitive environment that amplifies the spirit of effort through the stimulus of ranking competition among learners. This approach effectively fosters high interest and encourages active participation from participants.
Challenge	The main goal is to perform a given task accurately, just as in a competitive endeavor, and by having the flexibility to adjust the difficulty based on the

	learner's skill level, users are able to take on challenges that match their skill level.
Illusions	While the game's lack of screen composition (the visual part of the experience) makes it a weak way to visually get the feeling of saving someone's life, the direct involvement of physical abilities promotes a deep sense of immersion. By simulating the successful completion of a given mission, participants are able to envision themselves resuscitating a patient in an authentic, real-world scenario, which contributes significantly to the overall robustness and effectiveness of the experience.
Safety	Failure in a mission doesn't actually kill the patient and doesn't give you a sense of hopelessness, such as feeling guilty for not being able to save the patient; failure can be overcome through continued challenge.
Fun	Inherent in the aforementioned elements is the fun factor. Clear goals, established rules for achieving them, and adaptable challenges create an engaging experience for both novice and experienced participants. Coupled with the ability to visually articulate errors in mission execution, this framework has a strong learning effect and encourages active participation in training through competition.

4. Conclusion

While researching for effective safety education tools that can be utilized in schools, we came across the Korea Safety Education Association's CPR Simulator, which combines some educational game elements. Students were satisfied that they could compete with their friends and know what went wrong by looking at the analyzed screen, and they actively participated in the education instead of just pressing the button. Currently, safety education contents that incorporate the latest technologies such as mobile and VR are emerging, but they are limited in their applicability to school sites and have the disadvantage that the experience is based on different manipulative tools. However, if you develop content by linking programs to these common simulator tools and introducing game elements, more students will be able to experience safety education in an efficient and fun way. As a limitation of the study, we can point out the limitations of the tool and the fact that the application and analysis were not complete in all areas, such as the general factor analysis, but we were able to find out what to keep in mind when designing contents that can be used in schools and what areas are still lacking. The lack of entertainment means that once students have played and succeeded, they may not be motivated to try again. It will take more trial and error to overcome this, and an educational tool that understands the school environment and combines the purpose of safety education with the fun of the game will help students get a better education.

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