### The Development of STEAM Career Education Program using Virtual Reality Technology

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**Abstract:** This paper provides the research cases of the STEAM education program and utilization of virtual reality in the training programs. It proposes the STEAM education program on virtual reality and the teaching methods for 3rd~4th graders of elementary schools. The training program, textbooks and teaching materials were developed in consideration of the level of intellectual development and interest of 3rd~4th graders.

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### 1. Introduction

This paper provides the research cases of the STEAM education program and utilization of virtual reality in the training programs. It proposes the STEAM education program on virtual reality and the teaching methods for 3rd~4th graders of elementary schools. The training program, textbooks and teaching materials were developed in consideration of the level of intellectual development and interest of 3rd~4th graders (Yongwan Kim 2010). To verify the effectiveness of the textbooks developed, phased training is planned for 3rd~4th graders in Jeju-do. The follow-up study and extended application of the program are also planned (Kim Tae Hyun 2003). It is expected that the STEAM career education program on the virtual reality proposed in this paper will be effective in career exploration and development of related knowledge.

### 2. Virtual Reality Tech. and Occupational Cluster

Virtual reality is an artificial world in which what is imagined is implemented in real-time by the computer and is felt as real by one or more senses of the participants. All the sensory organs are immersed in the artificial world, making people feeling as if they are actually in the place (Yeonghae Ko 2013). Virtual reality is also called as artificial reality, virtual world or virtual environment (Yeonghae Ko 2012).

In 'Promising New Occupational Clusters Selected by KISTEP in the Science and Technology Field' published in 2011 (Yilip Kim 2012), Korea Institute of S&T Evaluation and Planning (KISTEP) selected cyber network expert as one of the promising new occupational clusters for science and technology majors. The cyber network expert cluster contains the occupations related with virtual reality (Park, N. 2012). The virtual reality technologies have been commercialized in the recent years, and are being developed rapidly. For example, in relation with 3D which is the fundamental virtual reality technology, markets have evolved rapidly for 3D TV and 3D cinema, and HMD has been miniaturized for everyday use (Ko, Y. 2011). The related industries are also growing rapidly. For example, keyboard and mouse will be replaced by data gloves which are expected to be commercialized in a few years.

## **3.** Development of STEAM Career Education Program on Virtual Reality

### 3.1 Steps of research

The paper has been made according to the research steps as shown in Table 1 to develop and verify the STEAM career training program on virtual reality.

Preparation	- Analysis of preceding researches			
	- Analysis of related researches			
	- Study on STEAM cases			
Planning	- Analysis of curriculum			
	- Development of textbooks and			
	teaching materials			
	- Development of education program			
Action	- Pre-survey of students			
	- Orientation for teachers			
	- Operation of the education program			
Verification	- Verification of effectiveness			
	- Feedback from experts			
	- Amendment and supplementation of			
	the program			

Table 1. Steps of Research

### 3.2 Object of the Research

This paper is to find out the effect of the STEAM career education program on virtual reality on elementary students. For this purpose, this paper proposes an education program for 3rd~4th graders. The effectiveness of the STEAM career education

program will be verified through its application to 3rd~4th graders in Jeju Special Self-Governing Province.

## 3.3 Method of Research

The STEAM education program was provided in 3 steps in a short period of time. In order that the STEAM education should be provided appropriately, orientation course is planned to be provided for the teachers so that they should be well-acquainted with the program (An, J. 2012, 2011).

In order to verify effectiveness of the STEAM education program on selection and exploration of virtual-reality-related careers, a survey was made on the level of difficulty of the textbook, the level of interest of the students, the connectivity with the curriculum, and the level of interest in the related careers (Park, N. 2011, Kim, Y 2012, Park, N. 2010).

# 3.4 STEAM Career Education Program on Virtual Reality Technology

The program consists of 3 steps: Step 1 - Presentation of situation and creative design, Step <math>2 - Creative design and sensitivity experience, and Step 3 - Sensitivity experience and exploration of career. The program is designed to utilize the practical cases, and to form attitude as well as to give knowledge. The course was supplemented by homework, and required the students to design a 3D block volcano and other creative 4D models (Kim, Y 2012, Park, N 2006).

Evaluations were made in various ways, including self-evaluation, peer-evaluation, portfolio, and observation-based evaluation (Park, N 2011).

Table 2. Comprehensive Contents of STEAMEducation Program

Step	Subject	Contents	Related subject
1-3	Virtual Reality Expert	<ul> <li>(S,T,A,M) Make a realistic 4D volcano</li> <li>Co</li> <li>(Photo of a volcano) Who is right? – Present the situation where 3D modeling is required to show the variable shape of Mt. Halla</li> <li>Present the situation where 4D modeling is required using the 4D cinema</li> <li>CD</li> <li>Design a 3D block volcano using the 3D block application</li> <li>Make a creative 4D volcano with various materials</li> <li>EI</li> <li>Talk about my virtual reality and those made by experts</li> <li>Talk about development of virtual reality</li> <li>Present the future life as a virtual reality expert</li> </ul>	Math - Sci. - Fine Arts

# 3.5 Textbook on STEAM Career Education on Virtual RealityTechnology

To carry out the STEAM career education program on virtual reality for the elementary students, the textbook for teachers and students were developed as in Figure 1. The textbook was designed in the storytelling format to draw interest of the students. In consideration that students are in the concreteoperational period, various cartoons, figures and photos were used. Helps and supplementary data were used to lead self-directed learning. Teaching materials were also developed for the teachers to enhance understanding on the contents of the program and to help them to guide the students.



Figure 1. Example of STEAM Textbook

The textbook was developed as a 2013 development research project of Korea Foundation for the Advancement of Science and Creativity (KOFAC) for the STEAM career education program. The textbook will be supplemented continuously through verification by experts.

# 4. Result of Implementing Education Program and Analysis of Effectiveness

The questionnaire comprises 5 questions developed based on Likert Scale and 5 descriptive questions, and

the result of implementing the education system is shown in Table 3.

Subject	Frequency (Person)	Average	Standard Deviation
Level of difficulty of the class and learning materials	100	4.20	.75
Level of words and sentences used	100	4.20	.75
Interest in and satisfaction with learning materials and the class	100	4.70	.48
Preference to learning through the program in the future	100	4.60	.66
Degree of program's effect in connection with other school subjects	100	4.40	.66

Table 3. Result of Implementing Education Program

According to the survey, the level of difficulty of the class and learning materials seemed appropriate as it showed 4.20 in average, so did the level of words and sentences used as it also showed 4.20 in average. The interest in and satisfaction with learning materials and the class showed 4.70 in average, meaning that respondents were quite interested in and satisfied with learning materials and the class. The preference to learning through the program in the future was 4.60, meaning that they highly prefer learning in STEAM program in the future and the degree of program's effect in connection with other school subjects was 4.40, meaning that the effect is high.

### 5. Conclusion and Future Study

STEAM education must have 5 domains converge on a single class in the course of solving problems instead of simply and mechanically putting them together. Also, learners concentrate in class more when it is about the issues related with real life and when the topic of study is exciting and interesting. In other words, STEAM education on IT is effective in fostering the convergent thinking and problem solving capabilities of students, and smart grid can enables effective STEAM education for it attracts students' interest and provides the problematic situation for students to develop the habit of convergent thinking (Jeon, H 2014)

The career education provided by schools mainly relies on delivery of knowledge and giving students direct/indirect experience. It is difficult to expect effective career education unless students design own career and develop the ability required for the job. Furthermore, career education for elementary students must consider the future society rather than the present society. The STEAM career education program on virtual reality proposed in this paper converts the awareness of students on the IT-related jobs into a positive one, and fosters future-oriented talents based on the education on future occupations rather than present occupations. Also, the proposed program not only makes a link with but also replaces the curriculum, enabling teachers to easily use it in the field (Yeonghae Ko 2014).

STEAM career education program on virtual reality proposed in this paper is designed to raise the level of interest on the IT-related career among elementary students. However, since the program is designed for a short term, the high interest level can be momentary. In order to make up for the defects, follow-up studies are planned on continuation of interest level, and the program will be expanded.

This paper applied STEAM education program on IT theme, particularly virtual reality, in a short period of time that it could only confirm the elements that exhibited changes in a short period of time which was not enough to conform problem solving capabilities or advanced thinking skills such as creativity. Such a limit can be overcome by examining changes in students through follow-up studies after a certain period of time passes and extending and applying the curriculum according to the result of examination and also by developing many more STEAM education programs and learning materials on IT theme to establish STEAM education system in Korea.

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