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Effects of Implementation and Application of Realistic Digital Contents

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Abstract

This study aims to explore the understanding of and the interest in realistic digital contents and examine their effectiveness, by implementing and applying VR around the science subject in middle schools. It organized each group of two for cooperative activities, in order to implement VR for 52 middle school students located at Y-county, who understood study contents and agreed to participate in the study. Then, it implemented and applied realistic digital contents regarding a change in the science geosphere and many kinds of forces, by extracting and designing them. As they implemented and applied VR around contents interest in science subject. VR assisted lessons made statistically significant differences in understanding and effectiveness of realistic digital contents. It will provide basic data used to cultivate future talents who can prepare for a change in the educational paradigms along with the fourth industrial revolution and adapt to the future knowledge-based society.

Keywords: *Virtual reality (VR), Realistic digital contents, Middle school students, Science subject*

1. Introduction

Today, the educational environment in the 21th century, which is required by the information society, together with technological transformation derived from the fourth industrial revolution and the high-tech ubiquitous circumstance and IT development, has a significant effect on an educational innovation. The development of information and communication technology and wired and wireless networks has brought about an innovation of the educational paradigm and a wide variation in the educational field [1]. Such a change in the educational paradigm has concentrated increasing interest on the development of digital contents as well as the utilization of technology to which augmented reality (AR) and virtual reality (VR) are applied. AR harmonizing real objects with virtual images can help learners feel senses of flow and reality, while VR allowing learners to directly experience 3D objects in the virtual world can efficiently enhance learning effects by interacting with learning contents [2]. The curriculum demanded by the Korean modern society emphasizes self-management, communication, knowledge information processing, aesthetical

emotion, creative thought and community competence-based learning.

Such an emphasis on core competence seeks out a change for self-initiated learning, by escaping from the existing text-directed class [3]. The Ministry of Education comes to pursue realistic digital contents which can complement for functional limits of text forms and induce the qualitative enhancement of teaching and learning, in response to transformation of the educational paradigm. In particular, it has led the smart education in the form of applications using smart devices, digital contents containing interactive functions and multimedia, for subjects of social studies and science in elementary and middle schools [4]. Although digital contents using VR and AR are currently introduced to the subjects of social studies and science for third and fourth grade in elementary schools, in 2018, digital contents for first grade in middle schools are not adequately developed. In order to overcome such educational problems, the utilization of new forms of realistic digital contents is required to unfold teaching/learning activities, regardless of space-time, and therefore, an educational foundation for provoking learning motivation and interest and fostering creative learning abilities is expected to be established through educational activities. This study, hence, aims to explore the understanding of and the interest in realistic digital contents and examine their effectiveness, by implementing and applying VR around the science subject in middle schools. It will provide basic data used to cultivate future talents who can prepare for a change in the educational paradigms along with the fourth industrial revolution and adapt to the future knowledge-based society.

2. Questions

This study aims to explore the understanding of and the interest in realistic digital contents and examine their effectiveness, by implementing and applying VR around the science subject in middle schools. Specific goals are as follows:

First, it extracts and analyzes realistic digital contents around science subject in middle schools.

Second, it examines difference in the interest in the science subject, by implementing and applying the contents of science units in middle schools through VR.

Third, it investigates difference in understanding and effectiveness of realistic digital contents for science units in middle schools.

3. Method

3.1 Model and Design

This study aims to investigate the understanding and the effectiveness of realistic digital contents by implementing and applying VR around science units in middle schools. Then, it implemented and applied realistic digital contents regarding a change in the science geosphere in middle schools and many kinds of forces, by extracting and designing them. VR implemented the internal structure of the earth and kinds and characteristics of minerals, among contents related with a change in the geosphere and gravity, friction and buoyancy among those regarding many forces as shown in Figure 1.
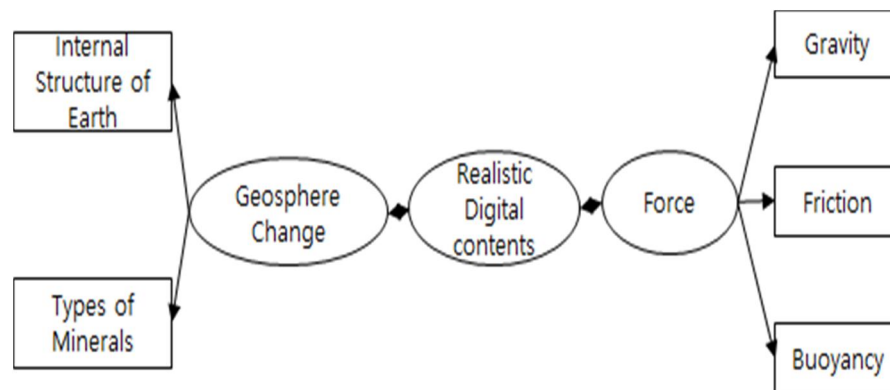
Figure 1. Extraction of Realistic Digital Contents regarding Science

3.2 Implementation and Application of Realistic Digital Contents

This study organized each group of two for cooperative activities, in order to implement VR for 52 middle school students located at Y-county, who understood study contents and agreed to participate in the study. In order to implement VR, the chrome web-browser was used to conduct Cospaces Edu, and then virtual spaces and spatial arrangement of objects were explained and each group was allowed to implement extracted contents by using VR. Next, production scenario presentation was tried to verify whether implemented VR contents achieve their goals, the achievement standards as shown in Figure 2.
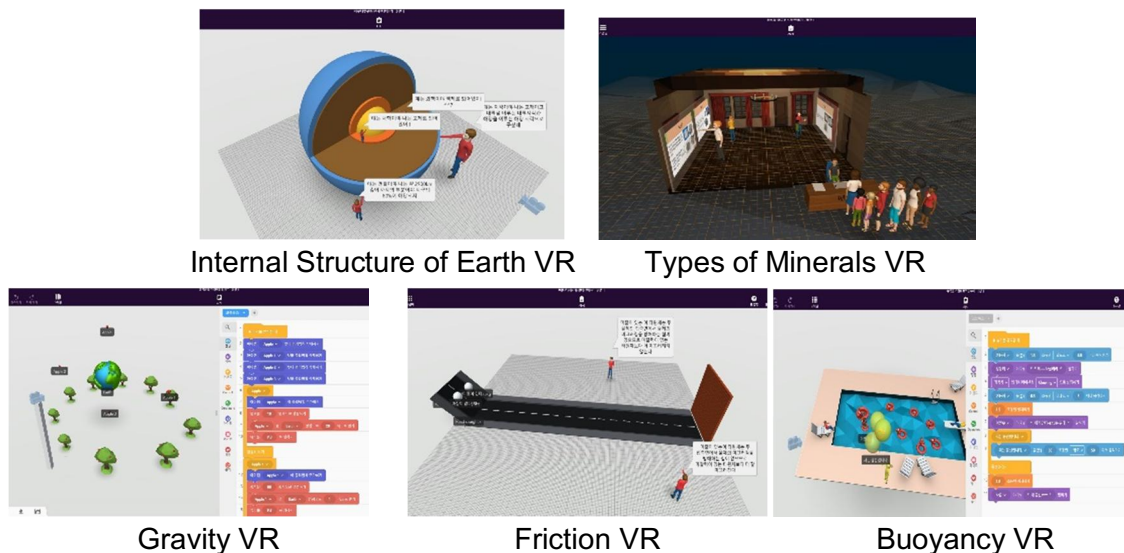

Internal Structure of Earth VR   Types of Minerals VR

Gravity VR   Friction VR   Buoyancy VR

Figure 2. Implementation and Application of Realistic Digital Contents

4. Verification Contents and Methods

This study reorganized the questionnaire provided by the Korea Education and Research Information Service(2013), in order to examine pre-post the interest in the science subject and the understanding and the effectiveness of realistic digital contents. As an analysis tool, the SPSS win 23.0 program was used, and frequency analysis, measurement of average and standard deviation, t-test were conducted as shown in Table 1.

Table 1. Verification Contents and Methods

Verification Contents	Verification Tools	Test Periods	Process of Data
•Students' Portfolio •Checklist of Class Observations •Understanding of and Interest in Realistic Digital Contents	•Questionnaire (Korea Education and •Research Information Service) •Interviews with Students •Learner's Attitudes	Nov 18th, 2018 -Dec 21st, 2018	Average Standard Deviation T-test

5. Results

5.1 Change in Interest in Science Subject

First graders' interest in the science subject in middle schools was examined before/after the implementation of realistic digital contents. As shown in Table 2, the number of students who responded that the science subject is 'funny' was increased by 10 (5.2%) than that in the pre-test, according to the results of the interest in science subject. This might be resulted from the fact that learners could resolve their questions which could not be understood through explanations and experiments in science subject units, by implementing and experiencing VR.

Table 2. Change in the Subjects' Interest in Science subject(N=52)

Contents	Pre-test	Post-test
Funny	24(46.1%)	34(65.4%)
Normal	21(40.4%)	16(30.8%)
Insipid	7(13.5%)	2(3.8%)

5.2 Difference in Understanding of Realistic Digital Contents

Difference in the subjects' understanding of realistic digital contents after the implementation of them through VR was measured to show that the average in the pre-test was increased by 1.12 in the post-test, as shown in Table 3. The t-test of difference in understanding of realistic digital contents exhibited that there was a statistically significant difference in understanding of them at $P<.05$. This suggests that the understanding of realistic digital contents may seem to be increased, as empathy for them using VR has been built based on the stream of the fourth industrial revolution era.

Table 3. Change in the Subjects' Interest in Science subject(N=52)

Division	Average	Standard Deviation	t	p
Pre-test	2.53	.854	6.465	.000***
Post-test	3.65	.529		

***p<.000

5.3 Effectiveness of Realistic Digital Contents

For the test of realistic digital contents' effectiveness, the subjects measure the checklist of presentation attitudes, after implementing VR through team teaching activities. Table 8 exhibits that the average of the subjects in the pre-test was increased by 0.62, than that in the post-test. The t-test of mean difference in the effectiveness was conducted to show that there was a statistically significant difference at P<.05. Rather than individual activities, thus, cooperative activities through team teaching have an effect of information sharing, in designing and implementing contents as shown in Table 4.

Table 4. Effectiveness of Realistic Digital Contents(N=52)

Division	Average	Standard Deviation	t	p
Pre-test	2.52	.758	4.332	.000***
Post-test	3.24	.468		

***p<.000

6. Conclusion and Suggestion

6.1 Conclusion

This study was conducted to examine the effectiveness of the contents extracted from science subject units, by implementing and applying VR. From the findings, following conclusions could be summarized:

First, realistic digital contents demanded by the future society gave an opportunity to enhance learners' interest in the science subject, who were accustomed to the digital environment, as they implemented and applied VR around contents of science subject units. Second, cooperative activities for implementing VR enhanced learners' competence to recreate creative knowledge and information, while they experienced convergence contents combined with ICT technology, and provided the foundation in which they could understand realistic digital contents. Third, learners understood scientific principles and realistic digital contents by implementing VR which can replace scientific phenomena which were not easily resolved through explanations and experimentations, among contents of science subject units in middle schools, and the effectiveness of the contents was proved with a sustainable research.

6.2 Suggestion

As the fourth industrial revolution age begins, the change in educational paradigm, for enhancing learners' competence in the 21th century, recreates communication, knowledge information processing, aesthetical emotion, creative thought and community competence-based knowledge and information and is focused on problem-solving ability, cooperation through SNS and the enhancement of self-initiated learning ability. This study provides following suggestions as efficient measures to develop realistic digital contents demanded by the future society. First, some attempts to improve the educational environment, such as provision of smart devices and establishment of wireless network infrastructures are required to implement realistic digital contents in the educational field. Second, training programs for reinforcing teachers' and learners' competence are required to provide efficient realistic digital contents, and therefore, administrative/financial support systems for them should be developed. Third, the current curriculum should be re-corrected to leap to a blue ocean of the educational paradigm, by reviewing, analyzing and extending subjects which can implement realistic digital contents.

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