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A Study on Effects of AR and VR Assisted Lessons on Immersion in Learning and Academic Stress

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Abstract

This study investigated the academic stress and the immersion in learning in relation to AR and VR assisted instructions compared to traditional approaches. To that end, 78 8th graders in T and S city in Gangwondo were assigned to experimental and control groups. The experimental group received the VR and AR lessons. The academic stress was measured with the pre- and post-test scores, while the immersion in learning was measured with the post-test scores. In brief, AR and VR assisted lessons made statistically significant differences in the academic stress and immersion in learning in comparison to the traditional approaches.

Keywords: *Augmented Reality(AR), Virtual Reality(VR), Academic Stress, Immersion in Learning*

1. Introduction

Different approaches to learning have emerged against the backdrop of the Industry 4.0 adding to the exponential growth of knowledge and information led by the ever-evolving ICT. AR enabling the harmony of things between real and virtual spaces and VR providing seemingly real but virtual 3D images are set to instigate another paradigm shift in education towards two-way learning contents [1][15]. Lately, the advancement of smart devices including smartphones and tablets and the increasing penetration thereof have raised the interest in the educational effects of diverse contents. Those media are useful for experiential learning, extend the immersion and experience of learners while they operate such devices, increase their interest in learning and contribute to relieving them of the stress from learning[2]. Particularly, AR and VR used in learning activities are regarded as extraordinary media for learning that give seemingly realistic information based on 3D graphics, promote the interactions between instructors and learners, facilitate the sensory immersion and thus enhance the immersion and interest in and satisfaction with learning [2-4][14]. Yet, most previous studies simply applied experiential approaches to small samples of students or involved some technical demonstrations of developers using their prototype technologies. Thus, this study incorporated AR and VR assisted contents in a middle-school science class to shed light on the their effects on the immersion and the academic stress ultimately with intent to increase middle schoolers′ interest in science and their sense of immersion in learning and alleviate their stress from learning.

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2. Questions

This study designed inquiry-based learning activities with the help of AR and VR, applied them to a science class, and compared the inquiry-based learning using such contents with the traditional inquiry-based learning to determine the differences in middle schoolers' immersion in learning and academic stress. To that end, the following questions were raised here.

First, is there any difference in the immersion between the AR and VR assisted inquiry-based learning group and the traditional inquiry-based learning group?

Second, is there any difference in the academic stress between the AR and VR inquiry-based learning group and the traditional inquiry-based learning group?

3. Method

3.1 Model and Design

This descriptive survey research was intended to establish the relationship between the AR and VR assisted inquiry-based learning and middle schoolers' immersion in learning and academic stress. Fig. 1 shows the model set up for this study.

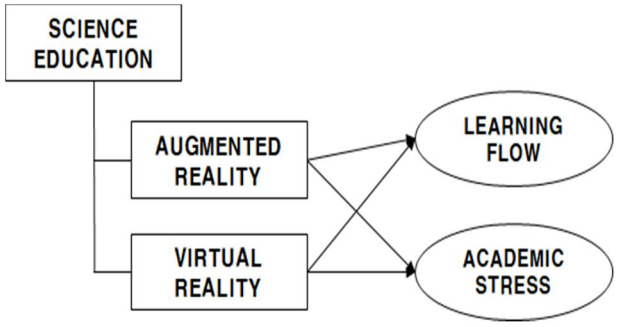

Figure 1. Framework

As for the study design, pre- and post-tests were used to determine the academic stress, while a post-test was used to determine the subjects′ immersion in learning. The experimental group used the AR and VR, whereas the control group used the traditional approaches as outlined in Table 1.

Table 1. Study Design

E_1 C_3	X_1 X_2	E_2 C_4
E_1 : Experimental group (pre-test) E_2 : Experimental group (post-test)	C_3 : Control group (pre-test) C_4 : Control group (post-test)	X_1 : AR/VR assisted learning X_2 : Traditional learning

3.2 Subjects and Data collection

78 8th graders attending two middle schools (A:39 and B:39) in T and S city in Gangwondo were informed of the purpose of this study and agreed to participate. The experimental group of 39 8th graders attending A had received lessons using smart mobile devices, whilst the control group of 39 8th graders attending B had never used smart mobile devices in class. The pre-test survey was conducted from June 1st to 10th, 2017. The post-test survey was conducted from October 1st to 15th, 2017. The author handed out and collected the questionnaire sheets.

3.3 Instrument and Method

1) AR assisted learning program

Referring to the learning system suggested by the Korea Education and Research Information Services[5] for AR, I designed the AR assisted program composed of three themes and 8 lessons concerning the digestion and circulation prescribed in the science curriculum for the 8th graders. Also, referring to [6] offering science contents based on existing textbooks, the instructor presented the multimedia contents including the learning content, images, 3D contents and videos to learners. Learners partaking in the science class installed the AR app on their mobile devices and familiarized themselves with the geometric markers so that they could use diverse multimedia contents in class.

2) VR assisted learning program

The CoSpaces [7] developed in Germany was used to implement a virtual world with diverse 3D characters and objects. The learning system was associated with the final stage of the science unit, where individual learners were presented with an assignment to build a virtual world and run it on mobile devices.

3) Immersion

The 36-item instrument used to measure the immersion in learning was adapted by [2] from the schedule originally developed by [8]. Each item was rated on a 5-point Likert scale (′Strongly disagree′ : 1, ′Strongly agree′: 5). The higher the score, the greater the immersion. [2] reported Cronbach′s α=.90 as the reliability of the instrument, whereas Cronbach′s α=.92 in this study.

4) Academic stress

To measure the academic stress, the 13-item multiple choice question scale constructed by [9-10] and used by [11] was used. Specifically, the items included 3 class factors, 6 achievement factors and 4 study method factors. Each item was rated on a 5-point Likert scale (′Strongly disagree′: 1, ′Strongly agree′: 5). The higher the score, the greater the academic stress. [11] reported Cronbach′s α=.80, whereas it was .93 in this study.

4. Analysis

The SPSS was used to analyze the data. To verify the difference between the experimental group using AR and VR and the control group using the traditional approaches, the pre-test scores underwent ANCOVA. To verify the difference in immersion, independent sample t-test was used.

5. Results

5.1 Academic stress

To determine the difference in academic stress between the experimental group using AR and VR assisted approaches and the control group using the traditional approaches, the pre- and post-test scores were analytically compared<Table 2>. The academic stress in the experimental group decreased by 1.73 from the pre-test mean 4.01 to the post-test mean 2.28, whereas that in the control group decreased by 0.01 from 2.10 to 2.09.

Table 2. Descriptive statistics about academic stress by group (n=78)

Group	N	Pre-test		Post-test	
		M	SD	M	SD
Experimental	39	4.01	.40	2.28	.82
Control	39	2.10	.71	2.09	.71
All	78	3.06	.59	2.18	.76

Also, Table 3 shows the difference in the academic stress between the two groups based on the ANCOVA results.

The experimental group using the AR and VR assisted approaches showed a significant difference in the academic stress compared to the control group using the traditional approaches. That is, the AR and VR assisted lessons significantly decreased the academic stress.

Table 3. ANCOVA results about academic stress (n=78)

Variance source	Sum of squares	Degree of freedom	Mean square	F	P-value
Covariance(pre-test)	5.989	1	5.989	11.340	.001
Group	2.736	1	2.736		
Error	39.611	75	.528		

*p<.05

5.2 Immersion

To verify the difference in the immersion between the experimental group using the AR and VR assisted approaches and the control group using the traditional approaches, the two groups′ post-test results underwent the independent sample t test <Table 4>.

Table 4. Independent sample t test results about the difference in immersion(n=78)

Group	N	M	SD	t	p
Experimental	39	4.37	.38	5.67	.000
Control	39	3.35	1.05		
All	78	3.86	.71		

*p<.05

The experimental group using the AR and VR assisted learning approaches averaged 4.37, in comparison to 3.35 in the control group using the traditional approaches. The t test used for establishing the inter-group

difference showed a statistically significant difference in the immersion between the two at a significance level of .05. That is, the immersion in learning was greater in learners using the AR and VR assisted approaches than those using the traditional approaches.

6. Conclusion and Suggestion

This study compared an experimental group using the AR and VR assisted approaches with a control group using the traditional approaches in terms of the immersion in learning and the academic stress. 78 8th graders attending middle schools in T and S Gangwondo were assigned to the experimental and control groups, respectively. The academic stress was analyzed based on the pre- and post-test results, while the immersion in learning was measured based on the post-test scores. In short, the AR and VR assisted learning exerted statistically significant effects on the academic stress and the immersion in comparison to the traditional approaches. The AR and VR contents similar to gaming are part of the positive entertainment appealing to students′ sentiments, induce students to feel interested in learning by dint of the fun factors arising in physical and leisure activities, and alleviate the academic stress from their school achievement. In the same vein, exploring the effects of gaming-oriented recreation activities on teens′ academic stress, [11] reported the recreation activities in class contributed to students′ satisfaction with school life and lessened their academic stress. Compared to the traditional approaches, the AR and VR assisted learning resulted in a significant difference in immersion with the experimental group outpacing the control group by mean 1.02. This finding is consistent with previous reports that the AR and VR were significantly effective for improving the immersion in learning as well as provoking students′ curiosity and expectation[1-2, 12-13].

Hence, it is crucial to take into account the technology factors relevant to AR and VR applicable to class settings, and to develop instructional methods and contents instrumental in relieving learners of any strain in class while enhancing their immersion.

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