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IMPLEMENTATION AND APPLICATION OF TEACHING AND LEARNING MATERIALS BASED ON REALISTIC IMAGE DISPLAY

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Synopsis:

Recently, there is a growing interest in technology of realistic image display such as virtual reality(VR) and augmented reality(AR), all over the world in the education sector. And, there have been reports about the development of various contents based on such technology as well as their educational effects. This study implements hologram-based teaching and learning materials, and objectively examines the flow when experiencing hologram-based materials and PC materials using the analysis method of the Facial Action Coding System(FACS). The significance of this study is in initiating the development of teaching and learning materials using hologram teaching technology in Korea. The direction for further research can be set based on the findings of this study to develop materials using hologram technologies.

Implementation and Application of Teaching and Learning Materials Based on Realistic Image Display

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Abstract

The purpose of this study is to implement teaching and learning materials based on hologram displays and objectively compare the degree of flow between materials based on realistic image displays and PC materials. The study used the 'Looking Glass' device as equipment for the hologram display, which is considered safe to be used as learning materials and allows participants to view 3D images without using additional equipment such as headphones or glasses. The images were first recorded as 2D images and depth-maps the 2D images were viewed on a 17-inch laptop screen; and finally as 3D videos by combining the 2D images and depth-maps using Looking Glass. The study then measured flow to evaluate effects by recording facial actions of three adults when they viewed each material. This study used 'FaceReader', a software for flow degree analysis of facial actions. The study analyzed facial actions of subjects while using two types of teaching and learning materials. Although prior studies used subjective degrees of flow that were self-reported or evaluated by the researcher, this study provided the possibility of implementing a new scale.
Key Words: Realistic Display, Hologram, Teaching and Learning Material

I.INTRODUCTION

Recently, the education sector the world over has shown increasing interest in realistic image display technologies such as virtual reality(VR), augmented reality(AR), holograms, and immersive sensory experiences. As these realistic learning materials can create non-existing learning situations as real and present, learners can perceive themselves as being in that situation, which enables them to achieve a higher flow of learning and actively participate in learning activities (Choi & Kim, 2018). Most prior studies reported that learning materials based on VR and AR lead to increase in interest and degree of objective flow in education as compared to existing learning materials, ultimately resulting in educational effects (Bacca et al., 2014; Liu & Chu, 2010; Ibáñez, 2014). However, there are only a few studies on the development of learning materials based on hologram image display. As learners do not require

any additional tools such as glasses to enjoy its realistic features, hologram technology is stable and easy to use in terms of education.

The purpose of this study is to implement teaching and learning materials using a hologram display, and to objectively compare the degree of flow between realistic image display and PC materials.

II. METHOD

1. Participants

Our study was conducted on three participants (one male, two females) who were aged between 30 and 40.

2. Materials

2.1. Holographic Display Device (Looking Glass)

The study used the 'Looking Glass' device as the equipment for the hologram display, which is considered safe as a learning material and allows participants to watch 3D images without the need for separate equipment such as headphones or glasses (Fig. 1). The images were first recorded as 2D images and depth-maps, following which the 2D images were displayed on a 17-inch laptop screen, and lastly, viewed as a 3D video by combining the 2D image and the depth-map using Looking Glass.

Fig. 1 The Looking Glass (a holographic display device)

2.2. FaceReader

FaceReader is a software that analyzes characteristics of emotions and facial expressions based on the Facial Action Coding System (FACS), and is used very commonly as it quantifies and analyzes emotions by observing facial expressions. FaceReader uses a program to identify 500 facial expressions in images and videos, pre-recorded or real-time, which are used to analyze emotions of subjects ranging not only from arousal and valence but also emotion (neutrality, happiness, sadness, anger, surprise, fear, disgust). In this study, participants recorded videos of their faces (about 15 seconds long) while looking at images on both PC monitor and through Looking Glass. After then, the videos were analyzed through FaceReader. The observers' arousal from videos was used as an objective indicator of flow.

3. Procedure

Four types of images (a flower, a red car, a donkey, and a landscape) were presented to participants on a 2D monitor (laptop screen) and a hologram monitor (Looking Glass). These four images were presented randomly to avoid the order effect. The study images were presented using a two-dimensional monitor and a hologram monitor, and at the same time, a flow toward study images was measured in real time using FaceReader (see Fig. 2).

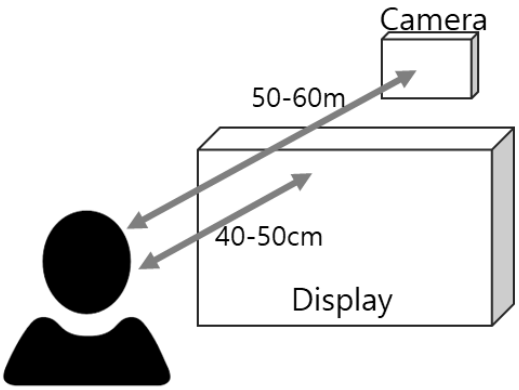

Fig. 2 Procedure of Experiments

III. RESULT

We measured and analyzed flow (arousal) of participants by FaceReader when they viewed the images on each material (PC and Looking Glass). The results of flow value when participants viewed each material are presented in Table. 1.

Table 1. Results of the Value of the Flow Calculated by FaceReader

Material	# of Images	Flow value		
		Participant1	Participant2	Participant3
PC	Image 1	0.2202	0.2833	0.2491
	Image 2	0.2315	0.2226	0.2909
	Image 3	0.2261	0.2955	0.2743
	Image 4	0.2525	0.2900	0.2779
LG	Image 1	0.3194	0.2620	0.2963
	Image 2	0.2475	0.2714	0.1618
	Image 3	0.2679	0.3979	0.1626
	Image 4	0.2852	0.3401	0.2452

Thereafter, analysis was conducted using SPSS 18.0 to examine differences in flow when experiencing the PC and Looking Glass. However, no significant differences in flow were observed between PC and Looking Glass ($t= -0.563$, $p>.05$).

IV. DISCUSSION

There were no significant differences in the degree of objective flow of participants between experiences of the existing media (PC) and that of Looking Glass (Hologram). To date, various studies have been conducted on the effects that such media can have as compared to traditional methods, and specifically, prior studies focusing on flow reported that new media leads to a higher degree of flow than traditional teaching methods (Ibáñez et al., 2014). However, results of this study are contrary to those of prior studies. This discrepancy likely resulted due to follow reason. Prior studies measured flow with subjective reporting by participants whereas this study attempted to determine degree of flow on an objective scale. Therefore, future studies must further explore the issue of how degree of flow should be measured.

Regardless, this study is meaningful in the following aspects: Prior studies used the subjective degree of flow that was self-reported or evaluated by the researcher, whereas this study provided the possibility of implementing a new scale. In addition, among prior studies on AR and VR, there were very few studies on holograms. The significance of this study is in

initiating development of teaching and learning materials using hologram technology in Korea. The direction for further research can be set based on findings of this study to develop materials using hologram technology.

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