

Development and Usability Evaluation of Unification Education Content based on Augmented Reality

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This research aimed to develop a new unification education content in an augmented reality-based learning environment centered on respecting different life aspects and peaceful coexistence, thereby marking a departure from the past lectures-based unification education. The augmented reality usability evaluation was conducted with 9 undergraduates and graduate students studying at University C. The usability evaluation tool was utilized to verify the degree of interaction and usability of the augmented reality unification education application. According to the findings, the overall evaluation of interaction and usability are 4.13(5) and 4.16(5) respectively. This implies that the interplay of the sounds, the degree of freedom of operation, and the convenience of learning need to be strengthened.

Keywords: Augmented Reality, Interaction, Unification Education, Usability Evaluation

Introduction

With the advancements in science and technology, the fourth industrial revolution is eliciting an increasing amount of attention. The fourth industrial revolution refers to the creation of intelligently controlled virtual systems through the development of technology such as virtual reality and artificial intelligence (Han, 2020). This will bring rapid changes in economy, industry, and medical care. While computers are expected to replace 55% of occupations in South Korea, unification education has not changed much compared to the 20th century (Han, 2020; Jang, 2017). Thus, To adapt to the rapid changes in society, it is imperative to get rid of the injection-type education method method to adapt to the rapid changes in society (Han, 2020).

The topic of continuous exploration in the field of education seeks ways of rationally using media resources and technical tools, designing effective teaching strategies, and promoting learning cognitive processing and learning effects. In the context, AR (Augmented Reality) is a technology that superimposes virtual learning materials on the actual environment and covers the virtual world based on the real world. Different from the existing 2D plane, it can display learning materials in 3D and promote effective learning. At the same time, learners' engaging experience and understanding of learning theory can be improved through AR learning materials. In the cognitive theory of multimedia learning, AR is evaluated as an effective learning tool (Wang et al., 2018). Unification education is mostly carried out through teachers' lectures, explanations, or watching videos. By developing various educational learner-centered programs, to guide students to actively participate, AR can get rid of this non-learner-centered, inefficient, obsolete, and indoctrinated education method, thus cultivating students' thinking and problem-solving ability.

This research aimed to get rid of the past lecture-style unification education method, centered on content education that respects different lifestyles and peaceful coexistence, and develop unification educational content in a new learning environment based on augmented reality.

Augmented Reality and Education

AR is a technology that projects computer-generated material (such as text, images, videos, 3D objects, etc.) into the user's perception of the real world (İbili, 2019). In real life, AR supplements or emphasizes relevant content through specific locations or activities, or adds objects that do not exist originally. As a result, digital content is seamlessly

superimposed and integrated into human perception of the real world, just like superimposing a virtual world onto the real world. This can help enhance people's knowledge and understanding of their surroundings or the things that are unfolding around them. Moreover, the superimposed content doesn't seem out of place, AR makes users feel that the perceived virtual content and the real world are a single, seamless environment.

AR has been used in many fields, and educational scholars have been exploring the possibility of using AR in education. AR consists of characteristics: the fitting of the real world and virtual elements, real-time interaction, and the correlation between the virtual elements and the position and orientation in the real world. Compared with VR, both are real-time interactive and immersive, but combining AR and reality can give people a sense of reality, whereas the combination with the real world can also prevent danger during use. In addition, AR applications can get rid of the head-mounted display (HMD) used by mobile phones, which not only reduces the cost but also increases the possibility of large-scale application. These advantages are in alignment with the requirements and characteristics of education and provide a good prospect for the development of AR in education.

The application of AR in education can attract, stimulate, and motivate students to explore learning materials from different perspectives, besides helping subjects who cannot provide real practical experience to build a virtual environment providing a first-person learning experience. At the same time, the feature of real-time interaction can strengthen the interaction between the teacher-learner and the learner-learner. The simulation of the real environment can give students more freedom to control their learning progress at their own pace. The use of virtual elements is also beneficial when it comes to cultivating students' creativity and imagination.

Unification Education with University Students

Before the 1990s, the content as well as the direction of the unification education primarily comprised air defense education and safety education, which mainly focused on the criticism of communist ideology and North Korea, and the clarity of students' safety awareness and attitude. After the North-South summit meeting in 2000, in conjunction with changes in the political and social atmosphere, the direction of unification education in schools has also changed from "system superiority" to a "peaceful coexistence approach" (Han, 2020; Antigurada, 2019; Institute for Unification Education, 2019). Kim and Kim (2022) surveyed 332 university students, wherein only 62% responded that unification is necessary, indicating that unification education is still an urgent task.

Currently, two Koreas are making various efforts for peaceful unification, and the importance of unification education is being emphasized in line with this situation. However, in terms of unification education, the majority of existing studies are establishing unification education by diagnosing the challenges of current unification education and seeking future directions through this (Kim & Kim, 2022). Looking at the background of the times, it appears that change is also necessary for unification education. In particular, university students' perceptions of unification do not suggest that the necessity of unification is greatly recognized (Ko, 2017). Therefore, compared with other generations, university students are somewhat negative about the possibility of unification and the benefits it brings to themselves, which causes them to opine that unification is impossible (Jo, 2018). In addition, the younger generation, including university students, perceive unification as a burden they must bear, so they feel a great burden or fatigue (Bae, 2017). Jung (2013) posited that, as a basic premise of unification education for university students at this point in time, an understanding of peace is necessary, and practical unification education is necessary to prepare for chaos before and after unification.

Therefore, the need of the hour is to provide education that is capable of overcoming the confrontation between the two Koreas and leading to peace and reconciliation. For this purpose, education for the unification of future generations, university students, should be conducted in a direction that excludes political means (Ahn, 2013). This is the time when unification education is needed to develop the will and attitude to draw the future image of unification by grasping the positive aspects of unification (Jun, 2012).

Development Process - Virtual Environment and Scenario

This study developed a software that can be used on mobile phones based on AR technology. Besides bringing in the advantages of learner-centered education, AR technology makes it easier for learners to access unified relevant educational knowledge, can enhance learners' learning interest and learning enthusiasm, and also enables learners to be free from location and time constraints. Learning can also take place beyond the confines of the school (Kim & Kim, 2022).

The virtual environment is the main factor that makes learners feel engaged. To meet the theme of unification education, we selected the most exchange activity between North and South Korea, namely the football exchange battle, to form an augmented reality virtual environment. In order to demonstrate that North and South Korea can solve the problem of peaceful reunification only by working together, the football exchange game is not shown as a mode of confrontation between two teams. On the contrary, North and South Korean players unite as one team and overcome difficulties in unison to kick the ball into the goal. The difficulty of peaceful reunification is visualized as

obstacles on the football field that prevent players from scoring goals. Participants need to eliminate all obstacles to help players score goals.

To remove these obstacles, participants need to learn about North and South Korea and answer questions. Obstacles will disappear while answering questions, footballs will get closer and closer to the goal, and North and South Korean players will get North and South Korea map fragments. When all the questions are solved, all the fragments are collected and subsequently assembled into the whole map of North and South Korea, symbolizing that North and South Korea are a whole. Then, owing to the successful end of the exchange battle, the referee will issue train tickets to the players that can travel to North and South Korea. Thereafter, the North and South Korean players can deepen their feelings during the trip, symbolizing the elimination of the gap between North and South Korea.

Development Process - Questions

Considering that the map of North and South Korea can be divided into 14 pieces, the participants are then given five chances to answer incorrectly. For this experiment, 19 questions were selected from the produced questions. All questions are developed by experts, since the learning object is aimed at university students, the questions are difficult. To compensate for this, all questions are set to be true or false. Answers and feedback are provided for correct or incorrect answers to maximize learning.

Developed AR

After entering the software, the first is the background introduction and the character's self-introduction. Participants are then introduced to the use of the AR

Figure 1
Background introduction and North Korean player self-introduction



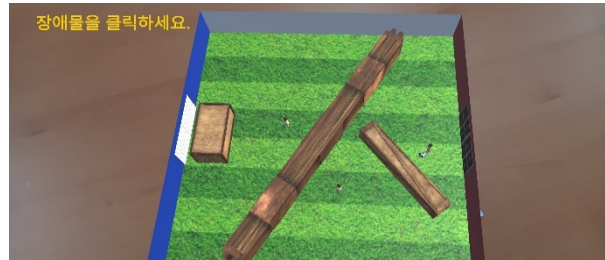
Figure 2
Introduction to use



After the introduction, you can turn on the AR by scanning the mark.

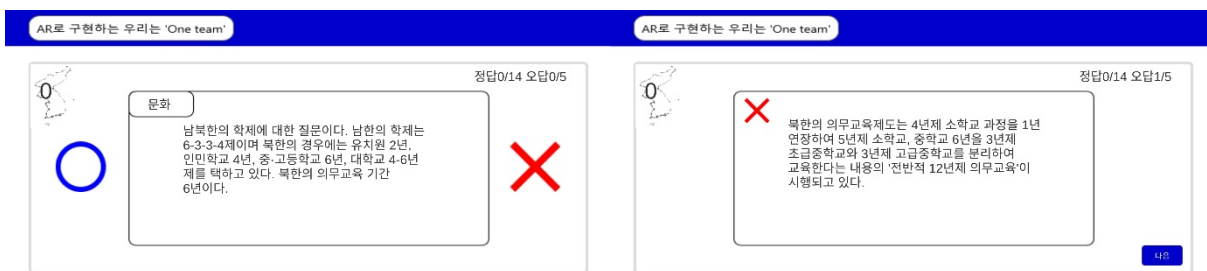
Figure 3

Mark and AR football Pitch



Answers can be started by clicking on obstacles, with results and explanations given after each question is answered.

Figure 4
Question and explanation



Research Design & Methods

Experimental Participant

This study conducted usability evaluation on undergraduate students and graduate students, all of whom had experience and a certain understanding of AR. A total of 9 participants, 6 women (66.7%) and 3 men(33.3%), participated in the usability evaluation.

Usability Evaluation Tool

The measurement tool in this study was developed by Barfiled(1998) and modified and supplement by Lee(2012) was used. The subscale consists of interactivity and usability.

Methods

In July 2022, each participant was provided with a separate quiet experiment and evaluation environment in classroom 103, Faculty of Education, University C.

After listening to the explanation about the experiment’s purpose, the participants personally used the AR software developed in this study and then completed an independent evaluation of the AR software through an online questionnaire.

Results

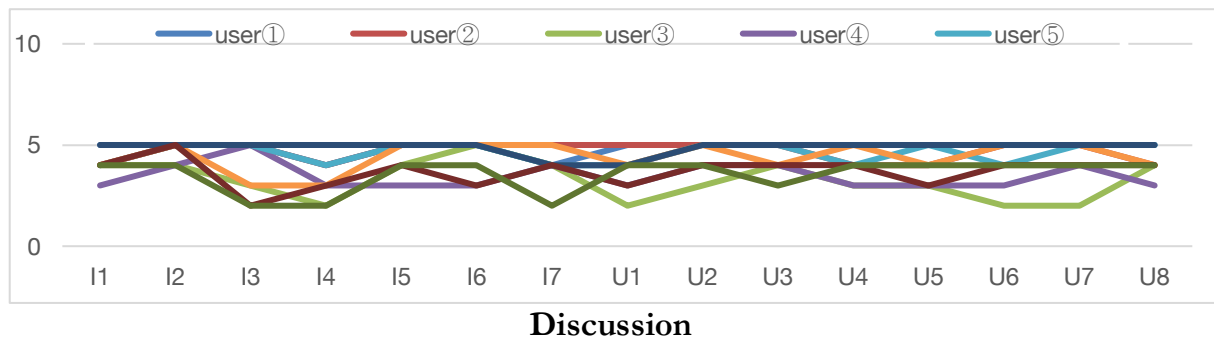
In this experiment, 55.6% of the participants were 20 to 30 years old, and 44.4% were 30 to 40 years old. Participants' ratings for each criterion are illustrated in Figure 5. I1 means interaction question 1, and U1 means usability question 1. On a 5-Likert scale, all participants rated their understanding of AR as above 3, and there is only one participant who claimed not to know about the interface design.

The overall average score for the interaction evaluation of AR applications was 4.13, with a score of 3.89 for "Augmented reality-based unified educational content provides auditory feedback", "Augmented reality-based unified educational content, freedom of direction of action" score was 3.33, and the other five criteria for interaction all scored above 4. The overall average score for the usability evaluation of AR applications is 4.16, the average score for "unified

educational content based on augmented reality is easy to learn" is 3.78, and the average scores for the other seven criteria are all above 4.

Figure 5

Participants' ratings for each criterion



This study aimed to develop unified educational content based on AR by keeping the focus on the learners. Provide new educational programs for inefficient unification education, and arouse students' learning interest and learning enthusiasm. However, many participants could not answer all the questions at one time due to the difficulty and only five chances of answering incorrectly, which is not in line with the purpose of education, so it is planned to correct this problem in future research.

Conclusion

In this study, a mobile AR application software was developed based on AR and student-centered to improve the immutable and inefficient unified educational environment. This software is expected that to arouse students' interest in unified education and provide opportunities for learning anytime, anywhere. This provides a new program suitable for the development of unification education. The results suggest that there is room for further improvement in the interaction of sounds and the freedom of operation and that the convenience of learning needs to be strengthened. These need to be noted in future research.

References

- Ahn, S. (2013). Nationalist discourse analysis of education in North and South Korea - Focusing on modernist nationalism theory. *The Korean Cultural Review*, 55, 355-374.
- Antigurada, Ten Prints. (2019). *It's a unified catch*. Seoul: Gyeongjin
- Bae, Y. (2017). A study on the current status of university unification education and its improvement direction. *Work and Peace*, 9(1), 317-357.
- Barfield, W., Baird, K. M., & Bjorneseth, O. J. (1998) Presence in virtual environments as a function of type of input device and display update rate. *Displays*, 19(2), 91-98.
- Han, S. (2020). Basic direction of education for peaceful unification of schools in the era of the 4th industrial revolution. *The Korean Association of Northeast Asian Studies*, 25(1), 51-69.
- İbili, E. (2019). Effect of Augmented Reality Environments on Cognitive Load: Pedagogical Effect, Instructional Design, Motivation and Interaction Interfaces. *International Journal of Progressive Education*, 15(5), 42-57.
- Institute for Unification Education. (2019). *Unification issue*. Seoul: Ministry of Unification
- Jang, H. (2017). *10 years later, Korea finds a way for future jobs*. Knowledge Empathy.
- Jo, J. (2018). A new paradigm of unification education and unification consciousness of the 2030 generation. *Unification Education Research*, 15, 21-45.
- Jun, J. (2012). A study on morality based on the 'meaning' of unification education, teacher organization and educational planning frame-Focused on the practice community theory. *Teacher Education*, 28(2), 247-266.
- Jung, G. (2013). A study on the basic premise and direction of university unification education. *Unification Strategy*, 13(4), 171-200.
- Kim, H., & Kim B. (2022). A study on the acceptance and diffusion of 'Unification Education' public PR campaign: Focusing on the perception of university students. *Korean Advertising and Public Relations Journal*, 24(2), 43-85.
- Ko, G. (2017). A study on the awareness of unification among young people. *Seoul: Korea Youth Policy Institute*

- Lee, J. (2012). *A study on the usability evaluation factors of an augmented reality environment*. Master's thesis in Korea, Graduate School of Hongik University.
- Wang, T. K., Huang, J., Liao, P. C., & Piao, Y. (2018). Does augmented reality effectively foster visual learning process in construction? An eye-tracking study in steel installation. *Advances in Civil Engineering*, 2018.