

Effects of Context-based Augmented-Reality Vocabulary Learning Materials on Learning Achievement and Motivation

Jiyoung Chun (Chonnam National University)*

Vocabulary knowledge is essential in foreign language learning which occurs through the process of constructing and adapting knowledge through experience (Kolb, 2009). In language learning, understanding the context of language culture and obtaining cultural knowledge promote vocabulary acquisition because learners can strengthen their knowledge of words during meaning-focused activities such as context-based reading (Batterink & Neville, 2011). Augmented Reality (AR) offers an innovative approach that enriches the language learning experience by providing context information in the form of digital resources. Thus, vocabulary learning with AR resources enables learners to appreciate and understand the context of language usage (Kim, 2018). The purpose of this study is to examine the effects of context-based AR reading on high school students' vocabulary learning and motivation. Two freshman English classes (25 high school students in each class) participate in this study. With IRB approval, a class engages in reading activity with six groups consisting of 5-6 students and reads text on "American football (lesson title: The Final Touchdown)" with AR intervention including cultural-context information while the other class read the same text with AR intervention which has only vocabulary meaning. The AR reading intervention include AR markers that present AR information for target texts. The AR information will provide narration that enhances reading information such as football positions and game rules/terms when recognized using a tablet. Learning achievement is measured using the vocabulary post-test consisting of a total of 20 items. Motivation will be measured using the Instructional Material Motivation Survey (IMMS) containing 20 items with a 5-point Likert scale developed by Keller (2010) based on his ARCS motivational design model.

Keywords: Augmented-Reality, Learning Materials, Learning Achievement, Motivation

* First author, Dept. of Education, College of Education, Chonnam National University (sallylaws@naver.com)

1. Necessity and purpose of the study

Digital technology was applied to society at large and the methods of education have changed with the 4th Industrial Revolution. Various attempts to apply media to the field of education have continued steadily. With the development of media, the scope of application to learning gradually expanded, and engineering led to a change in education (Banathy, 1991). As e-learning expanded, artificial intelligence (AI) was introduced into education, augmented reality being one such AI. With educational technology, there are attempts to enhance the learning effects using the subject knowledge learned in school (Kim, Yang, Heo, & Doo, 2006). It aims to strengthen the foundation of STEAM by sharing AR-based educational content and establishing a school system (Ministry of Education, 2021). AR is a technique that synthesizes virtual information or objects visible on the screen in the real world to make them look like objects existing in the original environment. It is predicted that practical learning will be possible by utilizing these high characteristics of reality.

Recently, culture-bound language education has been emphasized in language education. Language is an important means of living in an inseparable relationship with culture and is closely related to culture in terms of communication (Kramsch, 1998). Literacy, which forms and communicates meaning through language, is becoming more important in that it can only be understood in a shared cultural context. Literacy education in EFL (English as a foreign language) situations is also interested in language education and culture because language can be accurately understood and communicated when given the cultural context in which language is formed (Williams, 2008). Cultural differences can change the meaning of language, such as differences in language interpretation and word choice, so it is necessary to provide cultural knowledge about the 'target culture' (Meadows, 2016).

Vocabulary knowledge is an essential element in learning a foreign language. Research on how to maximize efficiency in order to expand the learners' vocabulary knowledge has continued over the years. Vocabulary learning research is divided into intentional and accidental learning research. Intentional vocabulary learning is learning with a focused interest in the target vocabulary, and accidental vocabulary learning is learning that is centered on contextual meaning without the intention to learn a specific vocabulary (Hulstijn, 2003). Although studies on the comparison of two lexical learning methods have reported that the benefits of intentional lexical learning are clearer (Laufer, 2003), the vast amount of vocabulary that learners know

Effects of Context-based Augmented-Reality Vocabulary Learning Materials on Learning Achievement and Motivation cannot be explained only by intentional learning. Therefore, there is a need for the research that learners naturally and unconsciously acquire vocabulary in the context.

In order to increase the effectiveness of language learning, it is necessary to use AR as an educational medium and learning material to guide specific learning designs. Although many studies show that media use is effective in language learning, it is necessary to measure the effect of improving vocabulary and concentration on learning when the learning materials containing cultural context information are presented using the characteristics of augmented reality.

This study is to verify the effect of augmented reality-based learning materials, including cultural knowledge, on vocabulary learning achievement and attention concentration of high school students. The effect of augmented reality learning materials on learners' learning achievement and attention concentration is analyzed, and based on this, implications for learners' effective design of English learning class materials are presented. The research questions set for the purpose of this study are as follows.

[Research Question 1] If cultural knowledge is included in augmented reality learning data, learners' vocabulary learning achievement will increase. As cultural background knowledge is presented together, accidental language learning occurs in the context, so it will have a positive effect on vocabulary learning achievement.

[Research Question 2] If cultural knowledge is included in augmented reality learning materials, learners' attention concentration will increase. It will have a positive effect on learners' class concentration due to the characteristics of high realism and immersion in augmented reality.

The purpose of this study is to examine the effect of vocabulary achievement and motivation of high school students when materials based on context-based English instruction using AR are provided.

The field of education using AR

With the 4th Industrial Revolution, the edu-tech field, a convergence of technology and education, is expanding; AI, virtual reality, and augmented reality (AR) are examples of these. Technology development is steadily being carried out to maximize the effectiveness of education. Unlike augmented reality, virtual reality is a technique that allows users to feel and immerse themselves in reality by implementing the real world and the simulated world on a monitor in three dimensions. Although the two technologies may feel similar, augmented reality is more realistic (Ministry of Education, 2021). AR technology can enrich the 'production' stage by providing a more contextualized environment and it aims to enable learners to express and understand well in situations other than classrooms (Kim, 2018).

Jang S. (2007) presents five educational advantages of classes using augmented reality. The first is that it

connects the real world and the virtual world to provide smooth interaction, and the second is that it improves the sense of existence. The third is that cooperative learning provides spatial information to participants, the fourth is that it supports a real-life interface using metaphorical expressions, and finally, it enables a smooth transition between the virtual world and the real world.

There are various cases in which augmented reality using these characteristics is applied. In order to increase the learning efficiency of Korean language education, learning content was produced by applying fairy tales to augmented reality (Park, & Jeon, 2013). A system for visually impaired learners is being developed, such as trying to improve learning methods using media devices by adding visual effects that incorporate web-based augmented reality for low-vision learners (Won, & Yoo, 2020). AR technology was used in the field of language therapy, confirming the results with high learning and therapeutic effects (Kim, & Kwon, 2016).

AR-based learning showed an effect in the affective domain. In science classes for fifth graders in elementary school, it can be seen that the augmented reality-based learning program had a significant learning effect in the areas of sensory immersion, manipulation, and realism (Kye & Kim, 2008). In addition, the educational mobile augmented reality game program for high school students showed high satisfaction by recommending vocabulary tailored to the needs of learners. There is a perception among college students that augmented reality-based educational content is useful to improve learning outcomes or efficiency and also their understanding of learning (Jo, & Kim, 2022). Although meaningful results were not obtained in the area of interest and immersion when learning English vocabulary using augmented reality apps for elementary school students, it suggested that it could help increase confidence (Lee, & Kim, 2021).

Augmented reality-based learning has also confirmed its effectiveness in the cognitive domain. It can be seen that vocabulary learning activities using augmented reality apps for elementary school students have significantly improved phonemic awareness (Lee, & Kim, 2021). In nursing education, in comparison with lecture-style learning, it was confirmed that the case of applying augmented reality increased statistically significantly in academic achievement (Kim, 2022). Learning commitment has a direct effect on learning effects in terms of knowledge and understanding, confirming a high level of predictive power (Kye, & Kim, 2008). As such, it can be seen that effective areas such as immersion have a major influence on cognitive areas.

Use of cultural knowledge in language learning

A language implies the culture of the society, so there is a justification for cultural learning reflected in language when learning a foreign language. Culture implied in a language is a broad concept, such as information and discourse, about the context of language through cultural information and language expression, and language-using culture is an educational aspect that requires appropriate language to be used according to the situation (Kim, 2018). In particular, foreign language learning is cultural learning, so it is necessary to properly understand cultural adaptation, cultural shock, and social distance (Brown, 1980; Choi, 1993). The experiential learning theory believes that learning occurs through the process of constructing and adapting knowledge through experience (Kolb, 1984), so learning through specific experiences of the culture different from existing classroom instruction increases. Based on this point, in order to systematize education using cultural knowledge, it is necessary to design a curriculum for valid cultural knowledge and hierarchize the cultural knowledge content in consideration of the learner's language level. Vocabulary acquisition occurs to an important extent in context as learners strengthen their knowledge of words during meaning-focused activities such as reading (e.g., Batterink & Neville, 2011; Elgort et al., 2018). Language learners who recently encoded new foreign vocabulary words benefitted from additional exposure to the words during story reading (Van, 2022). Lee. J. & Kim. Y. (2005) proved the effect of interacting the meaning of vocabulary more directly in various situations and contexts. It is clear that it differs from the learning process of simple vocabulary memorization in that knowledge of vocabulary is not separated from the world but recognized as a result of linguization of practical objects or concepts (Jung, 2014)

Method

1. Participants

The study participants of this experiment were from two classes in the first grade of a private high school in a metropolitan city. The high school is located in an area with a large socioeconomic variation, and the average number of students per class is 29.2. The two classes to participate in the study will randomly be selected out of 10 first-year classes. Before the experimental treatment, based on the results of the first semester's English test, two classes with similar average scores will be selected.

In order to minimize the differences by class, experiments will be conducted by dividing treatment groups within the same class. Random sampling will be conducted so that the number of treatment groups within each class is the same.

2. Independent Variables

The experimental group is provided with learning materials including cultural knowledge information intended to provide narration explaining graphic information including information about soccer positions and related information such as game rules and terms [Figure 1]. Also, as shown in [Figure 2], data analyzing the popularity and cause of American football in the United States are provided with narration. The AR learning material to be used for information research in American football will generate a marker containing augmented information next to the content of the text.

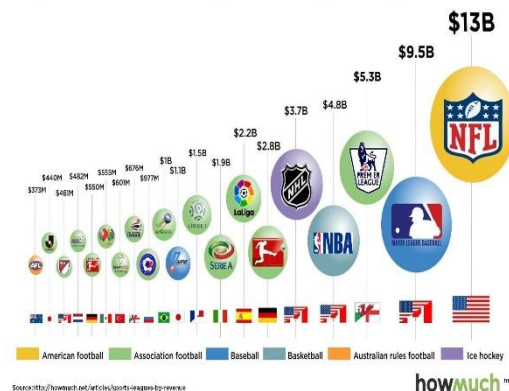
The control group is provided with graphic information on a page only with words needed to know the main vocabulary with the pronunciation recording such as independent variables. Next to the reading content is augmented reality, such as learning enhancement that will produce a marker of information.

Figure 1. AR learning material



Figure 2. AR learning material

Top Professional Sports Leagues by Revenue



3. Dependent Variables

Learning achievement: In order to measure vocabulary learning achievement, a post-test will be conducted. The same level of questionnaires will be used for post-mortem examinations. It consists of a total of 30 vocabularies, and the vocabulary selection criteria consist of a list of correct vocabularies at the learner level and intermediate level. The vocabulary test consists of 20 questions of the type to write the meaning of a given English word in Korean, 5 questions of the type to write the meaning of a Korean word in English, and 5 questions of the type to fill in the blanks in the sentence. The vocabulary post-test is all composed of the same problem type.

Motivation: When summarizing the results of previous studies, it is considered that it is difficult to draw a clear conclusion on the learner's motivation for second language acquisition. The purpose of this study is to understand the relationship between whether the learner focuses on the input, whether language acquisition occurs only with attention concentration, and whether attention concentration leads to the conscious process. It is intended to measure whether the augmented reality learning materials affect motivation in learning.

4. Experimental DATA

The contents used in this study are to learn the first unit body of the English subject in the first year of high school, The Final Touchdown. The main character Ethan has physical discomfort, but he gives positive energy to many people by doing his best as a football player. It will be used as experimental data that requires background knowledge of the content of rules and terms about American football. The learning contents for each class related to reading activities are shown in <Table 1>.

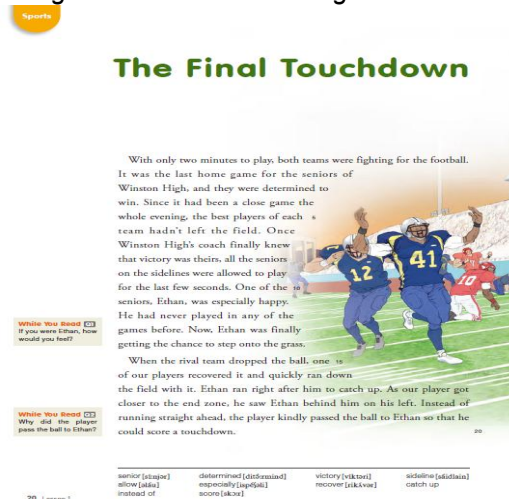
Table 1. Lesson Plan

Contents	Period	Teaching and Learning Activities
Before You Read	1/4	to preview the topic of the passage to figure out the meanings of some words and phrases
Read	2-3 / 4	to understand the main text to check students' understanding of checkup questions to learn new words, phrases, and language structures

After You Read	4/4	to understand the newspaper article and answer the questions to answer the school newspaper's interview questions to talk about what the quotes by famous sports people mean
----------------	-----	--

The augmented reality learning material to be used in this study will produce a marker containing augmented information next to the text. The main vocabulary to know on the page is graphic information, which provides recorded pronunciation together. We would like to develop two types of learning materials that provide narration which explains the related information such as graphic enhancement information and graphic information containing information about football positions and game rules and terms. When the marker is recognized using the ASUS Chromebook, the information can be displayed on the screen according to each marker.

Figure 3. Textbook reading material



5. Data Collection

The content of the reading activity to be used in this study is to learn Unit 1 of the English subject in the first grade of high school, The Final Touchdown. Ethan, the main character, has physical defects but gives positive energy to surrounding people by making his best efforts as an American football player. It will be used as experimental data that requires background knowledge of the content of rules and terms for American football. Half of the students in one class will be randomly assigned. Information related to the experiment is briefly provided to students before class, and the experiment is conducted during regular

Effects of Context-based Augmented-Reality Vocabulary Learning Materials on Learning Achievement and Motivation English classes. The experiment is conducted directly by the instructor. The class time is 50 minutes, and the media use time does not exceed over 15 minutes.

1) Learning achievement

The post-test will be conducted twice, the first session and the last session will include reading activities. The experimental participants will not be provided with prior information on the vocabulary test. It will be conducted within 15 minutes, including a brief explanation time.

2) Motivation

The ARCS model's structural material motivation survey is applied to the questions about attention concentration. The contents of attention concentration among the subcategories constituting the ARCS model are applied. In this study, a total of seven questions are used in the survey. Like other questions, it consists of a 7-point scale, from 7 to 1, which starts with 'strongly agree' at 7 and 'strongly disagree' at 1. Representative questions include the augmented reality learning environment that is interesting or the AR learning medium that is well-focused.

6. Data analysis

SPSS 25.0 program will be used. In order to interpret the results of the contrast analysis, it is determined whether to assume equal variance according to the results of the variance homogeneity test. I would use the Analysis of Variance as a statistical test.

References

- Banathy, B. H. (1991). Systems design of education. NJ: Educational Technology Publications.
- Batterink, L., & Neville, H. (2011). Implicit and explicit mechanisms of word learning in a narrative context: An event-related potential study. *Journal of Cognitive Neuroscience*, 23(11), 3181–3196. https://doi.org/10.1162/jocn_a_00013
- Convergence Education that Changes the Paradigm of Learning. The Ministry of Education, A Happy Education. (n.d). Retrieved July 20, 2022, from https://happyedu.moe.go.kr/happy/bbs/selectHappyArticleImg.do?bbsId=BBSMSTR_000000000191&entId=9973
- Hong, H. (2022). Factors Affecting a Sense of Reality of Virtual Objects in Augmented Reality Contents. (Master's Degree, Seoul National University of Science and Technology). Retrieved from <http://lib.jnu.ac.kr/>

- Hulstijn, J. H. (2003). Incidental and intentional learning. In C. J. Doughty & M. H. Long (Eds.), *The handbook of second language acquisition* (pp. 349-381). Oxford, UK: Blackwell.
- Jung, H. (2014). Lexical Education Using the Context of Formational Dimension. *Humanities Journal*, 39, 137-168.
- Kim, B., & Yoon, T. (2021). A study on elementary ell's' perceptions on AR-based English learning. *The Journal of Humanities and Social Sciences* 21, 12(3), 1049–1062. <https://doi.org/10.22143/hss21.12.3.74>
- Kim, K. (2020). A Critical Review of Culture-Based Language Education and Language Learning Research (Master's Degree, Korea University). Retrieved from <http://lib.jnu.ac.kr/>
- Kim, M. (2022). The Effect of Input Frequency and Working Memory on the Learning of Accidental Vocabulary through Reading of High School English Learners (Master's Degree, Korean National University of Education). Retrieved from <http://lib.jnu.ac.kr/>
- Kim, S. (2022). Effects of AR on academic success, problem solving and self directed learning skill in education on high risk delivery nursing. *The Journal of Humanities and Social Sciences* 21, 13(2), 1849–1864. <https://doi.org/10.22143/hss21.13.2.130>
- Kim, S.-J. (2018). A suggestion of direction of language education using augmented reality. *Teaching Korean as a Foreign Language*, 48, 1–28. <https://doi.org/10.21716/tkfl.48.1>
- Kim, Y.-G., & Kwon, S.-B. (2017). Trends analysis of Augmented Reality Technology applied in special education. *Journal of Special Education & Rehabilitation Science*, 56(2), 127–146. <https://doi.org/10.23944/jsers.2017.06.56.2.6>
- Krashen, S. (1985). *The input hypothesis: Issues and implications*. Longman.
- Kye, B., & Kim, Y. (2008). "investigation on the relationships among media characteristics, presence, flow, and learning effects in Augmented Reality Based Learning". *Journal of Educational Technology*, 24(4), 193–223. <https://doi.org/10.17232/kset.24.4.193>
- Laufer, B. (2003). Vocabulary acquisition in a second language: Do learners really acquire most vocabulary by reading? Some empirical evidence. *Canadian Modern Language Review*, 59(4), 567-587.
- Lee, M. (2022). Effects of textually enhanced captions and working memory on L2 learners' attentional processes and collocational knowledge development: An eye-tracking study. *Korean Journal of Applied Linguistics*, 38(1), 31–58. <https://doi.org/10.17154/kjal.2022.3.38.1.31>
- Lee, J., & Kim, Y. (2005). The Effects of Explicit Vocabulary Instruction through Picture Book Reading on Young Children's Acquisition of Words. *The Journal of Korea Open Association for Early Childhood Education*. 10(4), 197-316.
- Nermin, Gonca, & Meltem. (2022). Augmented Reality(AR) in Language Learning: A Principled Review of 2017-2021. *Participatory Educational Research*. 9(4), 131-152.
- Van den Broek, G. S., Wesseling, E., Huijssen, L., Lettink, M., & van Gog, T. (2022). Vocabulary learning during reading: Benefits of contextual inferences versus retrieval opportunities. *Cognitive Science*, 46(4). <https://doi.org/10.1111/cogs.13135>
- Williams, J. N. (2011). Working memory and SLA. In S. M. Gass & A. Mackey (Eds.), *The handbook of second language acquisition* (pp. 427–441). Routledge.
- Won, H., & You, J. (2020). Web AR based Cultural Heritage Learning System for Visually Impaired Learners -Focused on royal painting-. *Korea Society of Computer Information*. 28(2), 405-407.