

Robotics & AI Ethics

Vol. 6 No. 3

<Index>

1. An Analysis of Korean EFL Learners' Experience on English Classes Using AI Chatbot.
/ **Daeun Han**
2. A Study on the Development of a Public LIFELONG EDUCATION Model for Each Stage of the Life Cycle of Residents of Metropolitan Areas in Korea: Based on the Gyeongnam Metropolitan Case.
/ **Heungkweun Yang, Euna Yang, Nakyoung Choi**
3. Impacts the SMARTPHONE Use on Adolescents' Subjective Happiness in Korea.
/ **Bongmin Lee**
4. A Study on the Trends of Patents Concerning the Hair Loss Prevention and Improvement Technologies Using AI.
/ **Youngbae Kim, Sunnye Lim**
5. Impact of "The Online League of Legends(LoL) GAME School" Program on the COVID-19 Education Crisis: Focusing on Korean Students' Affective Domain.
/ **Junghye Fran Choi, Seungho Bang**
6. The Effect of ARTIFICIAL INTELLIGENCE Literacy Education on University Students' Ethical Consciousness of Artificial Intelligence.
/ **Aeri Lee**
7. Multicultural Education of South Korea through the VIRTUAL REALITY.
/ **Seongran Ha, Gyunyeol Park**

Robotics & AI Ethics

Publisher: J-INSTITUTE
ISSN: 2435-3345

Website: j-institute.org
Editor: admin@j-institute.org

Corresponding author*
E-mail: han3761297@naver.com

DOI Address:
dx.doi.org/10.22471/ai.2021.6.3.01

© 2021 J-INSTITUTE

An Analysis of Korean EFL Learners' Experience on English Classes Using AI Chatbot

Daeun Han

Gwangju National University of Education, Gwangju, Republic of Korea

Abstract

Purpose: The purpose of this study is to conduct English classes using AI chatbots, which are rapidly emerging as keywords for society as a whole, and to qualitatively analyze learners' learning experiences through learners' responses revealed in the process.

Method: For this purpose, an English class using AI chatbot was applied for one semester to 23 first-year students attending A middle school, and 4 of them were selected as research participants. For data collection, in-depth interviews were conducted with the 4 students who experienced English classes using AI chatbots to closely examine their thoughts and attitudes. Qualitative content analysis, a research method that reveals patterns and topics of content through the coding process, was adopted, and the transcribed data was uploaded to Target(taguette.com), an online free analysis tool, for analysis.

Results: As a result of the study, the students experienced increased English proficiency including speaking and listening skills, changed their motivation and attitude toward learning English, increased interest in learning English, decreased anxiety in learning foreign languages, difficulties with chatbot utterance speed and difficulty, and chatbot response limitations.

Conclusion: Through the results of this study, it was possible to an in-depth examination of the changed learning experiences of students and the expansion of learning methods suitable for the era of the 4th industrial revolution in the future. Therefore, in the EFL environment such as Korea, AI chatbots are highly likely to be used as an effective tool in terms of English learning and learners' affective domain, which is expected to maximize the effectiveness of English education.

[Keywords] Fourth Industrial Revolution, Artificial Intelligence(AI), AI Chatbot, English Education, Korean EFL Learners

1. Introduction

In a situation where the 4th industrial revolution is emerging as a keyword for society as a whole, and access to diverse and vast knowledge is growing more than ever, there is an increasing demand for a change in the traditional paradigm of school education, which focuses on teacher-centered knowledge transfer[1][2]. The case of English education is no exception, and the recent rapid development of artificial intelligence(AI)-based advanced technology or the launch of similar applications in Korea is causing a great impact on the English education community[3]. Therefore, it can be said that it is now inevitable to search for the future direction of English education.

Research based on linguistic big data called corpus has long been established as a research method[4], and research using various mobile contents and applications[5][6][7] are being performed. In addition, although the study of English education using robots is in its infancy, it has

been steadily continuing[8][9][10]. An AI robot, commonly known as a chatbot, is a program that can communicate like a human being, and research to use such a chatbot for teaching and learning is being conducted from various angles, but there is no qualitative research on it.

AI is a core technology for the 4th industrial revolution, and the interest in AI has grown even more significantly across various fields utilizing the information generated in a large quantity[11]. AI is also being pointed out as a basic technology that can make a big difference in school English classrooms. In particular, in the field of English education, AI is receiving a lot of attention in terms of expanding communication opportunities[12]. With the advent of AI-based technology, the uselessness of English education is sometimes mentioned, but there is also an argument that the effective use of AI can be efficiently used to arouse interest, motivate learners, and acquire language[13]. In addition, this AI technology has been studied as a potential learning tool that can expand opportunities to communicate in foreign languages by enabling machines to understand human speech and respond appropriately, acting as a human-like communicator[14].

For example, an AI chatbot 'Echo' equipped with an AI assistant Alexa can directly interact with English learners and provide authentic language input to learners. It is argued that this chatbot can be a useful and innovative educational medium for language learning and acquisition because learners must speak in English to interact with Alexa, listen and understand Alexa's responses to perform tasks. In addition, although AI chatbots such as Amazon Echo or Google Home are not exclusively for English education, they can command and perform in English, so cases and studies using them as English learning aids are increasing[12][15].

Therefore, this study intends to analyze the various experiences students have in English classes using the AI chatbots by applying voice-based AI chatbot 'Echo dot' to the school education field in the era of the 4th industrial revolution. In particular, the researcher tried to analyze the students' experiences by focusing on the aspect of language learning ability and affective factors. Since the subject of learning is the learner, it is judged that the effectiveness, efficiency, and attractiveness of the class can be guaranteed only when the learning experience the students are having in the class is understood. In addition, if the students have experienced negative learning experiences, it is necessary to explore for improvement. Therefore, the results of this study will contribute to providing basic data for effective learning for students using AI chatbots in English classrooms.

2. Method

2.1. Participant

It is predicted that English education using AI chatbots, which are combining AI technologies, will change the paradigm of education itself in the future as a future-oriented education. Therefore, a deep understanding of the phenomenon is urgently needed based on an in-depth exploration of common experiences through a qualitative approach to middle school students who are subjects of education[16]. Accordingly, an English class using AI chatbot was applied to 23 first-year middle school students enrolled in A middle school, and four of them were selected as research participants, and individual in-depth interviews were conducted.

As shown in <Table 1>, the participants of this study were 4 middle school students who were enrolled in A middle school and experienced English classes using AI chatbots for one semester. The researcher explained the necessity and purpose of this study to the students who will participate in the research and obtained consent for participation in this study. In this process, four participants who will sincerely participate in this study and show an active attitude were selected in consideration of the gender ratio.

Table 1. Participant.

Student	Gender	When to start learning English	The amount of English study per day	Study method	Experience using chatbots
A	Female	After age 10	30 minutes - 1 hour	English workbooks	No
B	Female	6-7 years old	1-2 hours	English academy	No
C	Male	After age 10	Less than 30 minutes	English workbooks	No
D	Male	After age 10	30 minutes - 1 hour	English academy	No

2.2. Data collection and analysis

This study was conducted to explore specific views based on a qualitative research method using in-depth interviews with middle school students who have experienced English classes using AI chatbots. In other words, Through a qualitative approach, we would like to explore the direction of efficient AI chatbot English education based on in-depth discussions on English education using AI chatbots by sharing common experiences[16][17]. Therefore, in-depth interviews were conducted to closely examine the individual thoughts and attitudes of the participants and to approach the phenomena and events they experienced in depth[18].

Interviews were conducted over the phone, non-face-to-face due to COVID-19, and were conducted every three weeks for about three months because the learning experiences experienced by the participants during the learning process could be affected by situational dynamics and task types. The interview was conducted in a semi-structured interview in which questions were added flexibly according to the responses of the study participants based on pre-prepared questions.

Based on a holistic understanding of the given data, the researcher adopted qualitative content analysis, a research method that reveals patterns and topics of content through a coding process, a systematic classification method, and uploaded the transcribed data to the online free analysis tool 'taguette.com' and analyzed.

The analysis process consisted of the following steps. First, the researcher read the transcription data and generated meaning-based code, which was interrelated. Open coding was continued based on the analytical induction method, and in this process, as the category creation version of the original coding was reinterpreted, the integration and separation between categories were made, rearranged and reorganized, and the final category could be derived.

In order to conduct peer review to secure reliability, it was reviewed by two Ph.D.s majoring in English education, who were well aware of the purpose and contents of this study and have extensive experience in conducting qualitative research. Through this, it was possible to secure the validity of this study and increase its reliability.

3. Results and Discussion

3.1. English proficiency

As a result of the interview, the students mentioned that they seem to be improving their English speaking skills, especially in the four areas of English. Also, through AI chatbot, students were able to have more opportunities to speak in English by alleviating the constraints of the daily English use environment and spatiotemporal learning constraints, and they thought that it was helpful to improve their English speaking ability through attempts to speak English consistently, even if lacking.

Being able to continue talking to native speakers regardless of time and place is a great help to improve my English speaking skills. I think the environment where there are many opportunities to speak in English is the most important, and Alexa(Chatbot) is like a native speaker who is always next to me. [Student D]

There was an opinion that the nature of the AI chatbot task helps not only the ability to speak English but also the ability to listen because it is done through mutual communication with the chatbot.

I think my listening and speaking skills have improved. Because I was able to practice listening and speaking continuously while doing chatbot activities. I usually had little time to practice speaking English, but I was able to practice speaking a lot while working on a chatbot. [Student A]

Unlike general artificial intelligence, it was fun it felt like talking to real people rather than being cut off. Of course, it was a little frustrating because there were many cases where the answer was not recognized properly, but I think it will be much more efficient than going abroad for studying English because it can improve not only English speaking skills but also English listening skills. [Student B]

As such, it is very important for EFL learners, who have great limitations in the daily English-speaking learning environment like Korea, to have sufficient opportunities to speak English in order to improve their English communication skills. In this study, by having students repeatedly perform AI chatbot-based speaking tasks, they were able to have more opportunities to speak English, and even if they were insufficient, they tried to speak English steadily. As can be seen from Swain's Output Hypothesis, which emphasized the importance of speech, and several studies that emphasized the importance of a large amount of speech in L2 learning [19], to improve communication skills, it will be necessary for learners to have the opportunity to express themselves in English above all else.

3.2. Attitudes and motivations

As a result of the interview with the students, it was found that during the study period, they gained a sense of achievement and confidence while doing activities on various topics in English class, and that they were willing to discover and supplement their shortcomings such as vocabulary and grammar while communicating with the chatbot.

I thought I needed to know the sentences and words clearly to ask a question. Since we only talk in English, I want to say it, but I am curious about how to say it in English, and I think I will find the expression myself and write it down and remember it. [Student C]

In addition, in an interview with the student, it can be seen that AI chatbot learning has a positive effect on learners' motivation, given that they were initially frustrated by their inexperience in speaking English, but were proud of themselves for their efforts and development in AI chatbot-based activities. Therefore, AI chatbot can be seen as a learning tool that induces an intrinsic motivation that can maintain learning in the long term, leading to successful foreign language learning.

At first, I was confused as to what and how to ask. As the number of repetitions increased, the feeling of frustration and fear gradually eased. It was hard to say even a single sentence, but it wasn't perfect, but I kept talking to Alexa(chatbot) over and over again. I looked up and asked questions about words I didn't know. Also, when making sentences, I applied grammar knowledge that I knew. And I was

curious about various ways of expression, so I looked it up and put it aside for future use. I am very proud of myself for speaking English, and I want to keep talking with Alexa(chatbot). [Student B]

Also, unlike traditional teacher-centered classes, the chatbot-using class induces active participation of students and increases the participation of introverted and passive learners[20][21].

Instead of focusing on grammar and reading classes, I became interested in English, which is needed for everyday conversation such as pronunciation and various expressions, and I could feel my concentration increased because it was much more interesting and fun than previous classes. [Student D]

As such, students were feeling the usefulness of using AI chatbots in English classes by showing positive attitude changes toward English learning after classes using AI chatbots. In addition, the fact that there is the attitude to find and solve the reason when speech recognition is not working well, the willingness to fulfill the minimum goals set by the individual, and no need to worry about mistakes have positively changed the attitude toward learning English.

3.3. Interest

Through the interview, it was found that experiencing the novel effect of AI technology that understands and responds to human speech through AI chatbot classes, and the technology of recognizing voices and texting them had a positive effect on learners' interest.

Conversation in English was interesting and fun. There seems to be a lot to gain from talking to Alexa(chatbot). I want to take a class with Alexa(chatbot) again next time. It was a shame that this was the last time. [Student B]

It was more fun than the usual class, and it was interesting to be able to check the sentences I said on the app, and it was good to refer to the next sentence as I said it. [Student C]

In the past, it was a little boring because it was a way to look at the text of the textbook and say things repeatedly with the ppt that the teacher prepared, but it was new because it was the first time seeing a chatbot. I wondered if the machine could understand me, so I doubted it at first, but it was interesting and fun to see that it actually understands people. [Student D]

However, there were cases in which students were not interested in activities using AI chatbots, which could be seen in interviews that sometimes caused students to lose interest in continuing to talk by not answering or responding properly to their questions.

When asked a question with a fixed answer, the chatbot responded relatively well, but it could not respond to a question asking for opinions or feelings. It was frustrating that Alexa(chatbot) sometimes misinterpreted my pronunciation and gave a wrong answer. [Student A]

3.4. Foreign language learning anxiety

Rather than face-to-face conversations, the students felt that the shame about speaking English or the embarrassment of being wrong had disappeared a lot. Also, it was found that when speaking, it was less burdensome to communicate with the chatbot than speaking alone in front of the teacher or in front of all students, and it was found that the conversation continued even if there was a mistake.

When I talked to foreigners in person, I was afraid of being burdened and wrong, and when foreigners didn't understand, I didn't have the courage to speak anymore. But Alexa(chatbot) didn't feel that pressure, so even if I didn't understand, I seemed to have kept talking to it. As I had many opportunities to practice speaking, I felt that my English speaking skills improved. [Student D]

Among the students who enjoyed interacting with the chatbot, it can be seen that students who are usually shy and have low English proficiency continued to try to communicate with the chatbot without being ashamed or embarrassed even if their pronunciation was strange or grammatically incorrect. This was also confirmed in interviews with students.

I think it was okay because I could do it again even if I make a mistake. When I was talking with my partner, there were cases where I was embarrassed and embarrassed because I was pointed out if I made a mistake, but it was good that I didn't do that this time. [Student B]

3.5. Chatbot's speech speed and difficulty

On the other hand, as a negative experience of English classes using AI chatbots, all students pointed out that chatbots speak faster. Some students also mentioned that the chatbot's answers were too long to understand and that when students asked a question, the chatbot did not recognize it well due to problems with pronunciation or intonation.

Alexa(Chatbot) spoke so quickly that it was hard to understand. In particular, if I miss the first part, I don't know what the story is at all, and I thought it was difficult to talk to Alexa(chatbot) alone. I heard the words I knew and understood them roughly, but I couldn't hear them all, so I thought it was because I lacked vocabulary or listening skills. It was a time when I experienced the limits of my English ability, and I wanted to say, 'Could you lower your level a little?' [Student C]

As such, it can be seen that the conversation speed of the chatbot is as fast as that of a native speaker, the sentence structure is complex, and the difficulty of vocabulary is high, so it can make beginner learners feel difficult to use.

3.6. Limitations of chatbot's answers

In addition, there were opinions that chatbots are not human, so there were many cases where they answered that they did not know when they had questions asking for feelings or opinions, and conversations about sensitive topics. And there was a response that they could not answer when asked about certain things in Korea, such as Korean movies or Koreans, because the chatbot manufacturer is in the U.S. For example, the chatbot used in this study showed limitations in that it should be able to recognize the title of Korean films, not just foreign films, but also respond appropriately and ask questions later.

4. Conclusion

As we enter the era of the 4th industrial revolution, interest in AI technology is growing. The development of AI technology has a great impact not only on science, society and economy [22], but also on people's lives in general, and several attempts are being made to promote more effective learning by using AI in the field of education [12]. As the AI system is widely used in various fields, the demand to apply and utilize it in English learning is increasing. Therefore, this study conducted English classes for middle school students by using AI chatbots, and looked into the learning experiences of learners in detail through in-depth interviews. The results of the study are summarized as follows.

First, in terms of English proficiency, there were many opinions that the class where AI chatbots were used was useful not only for speaking English but also for listening to English, and there were many opportunities to encounter native speaker pronunciation. According to the Output Hypothesis, even if the learner's ability to communicate in the target language is insufficient, the target language can be automated by the attempt to express, thereby promoting language learning. It can be seen that the AI chatbot is working as an excellent English speaking learning tool for students in the EFL environment who don't have many chances to communicate in English.

Next, the students felt that there was a positive change in their attitude and motivation for learning English. Since the class was conducted from a teacher-centered class to a student-centered class, the students showed attitudes to participate in their own learning, and through repeated conversations with the chatbot, they saw their progress and motivation to learn English in the future. However, some students felt discouraged or frustrated during the initial conversation with the chatbot. This may be due to the students' lack of proficiency in English, but it is also presumed that the chatbot is still technically limited in conversing with humans as an AI program. Therefore, in order to use the chatbot for English learning, it is necessary to consider a method that can be used effectively while maintaining the learners' motivation.

The traditional monotonous and boring classes, grammar and interpretation-oriented classes make them lose the fun and reduce learners' interest in learning English. It can be assumed that the decrease in interest is due to the teaching method rather than the ability of the instructor. This study applied AI, a cutting-edge technology, to the existing English class, and it was found that the students had a high interest in learning English through the use of an AI chatbot. However, on the other hand, there was also an opinion that motivation and interest were lowered in the case of an uninteresting topic or a difficult activity. Therefore, it is important for the teacher to select a topic and produce activity sheets that match the interest and level of the learners because the level of interest in learning may be lowered depending on the topic or difficulty of the activity. In addition, innovative teaching methods such as using chatbots for English learning so that teachers can keep learners interested, and encouraging learners to voluntarily pursue self-directed learning are factors that arouse learners' interest in learning English.

Lastly, through a learning environment in which students can speak English comfortably without being aware of their surroundings, the anxiety that can be felt in face-to-face speaking situations is greatly reduced and learning attitudes were found to have positive changes, regardless of their mistakes or shyness about insufficient English skills or tendency to be introverted.

However, on the other hand, students complained about the conversation speed, difficulty and the limitations of answers of the chatbots. First, it was found that Korean students, who are EFL learners, felt a lot of difficulties because the chatbot's speaking speed was fast, similar to that of a native speaker, and the sentence structure was complex and the difficulty of vocabulary was high. Therefore, it is judged that it is not suitable for students with very low English proficiency.

Next, in terms of the limitations of the answers, all students pointed out the limitations of conversations with computers rather than humans. In other words, because the opponent is a robot, there were many cases where they could not answer questions asking emotion or thought, and when a student used a grammatically wrong sentence, the chatbots answered they did not understand in many cases. In addition, some students answered that it would be desirable for the chatbot to generate more diverse sentences. They found that it was boring to automatically list some sentences regardless of the students' individual answers to the questions, as well as the chatbot asking some questions almost every time. Since the chatbot's current level of conversation is not yet up to the human level, the natural conversation was rather difficult, which had negatively affected the effect of learning English speaking.

Nevertheless, AI chatbot-based English class had a positive effect on the students' affective domain such as learning attitudes, motivation, interest, and anxiety. It was also meaningful in

that it gave students plenty of opportunities to speak English without restrictions on time and place. As such, AI technology that emerged along with changes in society is closely related to the field of English education, and in recent years, various movements of change are appearing in English education. First, it is expected that AI technology will be able to provide a variety of English-speaking experiences to learners who have little exposure to English and less opportunity to use it. Being able to systematically provide an English learning process optimized for individual learners can be a good alternative to overcome many physical limitations in foreign language learning. In addition, in EFL environments such as Korea, AI chatbots are highly likely to be used as effective tools for learning and using English, which is expected to maximize the effectiveness of English education. Therefore, to prepare for changes in English education methods in a rapidly changing society, a study on the educational use of AI chatbots is required as in this study, and continuous research is needed to properly apply the chatbot to education.

5. References

5.1. Journal articles

- [1] Kang YD. A Design on Teaching and Learning Method for Creative Talent in the Fourth Industrial Revolution. *International Journal of Human & Disaster*, 5(1), 1-9 (2020). [\[Article\]](#)
- [2] Kang YD. English Teaching Method Using Flipped Learning in the Artificial Intelligence Era. *Robotics & AI Ethics*, 4(2), 14-21 (2019). [\[Article\]](#)
- [3] Han DE. The Preliminary Elementary School Teachers' Perception and Attitudes on the Future English Education Using AI Technology: Focusing on the Students Majoring in English Education. *Robotics & AI Ethics*, 6(1), 7-17 (2021). [\[Article\]](#)
- [4] Ma JH & Goo JM. Research Trends Reflected in Articles Published in Studies in English Education from 1996 to 2016. *Studies in English Education*, 21(4), 207-225 (2016).
- [5] Kim HJ & Hur K. A Teaching and Learning Design for E-learning English Conversation Subject Using SNSs. *Language Research*, 49(3), 489-525 (2013).
- [6] Kim HY & Park DG. Mobile Application Design and Evaluation for English Speaking Practice: Design-based Research. *Multimedia-assisted Language Learning*, 19(1), 58-85 (2016).
- [8] Lee SM & Han JH. Development of the Contents of a Robot for Elementary English Education and its Application. *Journal of the Korea English Education Society*, 8(2), 97-119 (2009).
- [9] Ban JC & Jin KA. Effectiveness of Using Autonomous Intelligent Robots for English Teachers on Students' Achievement and Affective Traits: A Case Study in an Elementary School. *The Journal of Curriculum and Evaluation*, 13(2), 389-410 (2010).
- [10] Alemi M & Meghdari A & Ghazisaedy M. The Impact of Social Robotics on L2 Learners' Anxiety and Attitude in English Vocabulary Acquisition. *International Journal of Social Robotics*, 7(4), 523-535 (2015).
- [11] Lee AR. Analyzing the Effects of AI Education Program based on AI Tools. *Robotics & AI Ethics*, 6(2), 21-29 (2021). [\[Article\]](#)
- [12] Hyun JE & Um HJ. Analysis and Implications of AI Speakers as English Learning Tools. *The Mirae Journal of English Language and Literature*, 24(1), 201-219 (2019).
- [13] Kim NY. Effects of Different Types of Chatbots on EFL Learners' Speaking Competence and Learner Perception. *Cross-cultural Studies*, 48, 223-252 (2017).
- [14] Kim HY & Shin DK & Yang HJ & Lee JH. A Study of AI Chatbot as an Assistant Tool for School English Curriculum. *Journal of Learner-centered Curriculum and Instruction*, 19(1), 89-110 (2019).
- [15] Shin DK. Exploring the Feasibility of AI Chatbots as a Tool for Improving Learners' Writing Competence of English. *Korean Journal of Teacher Education*, 35(1), 41-55 (2019).
- [17] Kim HY & Jeong WY. A Qualitative Study on the Distance Education Class Experiences of Early Childhood Preservice Teachers due to Covid-19. *Journal of Learner-centered Curriculum and Instruction*, 21(2), 485-508 (2021).

- [19] Gu S & Reynolds ED. Imagining Extensive Speaking for Korean EFL. *Modern English Education*, 14(4), 81-108 (2013).
- [20] Beauvois MH. Computer-assisted Classroom Discussion in the Foreign Language Classroom: Conversation in Slow Motion. *Foreign Language Annals*, 25(5), 455-463 (1992).
- [21] Warschauer M. Comparing Face to Face and Electronic Discussion in the Second Language Classroom. *The Computer Assisted Language Instruction Consortium*, 13(7), 7-26 (1996).
- [22] Baek MJ. The Study on the Criminal Subject and Liability of AI Robots. *International Journal of Justice & Law*, 2(2), 15-21 (2017). [\[Article\]](#)

5.2. Books

- [7] Chapelle CA. Computer Applications in Second Language Acquisition. Cambridge University (2001).
- [16] Creswell J & Poth C. Qualitative Inquiry and Research Design: Choosing among Five Approaches. Sage (2016).
- [18] Denzin NK & Lincoln YS. The Sage Handbook of Qualitative Research. Sage (1994).

6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Author	DH	-Set of concepts <input checked="" type="checkbox"/>
		-Design <input checked="" type="checkbox"/>
		-Getting results <input checked="" type="checkbox"/>
		-Analysis <input checked="" type="checkbox"/>
		-Make a significant contribution to collection <input checked="" type="checkbox"/>
		-Final approval of the paper <input checked="" type="checkbox"/>
		-Corresponding <input checked="" type="checkbox"/>
		-Play a decisive role in modification <input checked="" type="checkbox"/>
		-Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/>
		-Participants in Drafting and Revising Papers <input checked="" type="checkbox"/>
		-Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

Robotics & AI Ethics

Publisher: J-INSTITUTE
ISSN: 2435-3345

Website: j-institute.org
Editor: admin@j-institute.org

Corresponding author*
E-mail: lggyea@kornu.ac.kr

DOI Address:
dx.doi.org/10.22471/ai.2021.6.3.10

© 2021 J-INSTITUTE

A Study on the Development of a Public LIFELONG EDUCATION Model for Each Stage of the Life Cycle of Residents of Metropolitan Areas in Korea: Based on the Gyeongnam Metropolitan Case

Heungkweun Yang¹

Daegu University, Gyeongsan, Republic of Korea

Euna Yang^{2*}

Korea Nazarene University, Cheonan, Republic of Korea

Nakyoun Choi³

Baksuk Culture University, Cheonan, Republic of Korea

Abstract

Purpose: This study developed an education model that satisfies the lifelong learning needs of residents of metropolitan areas in the midst of today's era of lifelong learning.

Method: A literature study, a survey of lifelong education officers, and a survey of residents of metropolitan cities were conducted. The literature study was on human development by life stage, lifelong education programs, and lifelong education models. The preliminary survey was conducted to ask the opinions of lifelong education managers and lifelong education experts on the implementation of lifelong education by life stage. The following questions were asked to them through workshops and interviews. For example, "What do you think should be prioritized when operating lifelong education by life cycle in the region?", "What kind of lifelong education program do you think is necessary for each stage of life?", "What do you think are the policies and projects for the development of lifelong education?" Specific needs and preferences were identified by asking about them. Based on the preliminary survey, a survey was conducted on the necessity of lifelong education by life cycle targeting 1,200 residents of metropolitan cities.

Results: It was found necessary to establish a lifelong education program that meets the developmental tasks and needs in each of five life stages and considers the characteristics of the learners' areas.

Conclusion: Residents of metropolitan areas should be provided lifelong education programs for each stage of the life cycle that reflect their needs in each stage as well as the characteristics of their area. Such lifelong education programs must be carried out with universal programs that are essential for each life stage.

[Keywords] Lifelong-Education, Lifelong-Learning, Life-Cycle, Lifelong-Education-Model, Public-Lifelong-Education

1. Introduction

1.1. Research purpose

This study developed a model for providing lifelong learning to metropolitan area residents according to their needs in each stage of the life cycle. Such lifelong learning will enable such residents to adapt to today's rapidly changing society in the era of lifelong learning, by enabling them to complete developmental tasks throughout their life and to hone their capacity to participate in society.

Traditional school-based education is implemented mainly by regional education offices and regional education support offices of the Ministry of Education. Such school-based education prepares individuals for the future and is centered on knowledge on different subjects.

However, the knowledge imparted in school-based education is not enough to enable human beings to develop fully throughout their lifespan. In the 2000s, heads of basic local government

units(LGUs), including metropolitan government units, started to provide education to their residents.

In metropolitan areas, the task of providing lifelong education is lodged with the Metropolitan Lifelong Education Promotion Agency, which is under the jurisdiction of the city history division. Lifelong education is provided in lifelong learning centers in cities, counties, and districts under the jurisdiction of the mayor.

This study developed and proposes a lifelong education model for each stage of the human life cycle for residents of metropolitan areas, through the Education Promotion Agency of each metropolitan area.

1.2. Previous studies

A person's development process shows characteristic developmental characteristics for each stage of the life cycle. While the life cycle refers to the entire period of human development, it is divided into shorter periods that show prominent characteristics for the applicable age group.

Developmental theorists divide the human life cycle in various ways because human development has various aspects of occurrence: physical, cognitive, emotional, and social. Erikson divides human development into eight stages; Haviguest, into six stages; Leveson, into seven stages; and Roebinger, in his Theory of the Four Seasons of Life, into eight periods.

In this study, the human life cycle was divided into six stages of development and three stages of transition. That is, the life cycle of development was divided into the fetal period, infancy, childhood and adolescence, early adulthood, middle adulthood, and late adulthood. The period of significant life transitions was divided into three transition periods: the period between childhood and adolescence, the period between adolescence and early adulthood, and the period between middle adulthood and late adulthood.

In each of the abovementioned six stages of development, tasks must be accomplished for personal self-development and social adaptation. Even in the three life transition phases, the developmental tasks needed for successful transition from the previous life stage to the next life stage must be achieved. However, it is difficult to achieve this lifelong task only with school education provided by schools. This is because, as described above school education is mainly for the development of the individual as a whole and for future careers. As such, school education has limit in meeting the needs of individuals at the present time and in the current life scene.

Therefore, the education needed by human beings to fulfill their developmental tasks in each stage of the life cycle should be publicly provided as lifelong education. However, up to now, lifelong education has not been able to systematically provide the education needed to achieve the individual needs and developmental tasks of members of society at both the national level and the government level. In other words, lifelong education at the national, regional, and local levels has not sufficiently provided education that satisfies individual needs.

On the lifelong education provided by the state, according to government policy, the object and contents of the education program are provided unequally. On the lifelong education provided by LGUs, more specific programs are provided depending on the interest of the head of the LGU, the characteristics of the region, and the preference of the person in charge of lifelong education. In other words, lifelong education programs are not systematically implemented to sufficiently meet the needs of members of society for each stage of the life cycle.

An analysis of statistical data on lifelong education from 2008 to 2010 by content area of lifelong education programs showed that civic participation education, educational background supplementary education, and literacy education decreased and credit banking system education is on the rise. In terms of program supply, the supply of lifelong education at the county level was smaller than at the city level[1].

The disproportionate supply of lifelong education programs to specific areas was shown in the analysis of cultural arts education programs[2]. Similar results were achieved in Yang's 2012 research and in Kim & Park's 2012 research[2][3].

According to a study that analyzed the supply status of lifelong education programs at the provincial level, focusing on cultural arts education programs, the arts and culture education programs of each

province in Korea increased significantly over the past 10 years. In Seoul, Gyeonggi, Busan, and Daegu, more than 58% of culture and arts education programs are implemented nationwide[4].

After arts and culture education programs, the most implemented programs were vocational education programs and certificate programs. Thus, the supply of lifelong education programs at the metropolitan and provincial levels in Korea is centered on cultural arts education, vocational competency education, and certification education. Regional differences in the implementation of the programs were also found[4].

At present, the need for lifelong education for all members of society by life cycle stage is increasing. This is due to various social problems caused by the rapid development of information and communications technology as well as of industrial technology in society, and by changes in demographic structures[5].

For example, middle-aged learners now have different lifestyles and learning patterns according to their individual demographic variables[6].

Also, due to rapid population aging, the elderly are experiencing various problems such as health problems, poverty, and vulnerability to crimes. To prevent these problems, lifelong education is necessary[7][8].

A case that shows the need for lifelong education for the elderly is that of an elderly person whose self-esteem dropped due to stress but was restored after physical activity[9]. As for the youth, the rapid expansion of online social network services is increasing their isolation, degradation of values, and juvenile crimes[10]. Close interaction between schools and parents is necessary for the healthy development of the youth, their adoption of appropriate values, and the prevention of crime[11]. Moreover, through lifelong educational physical activities such as taekwondo and hapkido for adolescents, their self-confidence is enhanced and their emotional stability and self-directed learning ability are developed[12].

On the other hand, lifelong education of parents and teachers of infants and young children is necessary for the physical, emotional, and social development and safety of infants[13]. These examples show that lifelong education should be provided to residents in each life cycle stage.

In the meantime, some study of lifelong learning models by life cycle has been conducted, but the related research itself is very lacking[14][15][16][17]. In addition, the studies so far have mainly focused on the analysis of one point in the life stage from a horizontal perspective, and almost no attempt has been made to approach it from an integrated perspective of life. To this end, the needs for lifelong learning that meet the developmental tasks of residents must be analyzed[18].

2. Lifelong Education Implementation Concept Model for Each Stage of the Life Cycle of Metropolitan Area Residents

2.1. Components of the lifelong education implementation model for each stage of the life cycle of metropolitan area residents

This chapter presents the conceptual components of the lifelong education implementation model for each stage of the life cycle of residents. The sub-components of the lifelong education implementation model by stage of the life cycle of the residents are shown in <Table 1>.

Table 1. Components of the lifelong education implementation conceptual model by stage of the resident life cycle.

Order	Component	Explanation
1	- Classification of the life cycle of the residents	- Step-by-step classification of the life cycle of the residents
2	- Development tasks by stage of the life cycle of the residents	- Development tasks by stage of the life cycle of the residents

3	- Lifelong education programs provided by stage of the life cycle of the residents	- Program provided for each stage of the life cycle of the residents
4	- Program implementing institutions by stage of the life cycle of the residents	- Program implementing organizations for each stage of the life cycle of the residents
5	- Educational implementation support organizations and institutions by stage of the life cycle of the residents	- Educational support institutions and organizations for each stage of the life cycle of the residents
6	- Educational implementation support organizations by stage of the life cycle of the residents and roles of the support organizations	- Roles of educational support institutions and organizations by stage of the life cycle of the residents

First, to provide lifelong education to the residents for each stage of their life cycle, their life cycle should be divided into stages according to distinct developmental characteristics.

Second, the developmental tasks that residents must fulfill in each stage of their life cycle must be analyzed.

Third, a list of lifelong education programs that must be provided to the residents in order to support their successful achievement of their development tasks for each stage in their life cycle must be provided.

Fourth, an institution must be set up that will implement the lifelong education programs that will be provided for each stage of the life cycle of the residents.

Fifth, an organization or institution must be designated that will support the implementation of lifelong education for each stage of the life cycle of the residents.

Sixth, the specific roles of the organizations and institutions that will support the provision of lifelong education by stage of the life cycle of the residents must be identified.

2.2. Components and contents of the lifelong education implementation model by stage of the life cycle of gyeongnam residents

In this section, the contents of each component of the lifelong education program implementation model for each stage of the life cycle of residents of the Gyeongnam metropolitan area are presented using the results of the expert opinion survey conducted among lifelong education managers working in 8 cities and 10 counties of the Gyeongnam metropolitan area.

Based on the results of the opinion survey of the public officials in charge of providing lifelong education, the contents of each component of the lifelong education implementation model for each stage of the life cycle of the Gyeongnam metropolitan area residents are presented in <Table 2>.

Table 2. Components and contents of the lifelong education implementation model by stage of the life cycle of the Gyeongnam residents.

Order	Component	Contents of each component
1	- Classification of the life cycle of the residents	- Six stages of the life cycle: prenatal period, infancy, childhood and adolescence, early adulthood, middle adulthood, and late adulthood - Three life transition stages: first transition period, second transition period, and third transition period
2	- Developmental tasks by stage of the life cycle of the residents	- Developmental tasks for each life cycle stage, such as fetus, infancy, childhood, adolescence, early adulthood, middle adulthood, and middle adulthood

3	- Lifelong education programs provided by life cycle stage	- Specific lifelong education programs that support the achievement of developmental tasks for each life cycle stage
4	- Program implementing institutions by life cycle stage	<ul style="list-style-type: none"> - Public health centers, childcare support centers, city and county offices, private facilities - Lifelong learning centers, social welfare centers, women's centers, multicultural family support centers, daycare centers, local children's centers, youth facilities - Libraries, education offices, schools, counseling centers, cultural facilities - Enterprises, commercial facilities, religious facilities, YWCA, YMCA
5	- Educational implementation support organizations and institutions by life cycle stage	<ul style="list-style-type: none"> - City halls, county halls, provincial offices - City lifelong education center, county lifelong education center - Gyeongnam lifelong education promotion institution
6	- Educational implementation support organizations by life cycle stage and roles of support organizations	<ul style="list-style-type: none"> - Lifelong education planning, program development, program dissemination - Instructor training lifelong education institution management consulting, lifelong education institution evaluation, selection of excellent lifelong education institutions - Lifelong education program consulting, lifelong education program evaluation

First, for the classification of the life cycle of the residents, their life cycle was divided into six periods and three transition periods, for a total of nine stages.

Second, in each of the nine life cycle stages, there are developmental tasks that must be accomplished.

Third, to achieve the developmental tasks in each stage of the life cycle of the residents, different types of programs must be provided in each life cycle stage.

Fourth, institutions that can provide lifelong education programs in each life cycle stage include various public institutions, private institutions, secondary school facilities, and religious facilities in each city and county.

Fifth, among the public lifelong education facilities that can support the implementation of lifelong education programs in each life cycle stage are the Gyeongnam metropolitan Lifelong Education Promotion Center, city and county lifelong learning centers, village lifelong education centers, and other facilities and institutions.

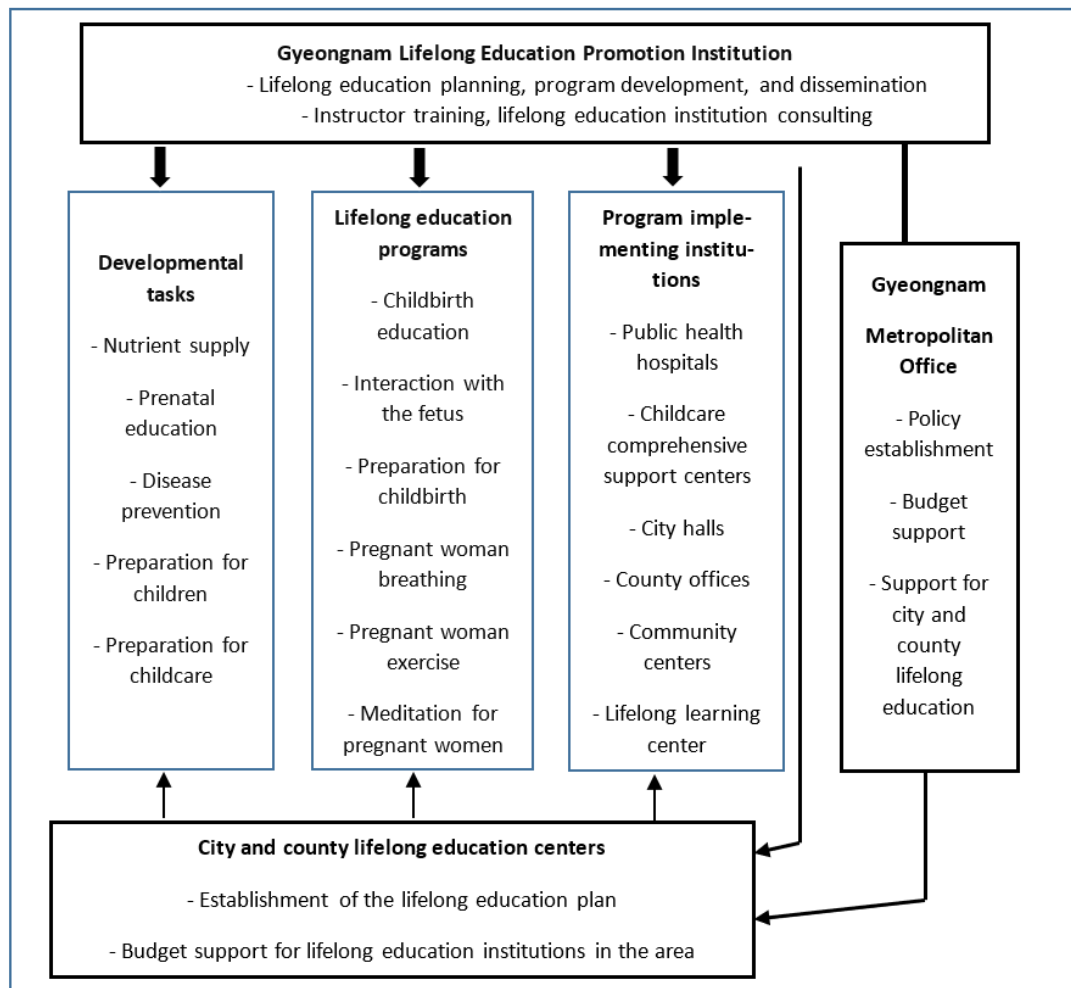
Sixth, as described above, institutions and organizations that support the implementation of lifelong education programs by life cycle stage must perform various roles such as lifelong education planning, lifelong education program development and dissemination, lifelong education institution consulting and evaluation, and lifelong education instructor training.

3. Lifelong Education Program Implementation Model by Life Cycle Stage in Gyeongnam

3.1. Prenatal lifelong education program implementation model

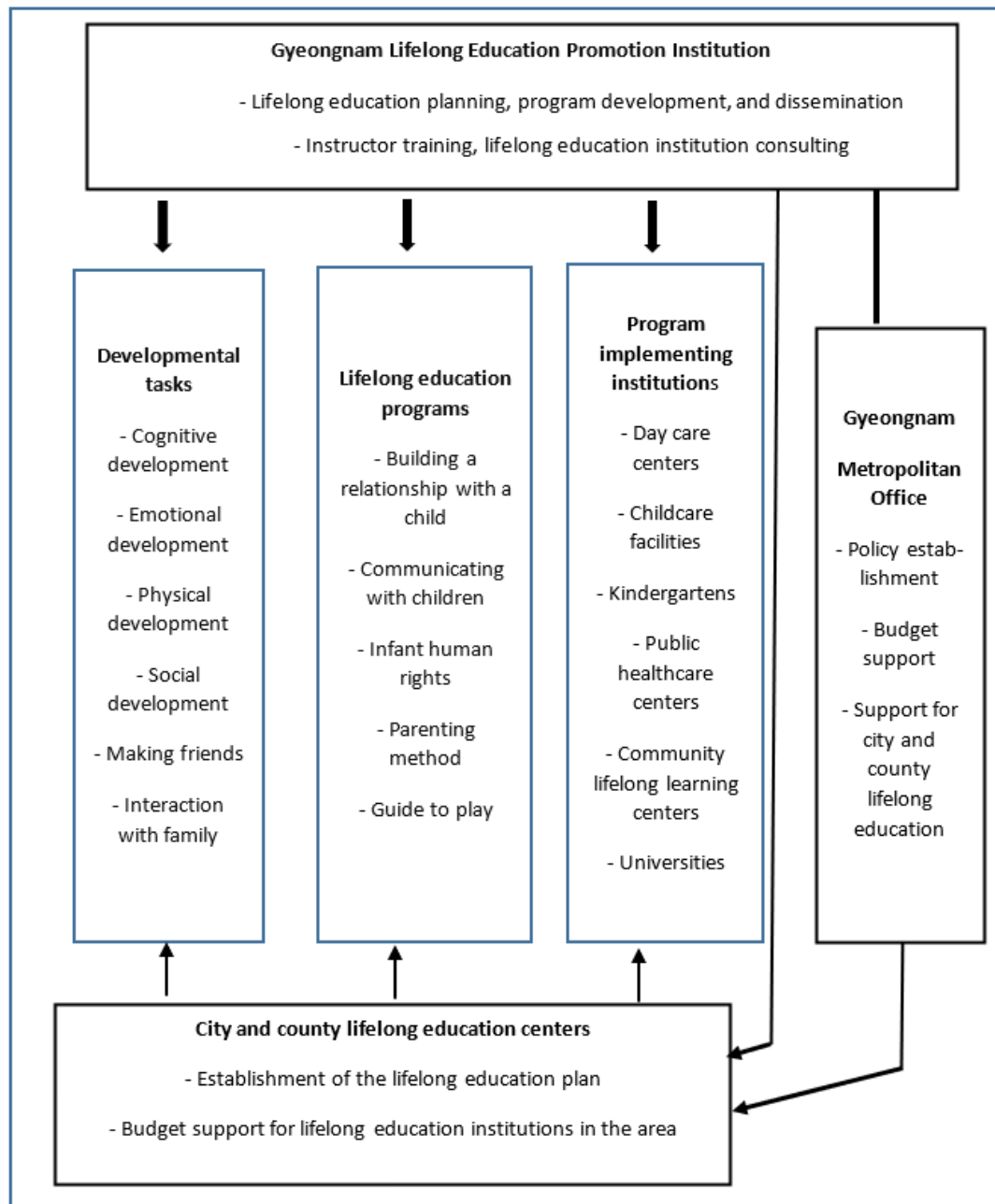
In this chapter, a model for the implementation of lifelong education programs in each of the six stages of the life cycle of Gyeongnam metropolitan residents is presented. <Figure 1> shows the prenatal lifelong education implementation model. It presents the developmental tasks in the prenatal period, lifelong education programs for pregnant mothers in the prenatal period, the program implementing institutions, and the roles of the Gyeongnam lifelong education provincial office and the city hall and county offices.

Figure 1. Prenatal lifelong education program implementation model.



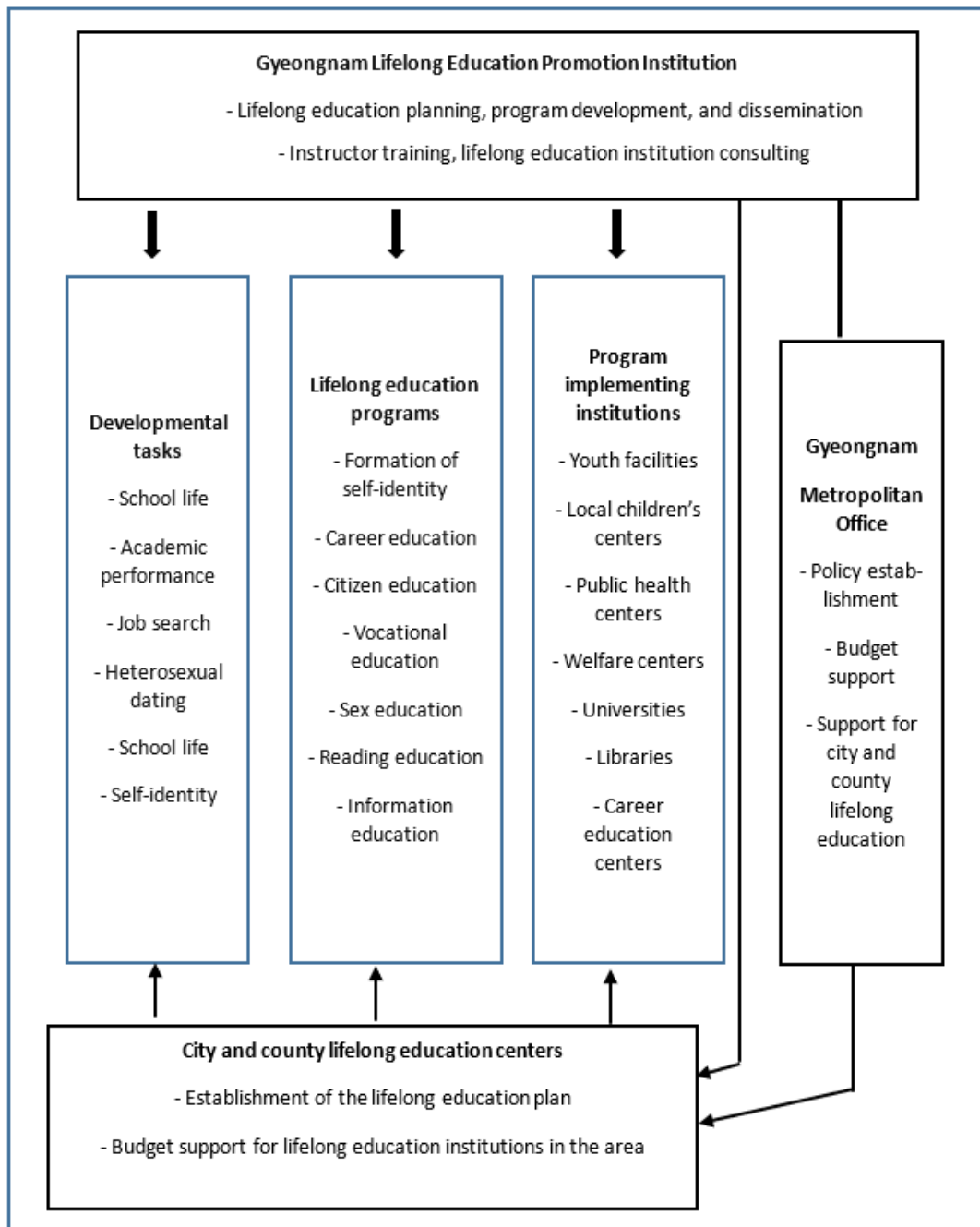
<Figure 2> shows a model for lifelong education in early childhood. It presents the developmental tasks in this stage, early childhood lifelong education programs for caregivers and parents, program implementing organizations, and the roles of the Gyeongnam lifelong education provincial office and the city hall and county offices.

Figure 2. Early childhood lifelong education program implementation model.



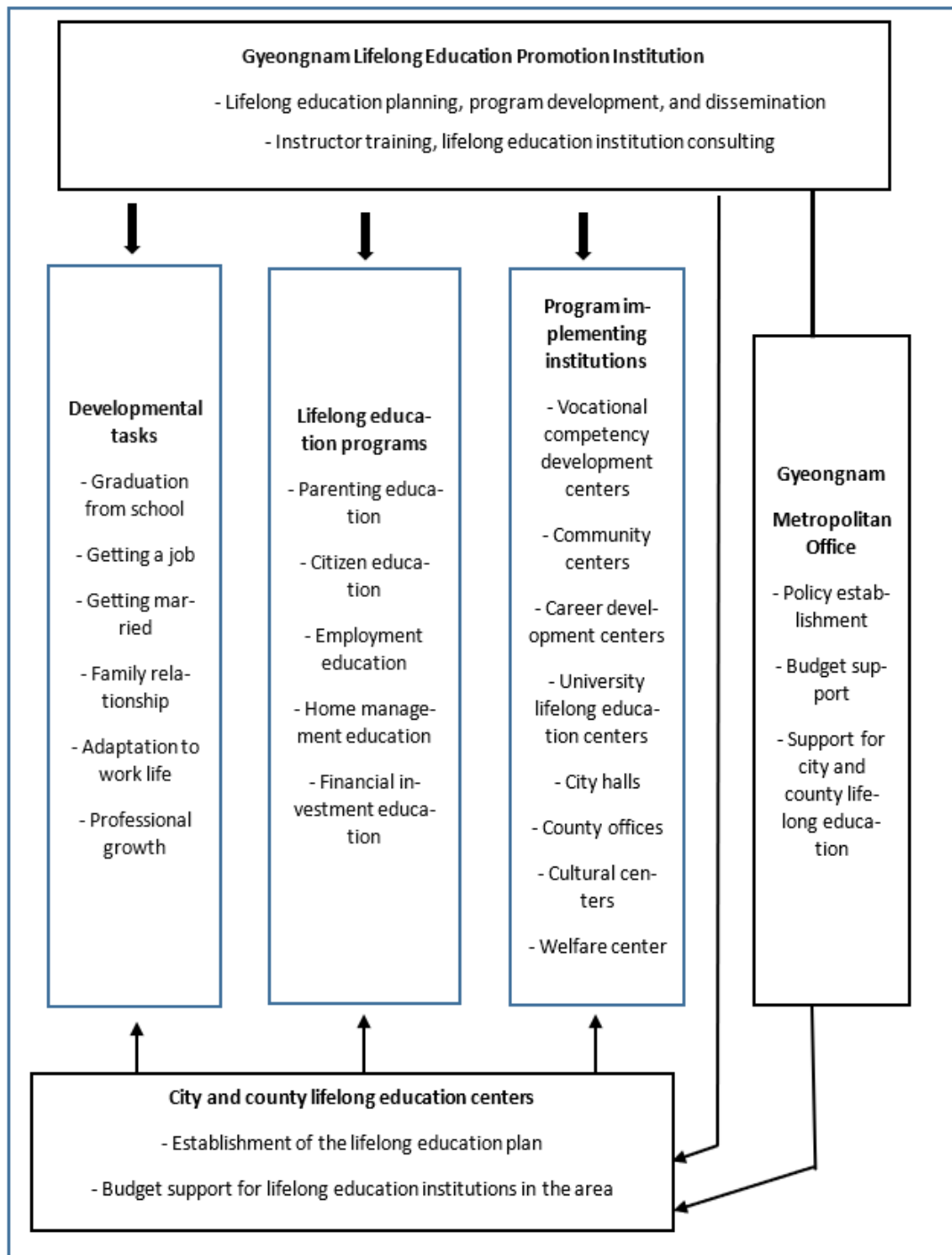
<Figure 3> shows a model for lifelong education for children and adolescents. It presents the developmental tasks in this stage, lifelong education programs for children and adolescents, program implementing institutions, and the roles of the Gyeongnam lifelong education provincial office and the city hall and county offices.

Figure 3. Child and adolescent lifelong education program implementation model.



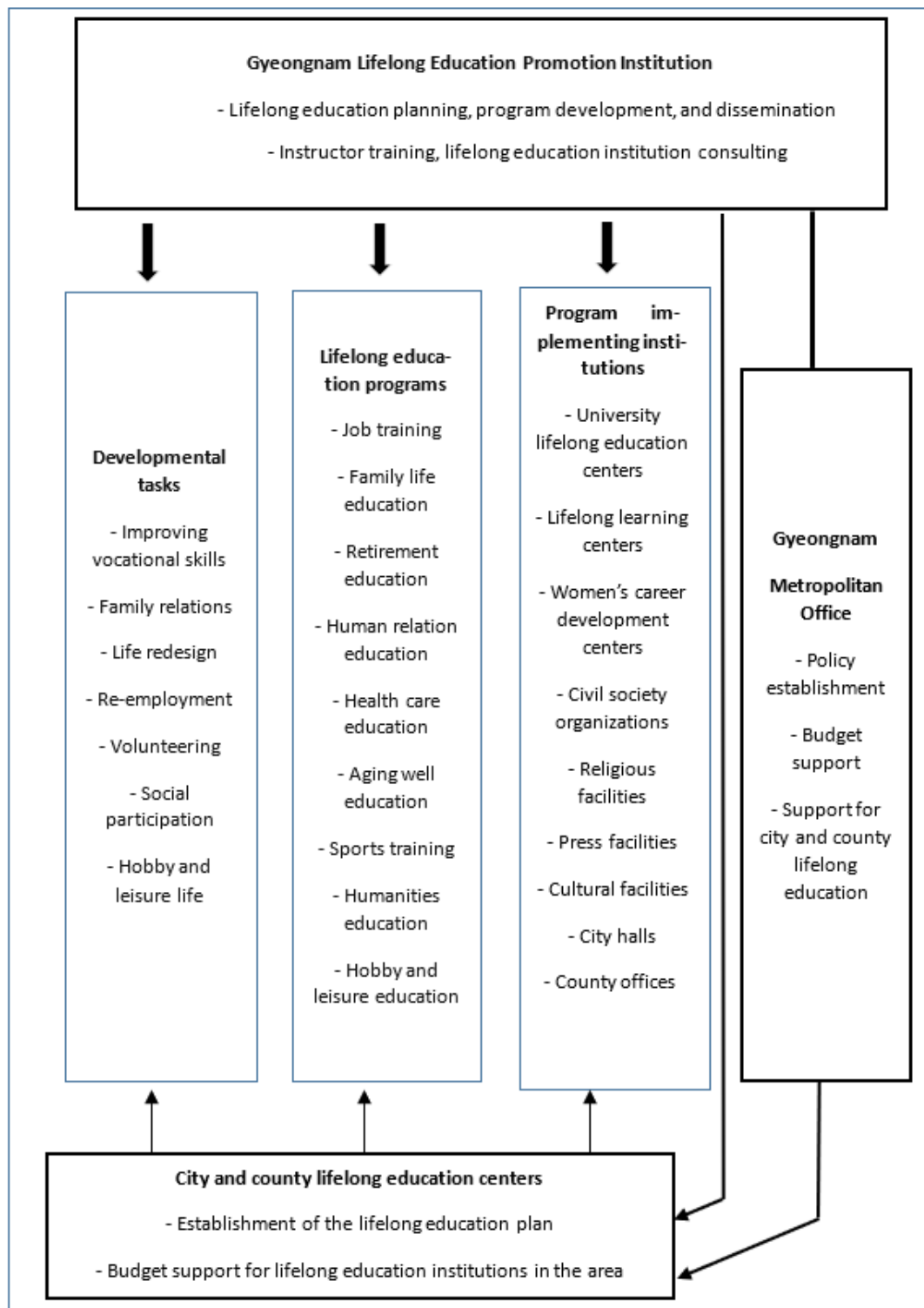
<Figure 4> shows a model for lifelong education in early adulthood. It presents the developmental tasks in this stage, lifelong education programs for early adults, program implementing institutions, and the roles of the Gyeongnam lifelong education provincial office and the city hall and county offices

Figure 4. Early adult lifelong education program implementation model.



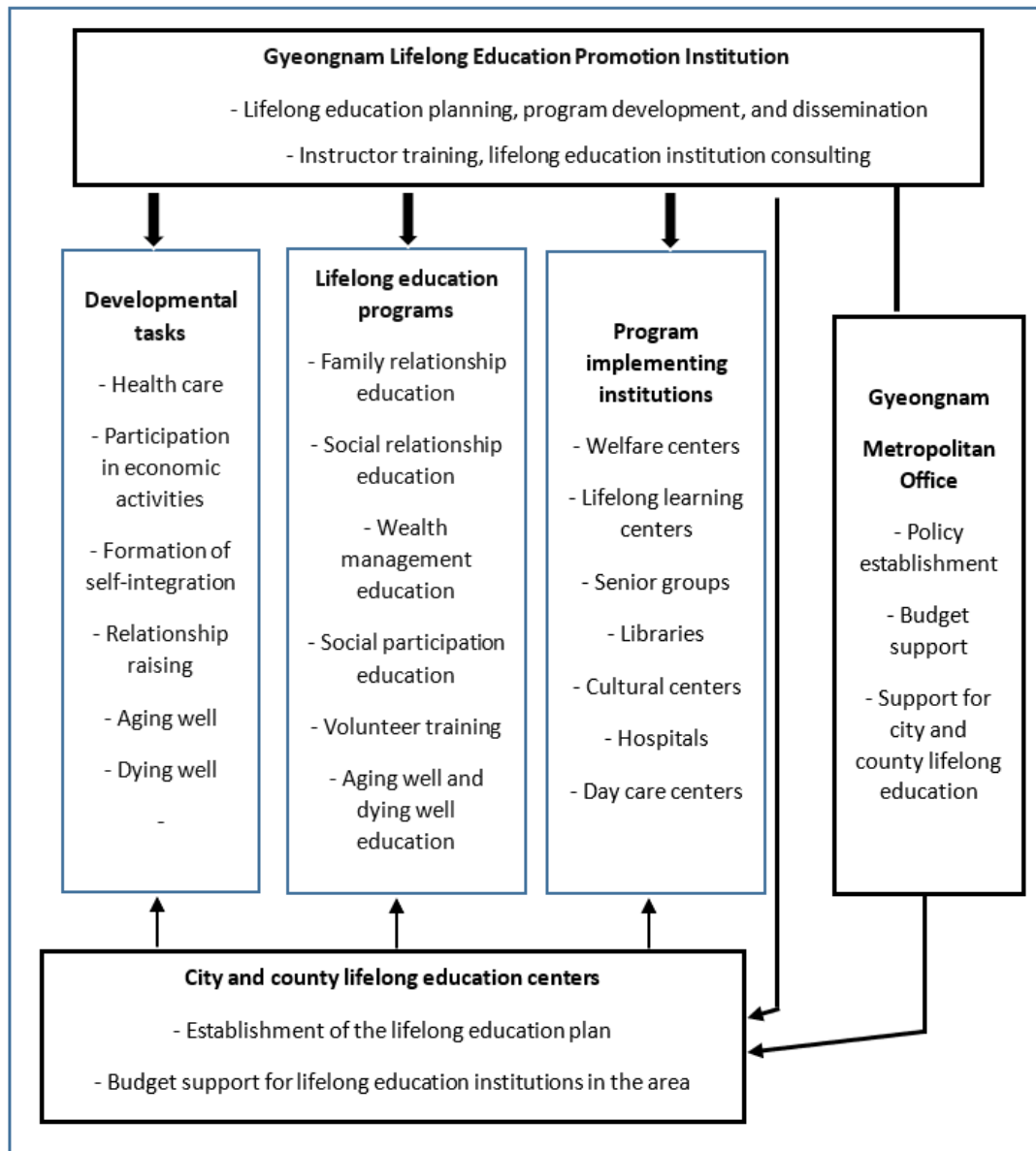
<Figure 5> shows a model for lifelong education in middle adulthood. It presents the developmental tasks in this stage, lifelong education programs for middle adulthood, program implementing institutions, and the roles of the Gyeongnam lifelong education provincial office and the city hall and county offices.

Figure 5. Middle age lifelong education program implementation model.



<Figure 6> shows a model for lifelong education in old age. It presents the developmental tasks in this stage, lifelong education programs for old age, program implementing institutions, and the roles of the Gyeongnam lifelong education provincial office and the city hall and county offices.

Figure 6. Old age lifelong education program implementation model.



4. Conclusion

In today's era of lifelong learning, all members of society feel the need for lifelong learning and participation in various lifelong education programs. School education is education that prepares individuals for future employment and life. However, individuals must continue to grow and complete their developmental tasks throughout their lifetime. In addition, since human development is continuous, lifelong education is necessary for the success of such development. Existing school education alone is not enough for individuals to live their lives successfully.

Since 2000, lifelong education has been promoted in earnest in Korea. General administration bodies such as in provinces, cities, and counties should directly support lifelong education for their residents. The state considers lifelong education compulsory education, so the state and LGUs should actively provide it.

However, lifelong education by the state and LGUs still falls short of fully meeting the needs of

individuals. To provide lifelong learning opportunities with various contents required by citizens, it is necessary for provincial and regional LGUs to systematically provide lifelong education.

In this study, a lifelong education operation model was developed for the provision of programs and policy services customized for each life cycle by examining the actual conditions and needs of lifelong education by life cycle suitable for local circumstances, and linking with learning tasks for each developmental stage. Based on this developed a lifelong education implementation model for each stage of the life cycle of residents of metropolitan areas. A lifelong education implementation model was presented by life cycle stage based on the development of a lifelong education model by stage of the life cycle in the Gyeongnam metropolitan area. It is hoped that such models will assist LGUs in Korea in providing and implementing lifelong education programs for their residents that are more responsive to the developmental needs of the residents at each stage of their life cycle.

5. References

5.1. Journal articles

- [1] Han SH & Yang EY & Lee JY. Analysis of the National Patterns of Lifelong Education Program Provision. *Journal of Lifelong Education*, 17(4), 83-119 (2011).
- [2] Yang EY. Typology of Cultural Art Education Programs and the Patterns of the Classifications in the Context of Lifelong Education Supply and Demand-analysis of 2010 Lifelong Education National Survey Data. *Journal of Arts & Cultural Management*, 22, 195-237 (2012).
- [3] Kim DY & Park E. An Analysis of the Provision Status and Patterns of Lifelong Education Programs for People with Disabilities: Focusing on Gyeonggi Province. *Journal of Special Education*, 25(1), 23-48 (2018).
- [4] Yang EA. A Study on the Provision and Participation Patterns of Art and Culture Education Program of Lifelong Education Institutions in Community. *The Korean Journal of Arts Education*, 17(1), 109-137 (2019).
- [5] Lee JB & Liang D. Suggestions for Using AI in Preparation for a Super-aging Society. *Robotics & AI Ethics*, 5(2), 57-64 (2020). [\[Article\]](#)
- [6] Yang HK & Nam MR. The Study on the Life Patterns and Learning Patterns of an Middle and Old Age Korean. *Global Creative Leader: Education & Learning*, 9(5), 223-244 (2019).
- [7] Sung MR & Park SY. Application of Community Based Group Validation Therapy for Dementia Patients in Korea: A Pilot Study. *Kinesiology*, 6(1), 10-19 (2021). [\[Article\]](#)
- [8] Lee MH & Kang KS. A Study on Causes of Elderly Crimes on Korea and Countermeasures. *International Journal of Criminal Study*, 2(1), 11-15 (2017). [\[Article\]](#)
- [9] Kim EY. Influence of Stress on Self-esteem and the Moderating Effect of Physical Activities in Korean Elderly People. *International Journal of Sport*, 1(1), 8-13 (2016). [\[Article\]](#)
- [10] Gong BW. Anomic Social Environment & Youth Crime Induced by Social Media in Korea. *International Journal of Criminal Study*, 1(1), 1-6 (2016). [\[Article\]](#)
- [11] Bae JY & Kim YJ. Youth Mental Health Crisis and Countermeasure in Korean. *International Journal of Human & Disaster*, 1(1), 13-18 (2016). [\[Article\]](#)
- [12] Hong CK & Lee JB & Kim JY. The Relationship between Elementary School Students' Perception, Fun and Self-directed Learning of Hapkido Training. *International Journal of Martial Arts*, 5(2), 72-80 (2020). [\[Article\]](#)
- [13] Sung EY. Children Safety Education in Korea: Pre-service Early Childhood Teachers' Changes after Flipped Learning on Child Safety Course. *International Journal of Crisis & Safety*, 4(2), 7-12 (2019). [\[Article\]](#)
- [14] Choi US & Lee HS & Byun JI. A Study of the Lifelong Education System Model by Life-cycle. *Journal of Lifelong Education*, 9(3), 299-325 (2003).
- [15] Hwang YA. Analysis of Adult's Perception of Development Tasks and Educational Needs. Andragogy Today. *International Journal of Adult & Continuing Education*, 21(1), 65-98 (2018).

- [16] Hwang MH. A Research on Aspects of Early Adulthood Women's Lifelong Education Participation according to Their Awareness on Developmental Tasks. *Journal of Learner-centered Curriculum and Instruction*, 20(15), 1095-1122 (2020).
- [17] Huh HG. A Lifespan-development-psychological Research about a Device to Promote the Effectiveness of Lifelong Education. *Andragogy Today. International Journal of Adult & Continuing Education*, 5(4), 27-52 (2002).
- [18] Shin HS & Park SJ. Needs Analysis for Adult Learners at Technical Colleges for the Improvement of Lifelong Education Center Programs in Korea: With Priority Given to Needs, Importance, Requests for Improvement and Requests for Supplementation Include Safety. *International Journal of Crisis & Safety*, 4(1), 37-47 (2019). [\[Article\]](#)

6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Lead Author	HY	<ul style="list-style-type: none"> -Set of concepts <input checked="" type="checkbox"/> -Design <input checked="" type="checkbox"/> -Getting results <input checked="" type="checkbox"/> -Analysis <input checked="" type="checkbox"/> -Make a significant contribution to collection <input checked="" type="checkbox"/>
Corresponding Author*	EY	<ul style="list-style-type: none"> -Final approval of the paper <input checked="" type="checkbox"/> -Corresponding <input checked="" type="checkbox"/> -Play a decisive role in modification <input checked="" type="checkbox"/> -Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/>
Co-Author	NC	<ul style="list-style-type: none"> -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

Robotics & AI Ethics

Publisher: J-INSTITUTE
ISSN: 2435-3345

Website: j-institute.org
Editor: admin@j-institute.org

Corresponding author*
E-mail: leebmin@knou.ac.kr

DOI Address:
dx.doi.org/10.22471/ai.2021.6.3.23

© 2021 J-INSTITUTE

Impacts the SMARTPHONE Use on Adolescents' Subjective Happiness in Korea

Bongmin Lee

Korea National Open University, Seoul, Republic of Korea

Abstract

Purpose: The purpose of this study is to identify the difference of happiness by the experience that adolescents use a smartphone. While many studies that digital media use had some negative effect on happiness have released, some studies have showed that the use of digital media worked positively. Also, contradictory theories such as "displacement" and "stimulation" have been suggested in the ways digital media can affect lives. This study is to analyze the impact smartphone use on adolescents' subjective happiness in Korea.

Method: Data from the 11th Korean Children and Youth Well-Being Index Survey conducted in 2018 were used to analyze the relationship between Korean adolescents' smartphone use experience and their subjective happiness. The dependent variable was subjective happiness, and smartphone using experience was subdivided into daily usage time, degree of problematic use, main usage (social relationship, joy, and study/information).

Result: The main purpose and hours of use of a smartphone were related to subjective happiness for male students, but problematic use was related for female students. And the longer male students used the smartphone daily and the worse female students' problematic use was, the lower their subjective happiness was. However, when main usage is for social relationships for male students, subjective happiness is higher than for the rest of them.

Conclusion: The relationship between smartphone use and subjective happiness varied by gender and the ways they used it. These results show that smartphone use may not only work in a particular direction, but also vary depending on the ways people use it. After all, it is important to identify the various factors that make this difference rather than to take the specific view of digital media even if that is positive or negative.

[Keywords] Smartphone, Subjective Happiness, Adolescent, Displacement, Stimulation

1. Introduction

Various studies have emerged on the relationship between information and communication technology and human life in the realm of economics, management, psychology, and computer science[1]. Interestingly, there are conflicting views on technology. Some people have on position that it will be useful in various areas using AI and networks but others argue that we should respond to social problems such as addiction and violence in cyberspace [2][3][4][5][6]. As people have been interested in happiness from the 2000s, many articles have shown that various factors as well as economic power affect human well-being[7][8].

By the way, the results of the studies on the relationship between digital media use and happiness were not consistent. These contradictory results can be explained by the following logic: First, there is a "displacement" effect, that increased use of the Internet reduces other offline activities in a time-limited situation[9]. For example, excessive Internet usage time can lead to overweight or obesity problems by reducing physical activity and an "Internet paradox"

phenomenon can occur in which Internet interactions replace face-to-face interactions[10][11]. This displacement effect can have a negative impact on individuals' well-being. The use of the Internet to avoid psychological problems leads to negative consequences in various areas[12][13]. Meta-analysis of research in the 2000s and 2010s also showed that Internet use and individual well-being are in a weakly negative relationship[14][15]. Second, there is a 'stimulation' effect that the features of offline interaction are enhanced by online interaction. By instance, some interactions with online users even if they don't know each other play a positive role in happiness by contributing to the relief of pain in reality[16][17]. Kraut and colleagues, who presented the "Internet paradox", also mentioned "Internet Paradox Revisited" to emphasize positive relationships and revised their position that the effectiveness of digital media depended on user capabilities[18].

Empirical studies show similar results about the relationship between Internet or smartphone using and happiness of adolescents[19]. Even if adolescents could manage their psychological or social issues with information acquisition or communication on the internet, problematic use of the Internet such as excessive Internet games, chatting, and pornography can lead to psychological problems[20][21]. Also, it can interact with other characteristics of individuals in online or offline and affects the lives of adolescents[1]. A comparative study of "Stimulation" and "Displacement" effects shows that the effect of strengthening social relationships for adolescents was at work, but the effect varied by Internet usage time, main usage(e.g. chatting, e-mail, gaming, web surfing, etc.) and online interaction targets(friends, unspecified others, etc.)[22].

In Korea, there have not been many researches on the relationship between digital media use and happiness for adolescents[23]. The concept of happiness has been used in a variety of terms such as "quality of life", "happiness", and "subjective happiness"[24][25][26][27][28]. Digital media usage experiences have been discussed around the online gaming behavior, Internet usage time outside of academic purposes, or smartphone overuse[24][25][27][28]. Their relationship which studies have showed was mainly negative which was particularly shown in the following groups: non-academic purposes, use over an hour and over 300 minutes and high levels of addiction[25][27][28].

But the motivation and the results of online game are positive made the relationship with happiness positive for adolescent girls[23][25]. And in terms of research methods, factors to affect happiness were not sufficiently included in the analytical model. The analysis was mainly conducted with those focused on digital media using or demographic characteristics. And some studies have included factors such as physical activity, stress, and social relationships(friends and parents) along with demographic variables[24][25][27][28][29].

Thus, this study analyzed impacts the experience of smartphone use on subjective happiness with the offline characteristics that affect happiness. As most students access the internet via smartphones, digital experience was focused on smartphones(hours of use, over-dependence, main usage). And the relationship between smartphone use and happiness was analyzed controlling demographic, social relation, and stressors which they felt. Especially, boys and girls were separately analyzed based on the study that there is a gender difference between the use of smartphones and subjective happiness.

2. Research Method

2.1. Data collection

This study used data on middle and high school students from the 11th Korean Children and Youth Well-Being Index Survey for the Year 2019 conducted in 2018. The subjects of analysis were limited to students who own a smartphone. The sample of the survey was taken in a proportional probability extraction method considering the size of the school, region, size of

the region, and gender based on the national statistics of education in 2018. And the survey was conducted through a self-administration method.

2.2. Variables and measurement tools

2.1.1. Subjective happiness

In this study, subjective happiness was used among various concepts related to well-being. That's because it was most used in Korean researches that analyze the relationship between digital experiences and the happiness of adolescents. Subjective happiness means the level of happiness that they feel in their life. That concept was measured on six items(health, school life, sense of belonging, relationships with people around oneself, loneliness without reason) and participants answered each items on a five-point scale(1: not at all ~ 5: very much). And the item of "loneliness without reason" was coded in a reverse way. The average value of six items was used and Cronbach alpha coefficient was 0.807.

2.2.2. Smartphone use

The digital experience of adolescents was initially focused on a usage time reflecting the view of over-use and a level of over dependence from the perspective of addiction. Recently, the main usage has been focused from the purpose of use, which means what you usually use your smartphone for. "Usage time" was measured by "hours of use per day", which was from "1" for "more than 0 hours to less than 1 hour" to "10" for "more than 9 hours to the maximum value. For the "Problematic use", the average value of the results responding to the 4-point scale(1: not at all ~ 4: very much so) was used, and the confidence value for 6 items was 0.782. For the "main usage" item, the answers to the "most frequent activities on a smartphone" was used. Phone calls, text messages, and social media messages were designated as "social relationship/network," playing video games and watching videos were designated as for "joy," and information search and learning activities were designated as "learning/information."

2.2.3. Other variables

Gender, residence area type, subjective class consciousness, expected educational background, the number of days of exercise per week, social relationships(father, mother, friends, teachers), and stressors(parents, education, friends, body, economic condition) were set as other variables. Residence area types are divided into "small and medium-sized cities/rural areas" and large cities, and subjective class consciousness is based on their living conditions(financial aspects)(6 levels, 1 being top to 6 being bottom). The expected educational background refers to expectations for one's final level of education(1: elementary school to 6: graduate school). Also, based on results that regular exercise has a positive effect on happiness, "the number of days of exercise per week" was set[27][29].

And social relationships means how they feels about their relationship is with father, mother, friend, and teacher relationships and the average values are calculated for a five-point scale response(1: not at all ~ 5: very much so) in each section. The reliability test showed that in Cronbach's alpha coefficient, "father" was 0.888, "mother" was 0.865, "friends" was 0.746, and "teachers" was 0.763. Stress factors are categorized into parents(academic performance, disagreement, interference, conversation, etc.), school(academic performance, homework or exam, preparing for an entrance exam or a job, study, etc.), friends(bullying, disregard, acceptance, inferiority complex, etc.), body(weight, height, facial appearance, etc.), and economic conditions(purchase of clothes, not enough allowance, purchasing goods, etc.). The average value of the results surveyed on a five-point scale in each category was used(1: not at all ~ 5: very much so). The reliability test showed that in Cronbach's alpha coefficient, "parents" was 0.892, "academic activities" was 0.852, "friends" was 0.879, "self" was 0.732, and "economic conditions" was 0.833.

2.3. Analysis method

After applying weights of Korean middle and high school students nationwide in 2019, the analysis was conducted using SPSS 26.0 version. A multiple regression analysis was conducted by applying the Enter method of simultaneously injecting all variables based on the results of a prior study which show that there is a difference between the experience of using a smartphone and the relationship of happiness depending on gender.

3. Analysis Results

As shown in <Table 1>, participants' subjective happiness was 3.87 of 5.0($SD = .80$) on average, which means that they feel happy a little. A significant gender difference in subjective happiness was revealed by t -test, which boys($M = 3.98$, $SD = .79$) were higher than girls($M = 3.75$, $SD = .81$).

In the smartphone use, they spent about 4.3 hours a day on using the smartphone($SD = 2.17$) and their degree of problematic use was about 1.86 of 4.0($M = 3.75$, $SD = .54$), that means that they don't think smartphone use is a problem for their daily life. And the percentage of respondents who answered 'social relation - calling, messaging, Social media'(47.6%) and 'fun - game, video'(44.8%) for the main purpose of using a smartphone was high, and the percentage of respondents who answered 'study/information' was relatively low. Significant gender differences in smartphone use was revealed by t -test or chi-square test. On average, the smartphone use consumed more 0.6 hour of girls' daily life($M = 4.59$, $SD = 2.21$) than boys'($M = 3.99$, $SD = 2.09$). Also, girls($M = 1.97$, $SD = .54$) were about 0.2 points worse than boys($M = 1.77$, $SD = .52$) in the problem use. In primary usage of smartphone, girls reported that in the order of social relation(61.6%), fun(30.9%), study/information(7.1%) while boys responded in the order of fun(57.6%), social relation(34.3%), study/information(8.1%).

Table 1. Subjective happiness and smartphone use by gender.

Description		<i>N</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	95% confidence interval of the difference	
							Lower	Upper
Subjective happiness	Girls	2,273	3.7511	.80502	-10.045***	4,763	-.27703	-.18656
	Boys	2,491	3.9829	.78683				
	total		3.8723	.80386				
Hours of use per day	Girls	2,289	4.5881	2.21093	9.587***	4693.511	.47474	.71882
	Boys	2,509	3.9914	2.08929				
	total		4.2761	2.16855				
Problematic use	Girls	2,265	1.9669	.54180	12.951***	4,737	.16999	.23063
	Boys	2,474	1.7665	.52258				
	total		1.8623	.54113				
Crosstab		Social relation		Fun	Study/information	total	Chi-squared test	
Purpose of use	Girls	1,415(61.1%)		704(30.9%)	161(7.1%)	2,280 (100.0%)	384.148*** (df=2)	
	Boys	856(34.3%)		1,437(57.6%)	201(8.1%)	2,494 (100.0%)		
	total	2,271(47.6%)		2,141(44.8%)	362(7.6%)	4,774 (100.0%)		

Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

<Table 2> shows the results of multiple regression analysis for male students and female students that are the difference in subjective happiness by their experiences using smartphones. There was no multi-collinearity problem based on VIF values.

For male students, the regression model had an R^2 of 47.8%, which was statistically significant. It has been shown that usage time(the hours of use per day) has a negative relation with subjective happiness, which is an hour's increase in usage reduced subjective happiness($B=-0.015$). On the contrary, the main use for social relationships is more positive than others, which main use for "social relationships" showed higher subjective happiness compared to joy or learning/information($B=-0.183$). But the relationship between the degree of problematic use and subjective happiness was not statistically significant. The school level, expected educational background, subjective class consciousness, and the days of exercise per week were statistically significant, while the residence area type and stressor-economic conditions were not.

For female students, the regression model had an R^2 of 43.3%, which was statistically significant. The degree of problematic use of smartphones has a negative relationship with subjective happiness, and the higher the level of problematic use of smartphones is, the lower the subjective happiness is($B=-.015$). However, usage time and the main usage have no statistically significant relationship with subjective happiness.

Besides, the residence area type, expected education background, social relation and stressor(body, school, friends) were statistically significant of subjective happiness, while school level, subjective class consciousness, the days of exercise per week, and stressor(parents, economic conditions) were not statistically significant.

In summary, the experience of using smartphones had some effects on Korean adolescents' subjective happiness. And there were some gender differences in the type of smartphone use that affected subjective happiness. The impact of smartphone daily use time on subjective happiness was negative in male students, but there was no statistically significant difference in female students. On the other hand, the level of problematic use of smartphones negatively affected the subjective happiness of female students, but not in male students. Besides, the influence of the primary purpose of smartphone use on subjective happiness only worked for male students, but not for female students. Specifically, male students had a higher subjective happiness in the group for social relationships than in the group for fun or study/information.

Table 2. Relationship between subjective happiness and smartphone use experience.

Description		Boys			Girls		
		B	β	t	B	β	t
Intercept		1.693		9.394***	1.294		6.314***
School level ⁺		-0.076	-0.051	-2.785**	-0.054	-0.035	-1.744
Residence area type		0.027	0.018	1.044	0.072	0.046	2.504*
Expected education background		0.048	0.061	3.518***	0.053	0.059	3.153**
Subjective class consciousness		-0.063	-0.076	-4.222***	-0.021	-0.023	-1.218
Days of exercise per week		0.044	0.112	6.288***	0.009	0.019	0.995
Social relation	Father	0.091	0.115	5.130***	0.118	0.150	6.746***
	Mother	0.165	0.175	7.598***	0.183	0.183	8.066***
	Friend	0.247	0.214	10.287***	0.278	0.236	11.031***
	Teacher	0.129	0.167	8.919***	0.125	0.161	8.302***
Stressor	Body	-0.065	-0.080	-3.603***	-0.036	-0.048	-2.022*
	Parents	0.039	0.056	2.281*	0.003	0.004	0.157
	School	-0.068	-0.101	-4.258***	-0.043	-0.060	-2.581**
	Friend	-0.096	-0.108	-4.644***	-0.134	-0.149	-6.539***
	Economic conditions	-0.027	-0.032	-1.342	0.014	0.019	0.747

Smart-phone using	Hours of use per day		-0.015	-0.041	-2.272*	-0.005	-0.014	-0.708
	Problematic use		0.001	0.001	0.046	-0.075	-0.052	-2.423*
	Main	Social	0.183	0.117	3.635***	0.057	0.035	0.967
	Usage ⁺⁺	Fun	0.062	0.041	1.290	0.055	0.032	0.891
R^2 / F			.478 / 94.394***			.433 / 74.722***		

Note: *p<.05, **p<.01, ***p<.001.

B: Non-standardization coefficient, β : Standardization coefficient.

+: '0' for middle school, '1' for high school, '0' for small/medium cities and rural areas, '1' for large cities.

++: Dummy variables, 'social relationships': 1, the rest: 0 / 'joy': 1, the rest: 0.

4. Conclusion

We have positive or negative changes in political, economic, and social area such as social network formation, online shopping, and online political activities as people has been using more digital media. At the same time, digital media, the Internet, smartphones, and online games are concerned to have positive or negative effects on youth's lives. Reflecting this view, various studies have revealed the relationship between youth's use experience of digital media and well-being. Early studies have revealed many negative relationships between media and well-being, but more and more studies have shown that media can contribute positively to well-being. Their results have depended on the analysis tools, targets, and methods of analysis. There were not many studies on those topic for adolescents in Korea, but most of them have showed negative relationships with digital media(such as the Internet, smartphones, and online games) and happiness[25][27][28]. However, some studies showed that the motivation of and outcome of digital media use made positive relationships[24]. Also, earlier studies have been confirmed the negative results without considering enough the factors to the results, which have shown to affect happiness.

Therefore, this study aims to understand the effects of smartphone use on subjective happiness of Korean adolescents considering the many factors that affect happiness. The subjects of analysis were limited to students who own a smartphone in middle school or high school. The data was from the 11th Korean Children and Youth Well-Being Index Survey for the Year 2019 conducted in 2018. The smartphone use was divided into the usage time(hours of use per day), problematic use, and main usage(purpose of use). And in this study, multiple regression analysis with 'Enter' method for boys and girls was applied to control various factors that affected subjective happiness. The results are summarized as follows.

First, the use of smartphones had a statistically significant effect on subjective happiness, but there were gender differences. The more time adolescents use their smartphone or the stronger the problematic use is, the lower the subjective happiness, which was a similar result to previous studies[25][27][28]. But this study set the usage time and the problematic usage levels as continuous variables while previous studies treated those as a discontinuous variable based on specific usage time or degree of use.

Also, it was the gender's difference of the way smartphone use affects subjective happiness. The negative effect of smartphone usage time was only found in boys. And the negative effect of problematic smartphone use on subjective happiness was only shown in female students. These were not consistent of previous studies which digital media use has negative effects on well-being regardless of gender[26]. The difference of these results might occur for the following reason: this study divided the level of smartphone addiction into the hours of use and the degree of problematic use, but previous studies integrated the two factors.

In addition, the difference of subjective happiness by purpose of smartphone use was only found in male students. Specifically, it was found that the group that used smartphones for social purposes had a higher subjective happiness than the group that used for fun or learning/information. These findings can be interpreted by the finding that the positive motivation and results of online games could

promote their happiness[24]. On the other hand, there was no relationship between main usage of smartphone and subjective happiness for girls.

Based on these results, it was concluded that both "stimulation" and "displacement" could work in the relationship between that smartphone using and subjective happiness. Besides, It was confirmed that one of the opposite operating principles could works depending on the qualitative nature of the user's gender or use experience. The deterministic view that the use of digital media, smartphones, games, etc. leads to positive or negative outcomes can lead to dangerous consequences. Rather, higher subjective happiness of the smartphone use group for social network show that we need some efforts to achieve positive results with digital media. Subsequent studies can make a comprehensive assessment of digital media usage time and dependence and analyze groups separately according to diagnosis results, group usage time, and problematic usage, and identify differences in influence between subgroups or higher groups. Finally, it is also important to find ways to effectively utilize and safely use these tools in an era when the term "digital native" has become familiar[30]. Considering that online and offline life are closely connected, it is necessary to identify the organic relationship and impact of activities in the two spaces.

5. References

5.1. Journal articles

- [1] Castellacci F & Tveito V. Internet Use and Well-being: A Survey and a Theoretical Framework. *Research Policy*, 47, 308-325 (2018).
- [2] Kim T & Park G. Future Oriented Smart Society and Ethical Issues. *Robotics & AI Ethics*, 6(1), 35-44 (2021). [\[Article\]](#)
- [3] Song S. Internet Gambling Policy: Prohibition Versus Legalization. *International Journal of Justice & Law*, 2(2), 22-27 (2017). [\[Article\]](#)
- [4] Kwon H. Research on Causes and Countermeasures of Juvenile SNS Cyber Verbal Abuse. *International Journal of Criminal Study*, 4(1), 14-19 (2019). [\[Article\]](#)
- [5] Kim H. A Study on Game Rating in Korea for Juvenile Addiction and Crime Prevention. *International Journal of Criminal Study*, 3(1), 15-20 (2018). [\[Article\]](#)
- [6] Lee J. A Proposal of Webhard Monitoring System against Cyber Sexual Violence. *International Journal of Police and Policing*, 5(1), 8-15 (2020). [\[Article\]](#)
- [7] Lyuborirsky S. Why are Some People Happier than Others? The Role of Cognitive and Motivational Processes in Well-being. *American Psychologist*, 56(3), 239-249 (2001).
- [8] Hall R & Banaszek A. The Internet, Happiness, and Social Interaction: A Review of Literature. *International Conference on HCI in Business*, 8527, 166-174 (2014).
- [9] Nie N & Hillygus DS. The Impact of Internet Use of Sociability: Time-diary Findings. *It & Society*, 1(1), 1-20 (2002).
- [10] Aghasi M & Matinfar A & Golzarand M & Salari-Moghaddam A & Ebrahimpour-Koujan S. Internet Use in Relation to Overweight and Obesity: A Systematic Review and Meta-analysis of Cross-sectional Studies. *Advances in Nutrition*, 11(2), 349-356 (2020).
- [11] Kraut R & Patterson M & Lundmark V & Kiesler S & Mukophadhyay T & Scherlis W. Internet Paradox: A Social Technology that Reduces Social Involvement and Psychological Well-being? *American Psychologist*, 53(9), 1017-1031 (1998).
- [12] Hong S. A Study Investigating the Effect of Adolescent Lifestyles on Experience with Sexual Commoditization Involving the Use of Smartphone in Korea: Validating the Mediating Effect on Sexual Awareness Level. *International Journal of Police and Policing*, 1(1), 1-9 (2016). [\[Article\]](#)
- [13] Senol-Durak E & Durak M. The Mediator Roles of Life Satisfaction and Self-esteem between the Affective Components of Psychological Well-being and the Cognitive Symptoms of Problematic Internet Use. *Social Indicators Research*, 103(1), 23-32 (2011).
- [14] Huang C. Internet Use and Psychological Well-being: A Meta-analysis. *Cyberpsychology, Behavior, and Social Networking*, 13(3), 241-249 (2010).

- [15] Çikrikci, Ö. The Effect of Internet Use on Well-being: Meta-analysis. *Computers in Human Behavior*, 65, 560-566 (2016).
- [16] Wolak J & Mitchell KJ & Finkelhor D. Close Online Relationships in a National Sample of Adolescents: A Description. *Adolescence*, 37(147), 441-456 (2002).
- [17] Rains SA & Young VA. A Meta-analysis of Research on Formal Computer-mediated Support Groups: Examining Group Characteristics and Health Outcomes. *Human Communication Research*, 35(3), 309-336 (2009).
- [18] Kraut R & Kiesler S & Boneva B & Cummings JN & Helgeson V & Crawford AM. Internet Paradox Revisited. *Journal of Social Issues*, 58(1), 49-74 (2002).
- [19] McKenna YA & Bargh JA. Coming Out in the Page of the Internet: Identity “Demarginalization” through Virtual Group Participation. *Journal of Personality and Social Psychology*, 75(3), 681-694 (1998).
- [20] Subrahmanyam K & Lin G. Adolescents on the Net: Internet Use and Well-being. *Adolescence*, 42(168), 659-77 (2007).
- [21] Morrison CM & Gore H. The Relationship between Excessive Internet Use and Depression: A Questionnaire-based Study of 1,319 Young People and Adults. *Psychopathology*, 43(2), 121-126 (2010).
- [22] Valkenburg P & Peter J. Internet Communication and Its Relation to Well-being: Identifying Some Underlying Mechanisms. *Media Psychology*, 9(1), 43-58 (2007).
- [23] Hwang H & Kim YH. A Systematic Review of Studies on Happiness Determinants among Domestic Adolescents. *Korean Journal of Youth Studies*, 24(7), 1-28 (2017).
- [24] An DG. The Effect of Youth Internet Behavior on Quality of Life. *Korean Policy Sciences Review*, 9(4), 259-285 (2005).
- [25] Park HJ. The Relationship between Internet Use for Non-academic Purposes and Happiness and Stress in Adolescents. *Journal of Korean Academy of Community Health Nursing*, 26(2), 169-177 (2015).
- [26] Kim KM & Yeom YS. Korean Students’ Smartphone Usage and Happiness: A Gender Approach to the Moderating Effect of Parent Relationship. *Information Society & Media*, 15(3), 31-56 (2014).
- [27] Kim KM & Youm YS. Korean Adolescents’ Addiction to Media and Subjective Happiness: Focusing on Gender Difference in the Moderating Effects of Physical Activity. *Korean Association of Health and Medical Sociology*, 48, 121-142 (2018).
- [28] Baek SH & Kim JH. A Convergence Study on Association of Internet Use Time with Perceived Status in Adolescents. *Journal of the Korea Convergence Society*, 9(11), 153-159 (2018).
- [29] Kim KS. Relationship between Physical Activity, Stress, Friendship and Happiness of the Youth. *Journal of Sport and Leisure Studies*, 65, 399-409 (2016).
- [30] Prensky M. Digital Natives, Digital Immigrants. *On the Horizon*, 9(5), 1-6 (2001).

6. Appendix

6.1. Authors contribution

		Initial name	Contribution
Author	BL		-Set of concepts <input checked="" type="checkbox"/>
			-Design <input checked="" type="checkbox"/>
			-Getting results <input checked="" type="checkbox"/>
			-Analysis <input checked="" type="checkbox"/>
			-Make a significant contribution to collection <input checked="" type="checkbox"/>
			-Final approval of the paper <input checked="" type="checkbox"/>
			-Corresponding <input checked="" type="checkbox"/>
			-Play a decisive role in modification <input checked="" type="checkbox"/>
			-Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/>
			-Participants in Drafting and Revising Papers <input checked="" type="checkbox"/>
			-Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

6.2. Funding agency

This research was supported by Korea National Open University Research Fund in 2020.

Robotics & AI Ethics

Publisher: J-INSTITUTE
ISSN: 2435-3345

Website: j-institute.org
Editor: admin@j-institute.org

Corresponding author*
E-mail: isn6685@nate.com

DOI Address:
dx.doi.org/10.22471/ai.2021.6.3.32

© 2021 J-INSTITUTE

A Study on the Trends of Patents Concerning the Hair Loss Prevention and Improvement Technologies Using AI

Youngbae Kim¹

Sungkyul University, Anyang, Republic of Korea

Sunnye Lim^{2*}

Dongshin University, Naju, Republic of Korea

Abstract

Purpose: In addition to congenital causes due to heredity, hair loss is caused by acquired causes such as aging, excessive stress, irregular eating habits, and smoking. The population of hair loss continues to increase every year, amounting to 10 million people, and the age at which the hair loss begins is gradually decreasing. As the interest and efforts for the improvement have increased, the market for the hair loss has also incrementally expanded.

Method: In this study, the technologies related to the hair loss prevention and improvement are classified into the scalp nutrition supply(field A), scalp stimulation(field B), scalp washing(field C), and oral administration(field D), and by examining the trends in the application of the patents for such fields of technology(including utility model), this study sought to identify the potential for the development of technologies related to the hair loss prevention and improvement and fields which ought to be focused on the hair loss related technologies in the future.

Results: Consequently, it was confirmed that active patent activities have continued for the hair loss prevention and improvement related technologies, and in particular, the intensive patent activities are conducted in the field of technologies related to the scalp washing.

Conclusion: Accordingly, this study seeks to contribute to the facilitation of the hair loss prevention and improvement related technology market and also expand the market by analyzing and understanding the trends of patents for the hair loss prevention and improvement related technologies and inducing the determination of the desirable directions for the research and development.

[Keywords] Hair Loss, Scalp, Treatment, Care, Improvement

1. Introduction

For the people of modern society, hair has been accepted as a main means of expressing external beauty.

According to which, hair dyeing and perm, etc., are frequently practiced to create a unique beauty through hairdressing, and such cosmetic actions rather increase the rate of damages for hair and scalp, and also act as a direct cause for the hair loss, and hence, the interest not only to create individuality and beauty through hair styling, but also care for rich and healthy hair has continuously grown[1].

Hair loss refers to a condition where there is no hair in the area where hair should normally exist, and also generally refers to the loss of hair on the scalp. In the case of East Asians, it is a normal physiological phenomenon where approximately 50 to 100 fully grown hairs are lost per day. However, if it exceeds that, it is classified as a cause of disease.

It has been identified that the cause of hair loss is not only a genetic factor, but also such acquired factors as environmental pollution, stress, eating habits, and smoking[2].

Examining the data gathered until 2019, the domestic population of hair loss is steadily growing each year, and the Korean Society of Hair Loss Treatment estimates the potential domestic population of hair loss to be approximately 10 million as of 2019. Furthermore, since the age at which the hair loss begins is gradually declining and the rate of hair loss for women is gradually increasing(44.9% as of 2019), hair loss has already been recognized as a concern for all age groups, and the interest has been rising.

Table 1. Number of new hair loss patients in Korea.

Year	2015	2016	2017	2018	2019
No. of patients (unit: 10,000 people)	20.9	21.3	21.5	22.5	23.4

Note: Source: Health insurance review & assessment service.

Table 2. Ratio of hair loss patients by age in Korea.

Age	0~19	20~29	30~39	40~49	50~59	Over 60
Ratio of patients (unit: %)	8.5	18.1	22.2	23.5	18.2	9.5

Note: Source: Health insurance review & assessment service.

As such, since the domestic population of hair loss has increased, the market size for the hair loss related products along with the hair loss treatment technology has also grown rapidly[3].

The domestic hair loss related market is approximately KRW 4 trillion via the shampoos or soaps with a hair loss prevention function, functional medicines which can supply nutrients to the hair roots by simply ingesting(taking them) or expanding the blood vessels of the hair roots, and the treatment devices which directly stimulate the scalp[4].

However, most of the products distributed and sold in Korea do not provide much help in helping to prevent and treat the hair loss, and in fact, it is urgently necessary to analyze the current state of technologies related to the hair loss prevention and improvement and set the directions for the future research and development[5].

Hence, in this study, in order to analyze the trends of technologies related to the hair loss prevention and improvement, the patents and utility model literatures were searched and classified by the field of technology, and the trends of patents for the classified field of technology were analyzed from various angles, and further to setting a desirable direction for the research and development for the prevention and improvement technologies, it is sought to contribute to the facilitation of the domestic market for hair loss and increase the market size.

2. Contents and the Method

2.1. Subject of the study and the number of data

As for the DB for the data collection of research subjects, KEYWERT, which provides the data related to patents and utility models for fees, and KIPRIS, which is operated by the Korean Intellectual Property Office, have been utilized[6]. The selection of the research subject data was made based on the data published and registered in Korea on or before January 20, 2021. To search for the data related to 'hair loss prevention and improvement,' 'hair loss' and 'care' were selected as the keywords, and as a result of searching by expanding the search terms by using synonyms and similar words of such keywords, approximately 2,700 raw-data were retrieved[7]. A total of 519 valid data were selected and collected by removing the noise and redundant data from the retrieved raw data and adding the related data.

2.2. Analytical method and statistical processing

A total of 519 valid data were classified by dividing the technical contents related to wigs into large, medium, and small categories as illustrated in <Table 3> below. By utilizing such valid data, the trends of patents were analyzed by year, major applicant, and by field of technology.

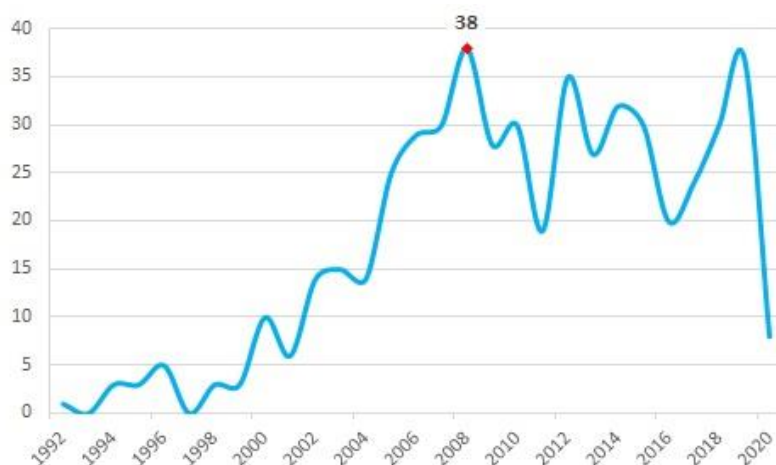
Table 3. Technical classification.

Large classification	Mid classification	Small classification	Criteria for classification
Hair loss prevention and improvement	Scalp nutrition supply (A)	Nutritional supplement(AA)	- Technology of directly supplying liquid or gel type nutrients to the scalp - Technology related to nutrition supply equipment
	Scalp stimulation(B)	Light irradiation(BA)	- Technology for irradiating the scalp with light such as LED or laser
		Massage(BB)	- Technology for massaging the scalp by supplying ultrasonic waves, electromagnetic waves, and electric currents - Simple vibration type and passive type technology excluded
	Scalp washing(C)	Shampoo and soap(CA)	- Technology for removing pollutants causing hair loss by washing hair and scalp
	Oral administration(D)	Health food(DA)	- Technology related to functional foods which may be consumed in the form of tablet or powder

3. Results and Consideration

3.1. Trends of patents by year

Figure 1. Number of patent applications per year for the hair loss prevention and improvement related technologies.



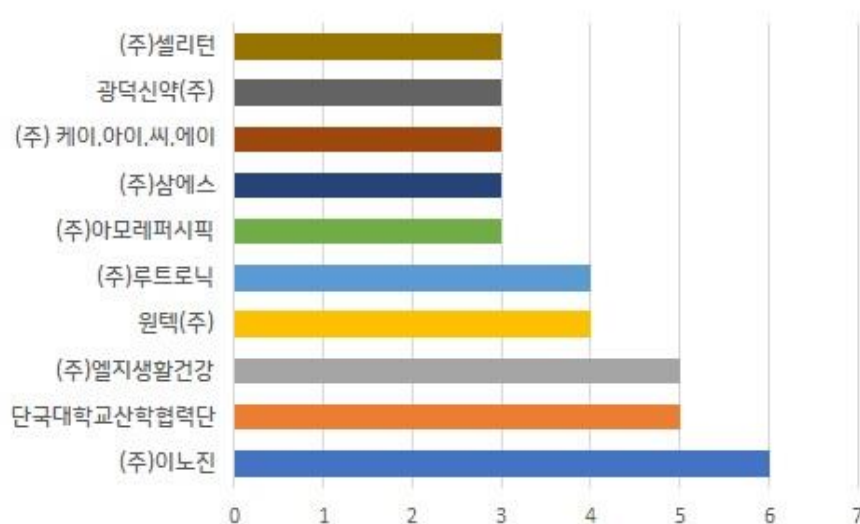
As a result of examining the overall trends of patent applications by year for the hair loss prevention and improvement technology, the first application was filed in 1992, and the applications continued to increase until the late 2000s, with 38 applications being filed the most in 2008, while the patent activities in the early and mid-late 2010s, yet from the late 2010s, the patent activities demonstrated a trend of increasing again. Through which, many technologies have already been disclosed in the technology market related to the hair loss prevention and improvement, but it may be expected that

various technologies are undergoing development recently.

Furthermore, the reason that the patent activities seem to have declined steeply after 2019 is that, given the nature of the patent system, it is not included in the data of patent analysis since an actual application has been made yet has not been disclosed because it is not published until when 1 year and 6 months have elapsed since the patent application is filed.

3.2. Patent trends for major applicants

Figure 2. (Top 7)high ranking major applicants for the hair loss prevention and improvement related technologies.



Note: (주)셀리턴: Cellreturn Co., Ltd., 광덕신약(주): Kwangdeok Co., Ltd., (주)케이.아이.씨.에이: KICA Co., Ltd., (주)삼에스: 3S Co., Ltd., (주)아모레퍼시픽: Amore Pacific Co., Ltd., (주)루트로닉: Lutronic Co., Ltd., 원텍(주): Wontech Co., Ltd., (주)엘지생활건강: LG Household & Health Care Co., Ltd., 단국대학교산학협력단: Dankook University Industry-Academic Cooperation Foundation, (주)이노진: Innogene Co., Ltd.

As a result of examining the top 10 applicants among all the applicants in Korea for the hair loss prevention and improvement technology, Innogene Co., Ltd. filed 6 applications and was ranked first in terms of the number of applications, followed by Dankook University Industry-Academic Cooperation Foundation, LG Household & Health Care Co., Ltd. applied for 5 patents each, Wontech Co., Ltd. and Lutronic Co., Ltd. applied for 4 patents each.

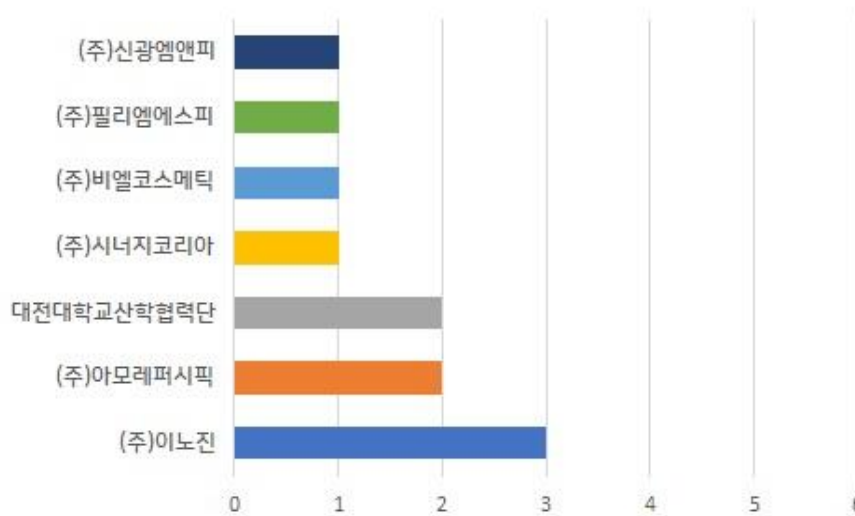
Innogene Co., Ltd. is a company which produces hair loss treatment agents and medical devices for the hair loss diagnosis and treatment, while LG Household & Health Care Co., Ltd. is a company which produces makeup, hair and skin care, and various general household goods[8][9][10][11][12][13]. In addition, Wontech Co., Ltd. and Lutronic Co., Ltd. are the companies specialized in skin care medical devices using laser and ultrasound.

While some large companies such as LG Household & Health Care Co., Ltd. and Amore Pacific Co., Ltd. are among the main applicants, all of them include small and medium sized enterprises except for Dankook University Industry-Academic Cooperation Foundation. Furthermore, such SMEs are more active in the patent activities than the large companies, and the business areas for each applicant are varied. Accordingly, it has been identified that no specific company is yet leading or monopolizing the technology market for the hair loss prevention and improvement technologies.

3.3. Patent trends for major applicants by the field of technology

3.3.1. Nutrients(AA field)

Figure 3. (Top 7)high ranking major applicants for the hair loss prevention and improvement technologies using nutritional supplement.

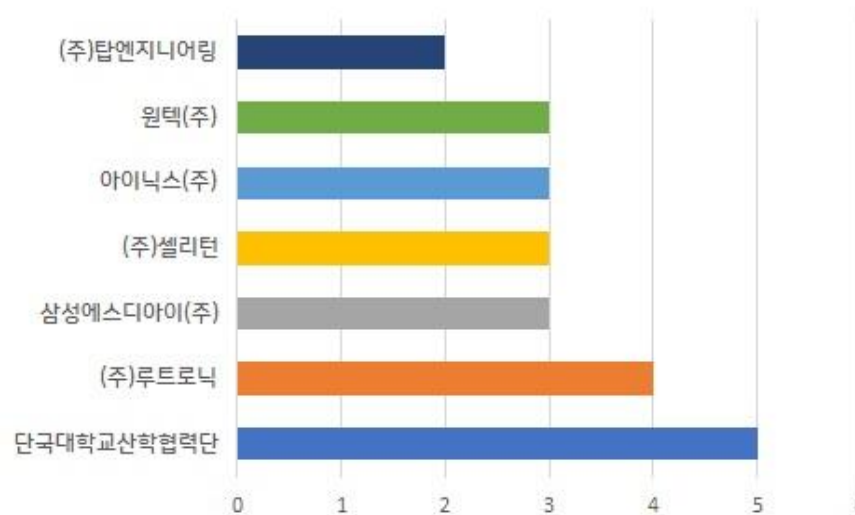


Note: (주)신광엠애피: Shinkwang M&P Co.,Ltd., (주)필리엠에스피: Philly MSP Co.,Ltd., (주)비엘코스메틱: BLCOSMETIC Co., Ltd., (주)시너지코리아: Synergkorea Co.,Ltd., 대전대학교산학협력단: Daejeon university industry-academic Cooperation Foundation, (주)아모레퍼시픽: Amore Pacific Co., Ltd., (주)이노진: Innogene Co.,Ltd.

Examining the Top 7 major domestic applications related to the technologies for the hair loss prevention and improvement using nutritional supplements, Innogene Co., Ltd. filed the most applications with 3 cases, while Amore Pacific Co., Ltd. and Daejeon University Industry-Academic Cooperation Foundation applied for 2 cases each.

3.3.2. Light irradiation(BA field)

Figure 4. (Top 7)high ranking major applicants for the hair loss prevention and improvement technologies using light.



Note: (주)탑엔지니어링: Top Engineering Co.,Ltd., 원텍(주): Wontech Co., Ltd., 아이닉스(주): Eyenix Co., Ltd., (주)셀리턴: Cellreturn Co., Ltd., 삼성에스디아이(주): SamsungSDI Co.,Ltd., (주)루트로닉: Lutronic Co., Ltd., 단국대학교산학협력단: Dankook University Industry-Academic Cooperation Foundation.

Examining the Top 7 domestic major applications for the technologies related to the hair loss pre-

vention and improvement using light such as laser or LED, Dankook University Industry-Academic Cooperation Foundation filed the most applications with 5 cases, Lutronic Co., Ltd. filed for 4 cases, and Samsung SDI Co. Ltd., Cellreturn Co., Ltd., Eyenix Co., Ltd., and Wontech Co., Ltd. applied for 3 cases of patents each.

Among which, Lutronic Co., Ltd., Samsung SDI Co., Ltd., Cellreturn Co., Ltd., and Eyenix Co., Ltd. turned out to be intensively engaged in the research and development activities in the field of light irradiation technology, while Wontech Co., Ltd., in addition to the field of light irradiation technology, tuned out to be carrying out some patent activities in the field of massage technology.

In the case of the hair loss prevention and improvement technology using light irradiation, the patent activities, which had increased until 2010, slightly decreased after 2010. However, given that the active patent activities have been maintained consistently until the late 2010s, it is expected that the research and development activities in the field of technology related to the light irradiation will also continue to be active.

3.3.3. Massage(BB field)

Figure 5. (Top 7)high ranking major applicants for the hair loss prevention and improvement technologies via massage.



Note: (주)서린메디케어: Seoulin Medicare Co., Ltd., (주)이노진: Innogene Co., Ltd., (주)뉴피아: Newpia Co., Ltd., 동국대학교산학협력단: Dongguk University Industry-University Cooperation Foundation, (주)웨이전스: Waygence Co., Ltd., 피에스아이(주): PSI Co., Ltd., 연세대학교산학협력단: Yonsei University Wonju Industry-Academic Cooperation Foundation.

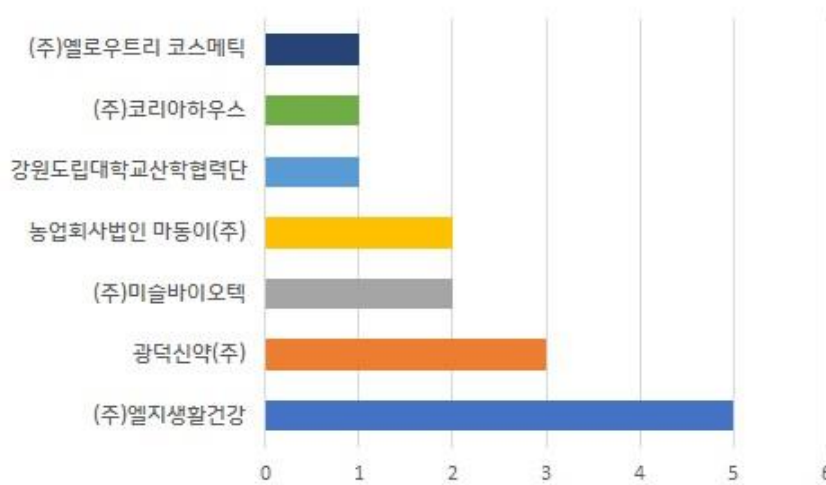
Examining the Top 7 domestic major applications for the technologies related to the hair loss prevention and improvement by massaging the scalp using any of ultrasonic waves, electromagnetic waves, or micro-currents, Yonsei University Wonju Industry-Academic Cooperation Foundation, PSI Co., Ltd., Waygence Co., Ltd., and Dongguk University Industry-University Cooperation Foundation filed the most applications with 2 cases each, followed by Newpia Co., Ltd., Innogene Co., Ltd., and Seoulin Medicare Co., Ltd. with 1 case each.

While relatively fewer patent applications were filed for the hair loss prevention and improvement technologies using massage compared to those using the light irradiation, the patent activities have consistently increased since 2015, and hence, it is highly likely that the future technological development will be active in this field.

Among the main applicants, Innogene Co., Ltd. has been very active in terms of the patent activities to the extent that it is included among the top major applicants not only for the field of technology using nutritional supplements, but also in the field of massage related technologies with such a high potential for development, and it is expected to capture a larger market share in the field of technology related to the hair loss prevention and improvement.

3.3.4. Shampoo and soap(CA field)

Figure 6. (Top 7)high ranking major applicants for the hair loss prevention and improvement technologies using shampoo and soap.



Note: (주)옐로트리 코스메틱: Yellow Tree Cosmetics Co.,Ltd., (주)코리아하우스: Korea House Co.,Ltd., 강원도립대학교산학협력단: Gangwon Provincial University Industry-Academic Cooperation Foundation, 농업회사법인 마동이(주): Madongi Co.,Ltd.,an agricultural corporation, (주)미슬바이오텍: Mistle Biotech Co.,Ltd., 광덕산약(주): Kwangdeok Co., Ltd., (주)엘지생활건강: LG Household & Health Care Co., Ltd.

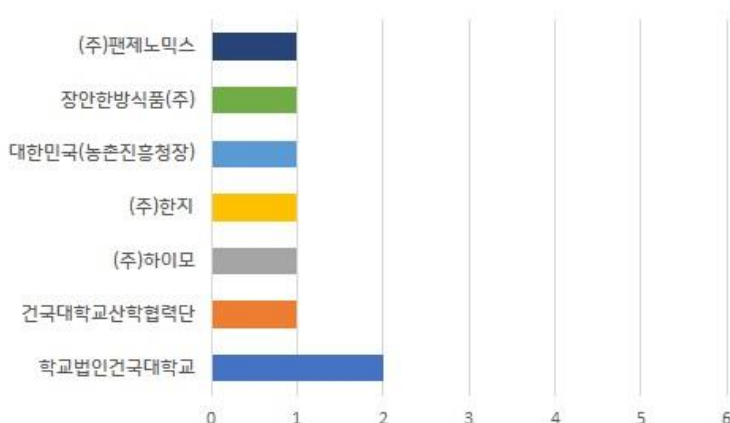
Examining the Top 7 major domestic applications for the hair loss prevention and improvement technology using shampoo and soap, LG Household & Health Care Co., Ltd. filed the most applications with 5 cases, followed by Gwangduk Co., Ltd. with 3 cases and Mistle Biotech Co., Ltd. and Madongi Co., Ltd., an agricultural corporation, turned out to have applied for 2 cases of patents each.

In the field of technology using shampoo and soap, patent activities are far much more strong than in other fields of technology, and the patent activities have consistently increased since 1992, and since 2012, over 10 patent activities have been carried out each year, which is considered to be the most active field of technology for the research and development activities.

However, it is determined that it is a field of technology which requires much time and money to commercialize the results obtained through the research and development activities and distribute them in the market, since most of them, except for the main applicants, have carried out patent activities.

3.3.5. Health food(DA field)

Figure 7. (Top 7)high ranking major applicants for the hair loss prevention and improvement technologies using health food made to be consumed in the form of powder or tablet.



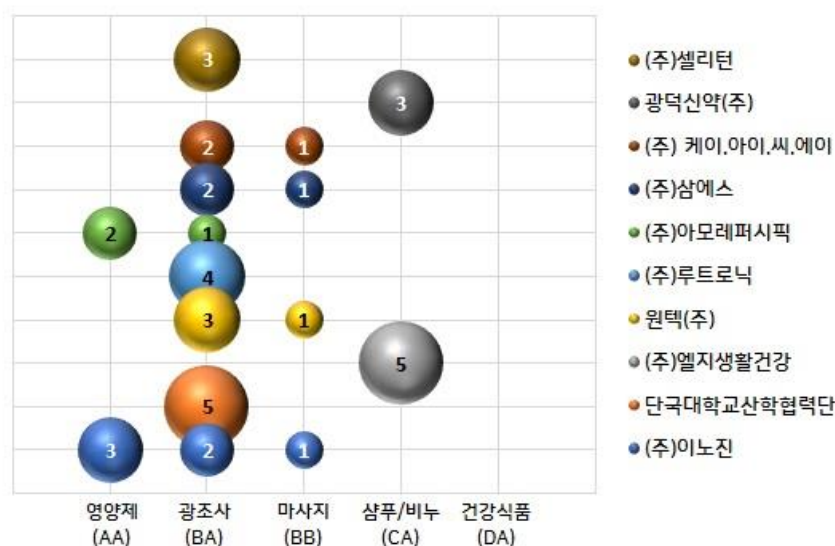
Note: (주)펜제노믹스: Pangenomics Co., Ltd., 장안한방식품(주): Jangan herb food Co., Ltd., 대한민국(농촌진흥청장): Republic of Korea(administrator of rural development administration), (주)한지: Hanji Co., Ltd., (주)하이모: Himo Co., Ltd., 건국대학교산학협력단: Konkuk university industry-academic co-operation foundation, 학교법인건국대학교 Konkuk university.

Examining the Top 7 major domestic applications for the hair loss prevention and improvement technology using health food, Konkuk University, a school corporation, filed the most applications with 2 cases, followed by Konkuk University Industry-Academic Cooperation Foundation, Himo Co., Ltd., and Hanji Co., Ltd. filing 1 case of patent each.

However, except for Konkuk University, the remainder of the applicants are filing 1 or less patent application, and given the nature of health food, it is a specialized field with difficult procedures such as obtaining an approval from the Ministry of Food and Drug Safety, and hence, it is identified that the patent activities are limited to the applicants closely related to the food or pharmaceutical industries.

3.4. Patent trends by the field of technology for major applicants

Figure 8. Patent trends by the field of technology for(top 10) major applicants for the hair loss prevention and improvement technologies.



Note: Nutritional supplement(AA), light irradiation(BA), massage(BB), shampoo and soap(CA), health food(DA), (주)셀리턴: Cellreturn Co., Ltd., 광덕신약(주) Gwangduk Co., Ltd., (주) 케이.아이.씨.에이: KICA Co., Ltd., (주)삼에스: 3S Co., Ltd., (주)아모레퍼시픽: Amore pacific Co., Ltd., (주)루트로닉: Lutronic Co., Ltd., 원텍(주): Wontech Co., Ltd., (주)엘지생활건강: LG household & health care Co., Ltd., 단국대학교산학협력단: Dankook university industry-academic, Coop eration foundation, (주)이노진: Innogene Co., Ltd.

Examining the patent trends by the field of technology for the Top 10 major domestic applicants, it turned out that the most patent activities were focused on specific fields of technology, while the patent activities have expanded to adjacent fields of technology(light irradiation and massage) of strong relevance.

In the case of Innogene Co., Ltd., which has applied for the most patents, in addition to scalp nutrition supply technology through the nutritional supplements, it is carrying out relatively even patent activities for the scalp stimulation technology through the light irradiation and massage, and in the case of Amore Pacific Co., Ltd., it turned out that the patent activities were carried out for the scalp nutrition supply technology and scalp stimulation technology through the light irradiation.

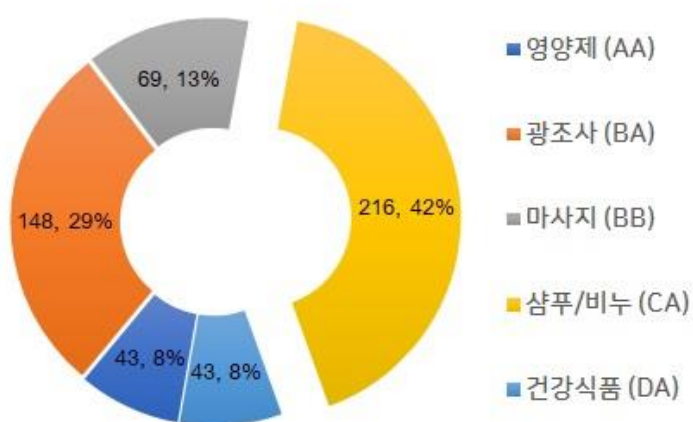
While large companies such as LG Household & Health Care Co. Ltd. and Amore Pacific Co., Ltd. are included among the Top 10 main applicants, the remainder are all small and medium sized enterprises, and even when examined by the specific field of technology, they are even more active than the large companies in terms of patent activities. Hence, as for the hair loss prevention and improvement technologies, the market is expected to be further subdivided into the SMEs based on technological prowess, thereby breaking away from the market operation system driven by the large companies.

As such, the hair loss prevention and improvement technology is expected to break away from the market operation system centered on large corporations and be segmented into small and medium-sized businesses based on technological prowess.

Furthermore, in the case of the nutritional supplements(AA field), massage(BB field), and the health food(DA field), which have relatively less patent activities vis-a-vis the light irradiation(BA field) and the shampoo/soap(CA field), steady technology development and certification acquisition measures have been in place, and it is determined that the possibility of their becoming a leader in the relevant fields of technology is very high.

3.5. Weight of patent application by the field of technology

Figure 9. Weight of patent applications by field of technology for all applicants for the hair loss prevention and improvement technologies.



Note: 영양제(AA)Nutritional supplement, 광조사(BA)light irradiation, 마사지(BB)massage, 샴푸/비누(CA)shampoo and soap, 건강식품(DA)health food.

Examining the weight of the applicants for the hair loss prevention and improvement technology by the field of technology, the shampoo and soap related technologies account for 42% of the total applications, yielding that the patent activities are very strong compared to other fields of technology.

The light irradiation related technology accounted for 29% of the applications, and it turned out that in the same field of scalp stimulation, patent activities were more than twice that of the massage related technology(13%). Furthermore, the light irradiation technology has maintained steady patent activities since the 2010s, and since the mid-2010s, the patent activities have been even stronger than the massage technology, which is in the trend of increasing patent activities, and hence, it is expected that the research and development and patent applications related to the scalp stimulation will continue to increase in the future.

In addition, the technologies related to the nutritional supplements and health food accounted for 8% each, and the patent activities were relatively less compared to the other fields of technology. In the field of health food, patent activities have been on the decline since the mid-2010s, while in the field of nutritional supplements, patent activities have increased significantly since the late 2010s, and hence, the moving forward, the field of nutritional supplements is also expected to demonstrate a continuous increase in the patent applications based on the active research and development activities.

4. Conclusion

This study targeted the patents related to the hair loss prevention and improvement(including utility models) gathered until January 20, 2021, which are included in the databases of KIPRIS, a free of charge DB and KEYWERT, a paid for DB, while the results of analyzing the patent trends by year, major applicant, and field of technology are as follows.

First, as a result of examining the patent trends by year, hair loss prevention and improvement technologies showed an increasing trend from 1992 to the late 2000s, and the largest number of applications were made in 2008 with 38 cases. Although there was a brief pause, from the mid-2010s onwards, patent activity showed a trend of increasing again.

Second, as a result of examining the patent trends of the top major applicants who applied in Korea, Innogene Co., Ltd. applied for 6 cases and was ranked first for the multiple applications, followed by Dankook University Industry-University Cooperation Foundation and LG Household & Health Care Co., Ltd. with 5 cases field each, and Wontech Co., Ltd., and Lutronic Co., Ltd. for 4 patents each.

Among which, Innogene Co., Ltd. turned out to be active for the patent activities mainly for the nutritional supplements(AA field), and was relatively active for the patent activities related to the scalp stimulation(BA field) and massage(BB field) technology as well.

Third, as a result of examining the patent trends by the field of technology, the patent activities are focused on shampoo and soap(CA field) technologies, followed by the light irradiation(BA field) technology and the massage(BB field) technology. However, the nutritional supplement(AA field) and health food(DA field) technologies turned out to be relatively less active for the patent activities.

However, the patent activities for the nutritional supplement(AA field) technology has gradually increased since the late 2010s, and the light irradiation(BA field) and massage(BB field) technologies have also maintained strong patent activities for the past 5 years, and hence, it is determined that there is a high possibility for active research and development activities for such fields of technology moving forward.

As a result of analyzing the patent trends for the hair loss prevention and improvement technology via this study, since the related market size has consistently grown along with the increase in the population of hair loss, the research and development activities for the related technologies have also been actively carried out. However, since the patent activities are focused on some areas which are easy for the consumers to access, such as shampoo and soap, it seems that it will be necessary to expand the foundation of the hair loss related market, and in order to maintain the market revitalized, it seems that the research and development activities ought to be focused on the scalp nutrition supply and scalp stimulation technologies, where relatively less patent activities have been seen.

5. References

5.1. Journal articles

- [3] Kim J & Lee J. Direction of Smart Healthcare Utilization in Korea's Non-medical Healthcare Service Area. *Regulations*, 6(2), 34-43 (2021). [\[Article\]](#)
- [4] Kim MJ & Kim JH. A Study on the Recognition and Worm by the Fact-finding of the Fashion Wigs - Middle Aged Women Centered-. *Journal of the Science of Alternative Medicine*, 2(2), 31-31 (2013).
- [5] Kim M & Cheon W & Lim W. A Study on the Improvement Plan of the Creation and Management of Healing Forests. *International Journal of Human & Disaster*, 6(2), 31-38 (2021). [\[Article\]](#)
- [6] Lee J & Choi J & Yeom J. Analysis of Properties of Deconstruction & Hair Expression Components in Maison Margiela Collection. *Public Value*, 6(1), 38-50 (2021). [\[Article\]](#)
- [7] Kim S & Lee J & Na E. Q-methodological Approach to the Perception of Meridian Massage for Health Management. *International Journal of Crisis & Safety*, 5(2), 47-54 (2020). [\[Article\]](#)
- [8] Lee J & Kim T. Exploring the Effectiveness and Utilization of Terahertz Waves for the Protection of Human Body. *Protection Convergence*, 6(1), 41-49 (2021). [\[Article\]](#)
- [9] Park S & Choi J. A Study on Military Makeup Design with Camouflage Characteristics during Crisis. *International Journal of Crisis & Safety*, 6(2), 19-27 (2021). [\[Article\]](#)

- [10] Yeon J & Choi J & Lee J. Color Reproduction with Drag Queen and Makeup Protection. *Protection Convergence*, 6(1), 33-40 (2021). [\[Article\]](#)
- [11] Baek S & Choi J. A Study on the Design of Art Mask based on Traditional Korean Patterns and Obang Color in Modern Society. *Public Value*, 6(2), 45-51 (2021). [\[Article\]](#)
- [12] Kim N & Choi J & Baek S. A Study on the Nail Art Design of Andy Warhol's Works to Protect Human Nail Disaster. *International Journal of Human & Disaster*, 6(1), 36-44 (2021). [\[Article\]](#)
- [13] We H & Lee J & Kim E. Exploring the Experience of Job Convergence Change in the Beauty and Health Industry Using Grounded Theory. *Protection Convergence*, 5(2), 84-93 (2020). [\[Article\]](#)

5.2. Thesis degree

- [1] Shin MH. A Study of the Effect on the Wig Preference by People with Oily Scalp. Chung-ang University, Master's Thesis (2011).
- [2] Jang SM & Loss H. Its Treatments and the Research by Cosmetological Approach for the Use of Wigs. Daegu University, Master's Thesis (2006).

6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Lead Author	YK	<ul style="list-style-type: none"> -Set of concepts <input checked="" type="checkbox"/> -Design <input checked="" type="checkbox"/> -Getting results <input checked="" type="checkbox"/> -Analysis <input checked="" type="checkbox"/> -Make a significant contribution to collection <input checked="" type="checkbox"/> -Final approval of the paper <input checked="" type="checkbox"/> -Corresponding <input checked="" type="checkbox"/>
Corresponding Author*	SL	<ul style="list-style-type: none"> -Play a decisive role in modification <input checked="" type="checkbox"/> -Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

Robotics & AI Ethics

Publisher: J-INSTITUTE
ISSN: 2435-3345

Website: j-institute.org
Editor: admin@j-institute.org

Corresponding author*
E-mail: hoho6173@naver.com

DOI Address:
dx.doi.org/10.22471/ai.2021.6.3.43

© 2021 J-INSTITUTE

Impact of “The Online League of Legends (LoL) GAME School” Program on the COVID-19 Education Crisis: Focusing on Korean Students’ Affective Domain

Junghye Fran Choi¹

Cyber University of Korea, Seoul, Republic of Korea

Seungho Bang^{2*}

Seoul Metropolitan Office of Education’s Student Education Research Institute, Seoul, Republic of Korea

Abstract

Purpose: This study aims to discover the changes made to the affective domain of the students who participated in “the Online League of Legends(LoL) Game School” program during the COVID-19 education crisis. The program was conducted by the Seoul Metropolitan Office of Education’s Student Education Institute from August 2020 to July 2021 for elementary school students(fifth grade onward) to juniors in high schools in Seoul. The program consisted of game English, game science, game humanities, game writing, game-related songs, game music composition, game analysis and game strategies about the online game League of Legends, and adventure-based counseling(ABC) activities.

Method: Twenty-nine students participated in the survey to determine positive and negative affections, intrinsic motivation, and the most interesting and challenging activities. The PANAS scale was used to find out whether participants had positive or negative affections about the program. This survey was highly reliable, and the questionnaires were scored on a 7-point Likert scale each. To examine the students’ intrinsic motivation, four intrinsic motivation factors were selected: pleasure, flow, challenge, and growth potential. The participants described the most interesting and challenging activities of the Online LoL Game School program with the help of open-ended questions.

Results: The participants had strong positive affections for the program(PA: 5.3928) instead of negative affections(NA: 1.9598), and experienced “flow”(5.26) the most among the four factors. Also, the most interesting and challenging activity of the program was game English.

Conclusion: These study findings revealed that 1)the students had positive affections about the Online LoL Game School program, 2)among the four intrinsic motivation factors, pleasure, flow, challenge, and growth potential, the students experienced flow the most, 3)the most interesting and challenging activity was game English. This study uncovered that the Online Game School program influenced the students’ positive affections and intrinsic motivation. Online education programs related to games, in which many students showed interest, can be triggers for students to engage in active learning and reconsider their growth and future careers. The study findings and attempts can help create a positive school climate and bring about social change to provide Generation Z students with a pleasurable and meaningful learning experience.

[Keywords] League of Legends(LoL), Online Game School, Online Learning, Affective Domain, Korean Students

1. Introduction

The COVID-19 pandemic has caused a crisis in education. Schools have adopted blended learning situations that combine online and offline classes, and consequently, conflicts with parents have become more serious as students spend more time at home[1]. The prolonged outbreak has reduced the scope of outdoor activities for students and increased indoor activities, especially related to digital media. According to a pre-pandemic survey conducted by the

Ministry of Science and Information Communication Technology(ICT) in South Korea in 2019[2], 30.2% of teenagers aged 10 to 19 were found to be media-dependent. This situation is getting more severe in this Untact Era. According to a survey conducted by the Korea Youth Policy Institute in 2020[3], elementary school students primarily used YouTube(34.7%) and games(30.2%) on their mobile phones.

Before the pandemic, a game-like learning program was applied to game overflow high school students in Seoul in 2019[3]. Eight out of 13 students in the high-risk and the potential risk user group based on the youth Internet overuse self-diagnosis test have changed to the regular end user group after the program[3]. Based on these attempts, the Seoul Metropolitan Office of Education's Student Education Institute conducted a pilot program for online game overflow students at a middle school in Seoul[4]. It was observed that 96.6% of the students were satisfied with the program. The findings of the pilot program provided insights regarding the students' active participation and positive educational effects under the theme of "game." The results led to run *"the Online LoL Game School"* program by the Seoul Metropolitan Office of Education[5]. From August 2020 to July 2021, a total of eight programs were conducted for elementary school students(fifth grade onward) to juniors in high schools in Seoul. This study aims to discover the changes made to the affective domain of the students who participated in *"the Online LoL Game School"* program.

2. Research Background

2.1. Challenges associated with media usage due to COVID-19

The COVID-19 crisis has rapidly changed everyday life as well as the education ecosystem. The number of students with learning deficits has increased, and conflicts between parents and children regarding long-term media access at home has been severe[6][7]. According to a recent survey in Korea[8], middle school students mainly watched video clips(31%) and played games on mobile phones(20.5%), while singing and dancing(10.5%), exercising, and physical activities(8.1%) constituted a relatively small. These results suggest that excessive media access can cause a variety of physical and affective developmental problems for students in their growth. It can result in prolonged learning deficits because of reduced learning time[9]. Moreover, in 2020, the Seoul Institute for Education Policy announced a decrease in middle school students' Korean, math, and English academic performance levels in the middle-leveled students[10]. As the upper ranks increased, so did the lower ranks[10]. Based on the results, the Ministry of Education prepared a countermeasure related to the foundation education measures for the second semester of 2021[11]. To restore the students' academic performance, the plans will focus on supplementing the curriculum for a total of 2.03 million students[11]. This necessitates an examination of the outcomes of these attempts, which can cover learning deficits effectively and help the students enhance their academic performance by considering their intrinsic motivation.

Meanwhile, there has been a surge in conflicts between parents and children at home due to the media overuse during the pandemic[12]. With the rapid increase in media overflow among pre- and post-pandemic students, there is a growing need for realistic measures to guide children to use media wisely rather than prevent its use altogether[13]. There is a need to suggest a variety of leisure activities related to exploring their future careers rather than just engaging in media use[14]. Parents need to especially consider their children as digital natives, not digital immigrants, because parents' perspectives on media use, directly and indirectly, affects their children's behaviors and thoughts[15]. Above all, the biased views of games as harmful, violent, and negatively influencing children's affections is causing conflicts between parents and children[16].

The COVID-19 crisis has created an environment where people have simultaneously experienced media harms and benefits. Some claim that it is the right time to make more efforts to

understand the media's features and languages are for students, parents, and educational stakeholders. This is based on objectively understanding media as a part of media literacy[17]. Game is a form of media, and analyzing the traits and languages in games would help understand it objectively[18]. These attempts are referred to as game literacy, which requires students, parents, teachers, and education policymakers to reconsider game as a useful educational medium and find practically beneficial ways to use it[19][20].

2.2. Characteristics of the league of legends game

The League of Legends(LoL) game was developed by Riot Games in 2009 and is played by more than 100 million users worldwide including millions of users in Korea[21]. Korea, a leading country of e-sports has adopted the LoL game as an e-sports event[22], and a lot of teenagers around the world enjoy the game[23]. LoL is a game in which 5 players use various strategies and weapons as a team to occupy the opposing team's camp, and the entire team must utilize the individual team members' abilities to win the game[24]. According to Kim et al.[25], individual competence cannot lead to victory, and teamwork based on interaction and communication between team members is the most significant factor for winning the game. There are five positions of the LoL game players in a team: top, jungle, mid, bottom, and supporter. Depending on the points, more than 150 characters can be developed. The fun elements of the LoL game include satisfaction, fulfillment, and social networking by co-working. These fun elements greatly appeal to teenagers because they can experience a fun through the game that is hard to find in their busy lives[26].

2.3. Online LoL game school program

The Seoul Metropolitan Office of Education's Student Education Institute conducted *the Online LoL Game School* program to contribute to the students' healthy play culture and to improve basic learning skills related to the curriculum during the pandemic[27]. Moreover, *the LoL game school* invited professional gamers and e-sports experts to provide opportunities to actively explore the students' prospects of building a future careers in games[28].

The Online LoL Game School was conducted based on the students' high satisfaction with the pilot program at a middle school in Seoul. It was conducted as a real-time online class using Zoom, a web conferencing tool, for fifth grade elementary school students to juniors in high school interested in games, especially LoL. This program was announced in the home newsletter of public elementary, middle, and high schools in Seoul. Considering the pandemic situation, the participants were allowed to access the online classes from home. In 2020, a total of four game schools were opened, and each session had four classes. One thousand five hundred students participated in the game school program in 2020. Four schools were held, and a total of 703 students participated in 2021. Eight classes were held per session for one and a half hours each.

The school was run by education researchers, dispatched teachers, and training instructors responsible for managing the students, communicating with students and parents, and designing learning contents. Game experts taught game analysis and game strategies, and were in charge of recruiting professional e-sports players. Game English and game science were taught by field teachers at a middle school in Seoul.

The Online LoL Game School program included game English, game science, game humanities, game writing, adventure based counseling(ABC) activities, and game strategy related to the LoL game. It also consisted of game music activities to help express the students' feelings related to the games, sing game-related songs and compose game songs. Each class consisted of 10 minutes each of game English, game science, game humanities, game writing, and ABC activities or game music along with 40 minutes of LoL game analysis and game strategies. In addition, ABC activities and game music sessions were held in the class of students' choice using Zoom's small room function. Game experts provided game-related consultations such as analysis of students' game strategies. This program also provided ABC activities for positive thinking and building

positive relationship with team players. After the online class, the students uploaded assignments and communicated with the instructors using the web community "Inner Quarantine" Naver Café.

The purpose of this study was to investigate the effects of the *Online LoL Game School* on the affective domain of the participating students. In the field of education, the affective domain of the learners increases interest in learning and helps learning in the cognitive domain, and the affective characteristics, such as interest, motivation, and attitude toward the subject, enable the learner to focus on learning[15]. In addition, since the affective area obtained as a result of learning also acts as an important factor in social life, it is necessary to meaningfully examine the affective domain when measuring the educational effect. Therefore, the aim of this study was to discover whether the participating students had positive or negative affections about the *Online LoL Game School* program and find out which intrinsic motivation factors were affected.

3. Methodology

3.1. Participants

There were 29 participants in total in this study. By grade, there were 10 elementary school students in fifth grade, 10 elementary school students in sixth grade, three middle school students in the first grade, three in second grade, and one in the third grade, and finally one high school student in first and second grade each. Ten students participated in the first school, eight were in the second school, two in the third school, and nine in the fourth school in 2021.

3.2. Research methods

3.2.1. Survey using PANAS scales

The Positive Affection Negative Affection Scale(PANAS) was used to identify the affective domains of the students who participated in *the Online LoL Game School*. The PANAS is known as a reliable scale used worldwide to measure affections[29]. The PANAS used to analyze the learner-defined effectiveness of this program was investigated in two factorial structures: the positive affection and the negative affection for the experience. Based on "Development and Validation of Brief Measures of Positive and Negative Affect: The PANAS Scales"[30], a total of 16 questions were modified for this study and examined with a 7-point Likert scale <Table 1>.

Table 1. Configuration of the PANAS Scale.

Positive affection(PA)		Negative affection(NA)	
1. Fun	5. Easy	1. Worried	5. Difficult
2. Happy	6. Exciting	2. Unstable	6. Depressed
3. Proud	7. Interesting	3. Frustrated	7. Shy
4. Good	8. Active	4. Tough	8. Lonely

3.2.2. Survey on the students' intrinsic motivation

Motivation is a factor for predicting human behavior, which is divided into extrinsic motivation and intrinsic motivation[31]. External motivation is given in an external environment and focuses on purpose-oriented reasons such as the rewards and benefits gained when performing a particular action[31]. Intrinsic motivation arises from the actions themselves, rewarding, pleasing, fulfilling, contented, confident, and spontaneous needs[32][33][34]. Intrinsic motivation is a meaningful indicator of sustainable growth as it can produce more positive results from

a long-term perspective when performing a task[33]. In particular, intrinsic motivation in learning experiences promotes growth with satisfaction in the learning process rather than just results, leading to positive outcomes[32][34].

Specifically, this study delved into the educational effectiveness of students' affective domain by examining the intrinsic motivations experienced by the students in *the Online LoL Game School* program. Four factors were selected to analyze intrinsic motivation: pleasure, flow, challenge, and growth potential. A total of 14 questionnaires were developed on a 7-point Likert scale. The questionnaires consisted of pleasure(three questions), flow(three questions), challenge(three questions), and growth potential(five questions). The survey of intrinsic motivation is also highly reliable($\alpha=.870$, $M=5.12$, $SD=2.10$).

3.2.3. Open-ended questions regarding students' preferences

Students who participated in this study were asked to describe the most interesting and the most challenging activities of *the Online LoL Game School* program, and give reasons for their choice. This study investigated what kinds of activities students preferred and why.

4. Research Results

4.1. Results of the affective domain for using PANAS scale

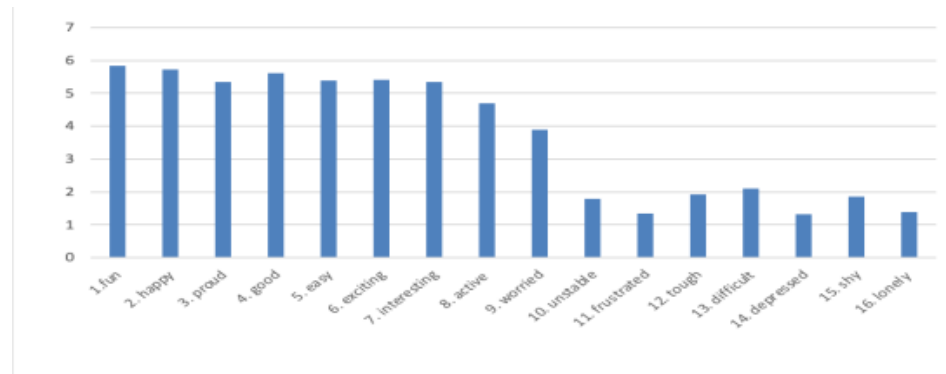
The PANAS scale was used to determine whether participants had positive or negative affections about *the Online LoL Game School* program. The Cronbach Alpha Coefficient was identified to verify the reliability of the survey from the subject's perspective. If this coefficient is 0.7 or higher, it is a highly reliable survey[35]. The survey on the PANAS scale showed a high reliability of 0.805 for 16 items. The results of the PANAS scale for *the LoL game schools* program showed that the positive affection(PA) was 5.3928 and the negative affection(NA) was 1.9598 out of 7 points <Table 2>.

Table 2. Results of analysis with the PANAS scale.

LoL game school program	Frequency	Min.	Max.	M	SD	Reliability cronbach's alpha value
PA	29	4.7857	5.7857	5.3928	1.8756	.805
NA		3.8214	1.3214	1.9598	1.1795	
Effective no.						

The participants had strong positive affections for the program(PA: 5.3928) rather than negative affections(NA: 1.9598). They associated this program with fun, happiness, pride, goodness, ease, excitement, interest, and activity. Among the negative affections(such as worried, unstable, frustrated, tough, difficult, depressed, shy, and lonely), it turned out that "worried"(NA: 3.8214) was stronger than the rest <Figure 1>.

Figure 1. Results of analysis with the PANAS scale.



4.2. Results of the students' intrinsic motivation toward the program

The results of students' intrinsic motivations for *the Online LoL Game School* program are as follows. Among the four factors, which included pleasure, flow, challenge, and growth potential, participants experienced "flow"(5.26) the most. They answered that they experienced it in the following order: flow(5.26), pleasure(5.22), challenge(5.09), and growth potential(4.91) <Table 3>.

Table 3. Results of intrinsic motivation.

Intrinsic motivation factors	Pleasure	Flow	Challenge	Growth potential
M	5.22	5.26	5.09	4.91
SD	2.13	2.17	2.09	2.02

4.3. Results of open-ended questions about the program

The program's most interesting activities were game English, and game song-making, and adventure-based game activities in that order. In addition, game humanities, game terminology learning, game operations, Q&A with professional gamers, and game science tied for fourth-ranked. The students responded that aforementioned activities were interesting, informative, and easy to understand. Game English was the most challenging activity in this program. The students mentioned that they felt that game English was challenging because they did not like English itself. The students also considered assignments, game strategies, learning game terms and knowledge, and game humanities challenging.

5. Discussion and educational implications

The following findings were identified through this survey:

- Participating students had positive affections about *the Online LoL Game School* program.
- Among the intrinsic motivation factors, the students answered that they experienced flow the most followed by pleasure, challenge, and growth potential.
- The most interesting and the most challenging activity was game English.

These results represented that *the Online LoL Game School* programs can provide positive affections to the students in the current educational crisis caused by the COVID-19 pandemic. Also, the students had a strong sense of the intrinsic motivation including flow, pleasure, challenge, and growth potential in that order. The program provided various educational contents based on the theme of the LoL game in which the participants were interested. It is necessary to develop the game English curriculum, considering its learning effectiveness.

This study's result cannot be generalized because of the small sample size. However, the educational implications reveal that the program, which consists of various educational contents under the overarching theme of the LoL game, contributed to students' pleasurable and meaningful learning experiences. Game-related educational content can be a trigger for students to learn more and to reconsider their growth and future careers. Largely, it is not easy to be triggered by other attempts in short periods. This study provides the insights that real-time online education programs based on games can have a positive effect on students from different grades and different schools in the public education sites.

In particular, the study found that games, which are often perceived as a hindrance to study, can be useful and beneficial educational tools to influence positive affections for students in the public education sector. This approach can also be applied to other educational environments around the world during the pandemic. More programs need to be developed based on the research findings for further studies. The study findings and attempts can help create a positive school climate and bring social change to provide Generation Z students with a pleasurable and meaningful learning experience.

6. References

6.1. Journal articles

- [1] Choi J & Oh S & Cho M. University Students' Learning Behavior, Online Learning Satisfaction, University Satisfaction, and Emotional Difficulties according to ADHD Tendencies and Gender in Covid-19 Crisis. *International Journal of Crisis & Safety*, 6(1), 51-67 (2021). [\[Article\]](#)
- [2] Lee SJ & Choi MJ & Rho MJ & Kim DJ & Choi IY. Corrigendum: Factors Affecting User Acceptance in Over Use of Smartphones in Mobile Health Services: An Empirical Study Testing a Modified Integrated Model in South Korea. *Frontiers in Psychiatry*, 10, 259-259 (2019).
- [6] Son HM & Choi WH & Hwang YH & Yang HR. The Lived Experiences of Covid-19 Patients in South Korea: A Qualitative Study. *International Journal of Environmental Research and Public Health*, 18(14), 7419-7419 (2021).
- [7] Choi JB. Instructor Competency for Innovative Teaching Methods in the Untact Era. *International Journal of Robotics & AI Ethics*, 5(2), 50-56 (2020). [\[Article\]](#)
- [8] Byeon SJ. Analysis of Media Literacy Education Performance Patterns and Perceptions of Elementary, Middle and High School Teachers. *Journal of Learner-centered Curriculum and Instruction*, 21(13), 149-167 (2021).
- [9] Choi JF & Choi JB. Development of Gamification Model for Flipped Learning. *International Journal of Crisis & Safety*, 6(2), 68-79 (2021). [\[Article\]](#)
- [12] Yoo C & Kim Y & Sohn JH. Evaluating the Social Cost of Conflict between New Media and Society: The Case of Gaming Disorder in South Korea. *Sustainability*, 13(14), 8106-8106 (2021).
- [13] Choi JB. Development of Program Model for Improving Intrapersonal Intelligence based on Flipped Learning. *International Journal of Human & Disaster*, 6(1), 16-25 (2021). [\[Article\]](#)
- [14] Kang YD. A Design on Teaching and Learning Method for Creative Talent in the Fourth Industrial Revolution. *International Journal of Human & Disaster*, 5(1), 1-9 (2020). [\[Article\]](#)
- [15] Lee SY & Park JH & Choi JF. Psychological Effects of Gamification on Young Learners: Focusing on a Serious Game for English Phoneme Discrimination. *Journal of Korea Game Society*, 19(2), 111-122 (2019).

- [16] Purnama S & Ulfah M & Machali I & Wibowo A & Narmaditya BS. Does Digital Literacy Influence Students' Online Risk? Evidence from Covid-19. *Heliyon*, 7(6), 1-6 (2021).
- [17] Choi JF. Gamification in Smart Learning Design to Enhance Speaking Skills for EFL Young Learners. *Journal of Korea Game Society*, 16(3), 7-16 (2016).
- [18] Lee SY & Choi JH & Park JH & Sung MJ. An ERP Study on the Digital Game-based Learning of English Phoneme Discrimination by EFL Children in Korea. *Multimedia-assisted Language Learning*, 22(2), 50-69 (2019).
- [22] Kim YH & Nauright J & Suveatwatanakul C. The Rise of E-sports and Potential for Post-covid Continued Growth. *Sport in Society*, 23(11), 1861-1871 (2020).
- [23] Mora-Cantalops M & Sicilia MÁ. Team Efficiency and Network Structure: The Case of Professional League of Legends. *Social Networks*, 58, 105-115 (2019).
- [24] Mora-Cantalops M & Sicilia MÁ. Exploring Player Experience in Ranked League of Legend. *Behaviour & Information Technology*, 37(12), 1224-1236 (2018).
- [26] Davidovici-Nora M. E-sport as Leverage for Growth Strategy: The Example of League of Legends. *International Journal of Gaming and Computer-mediated Simulations*, 9(2), 33-46 (2017).
- [29] Harmon-Jones E & Harmon-Jones C. On Defining Positive Affect(PA): Considering Attitudes toward Emotions, Measures of PA, and Approach Motivation. *Current Opinion in Behavioral Sciences*, 39, 46-51 (2021).
- [30] Watson D & Clark LA & Tellegen A. Development and Validation of Brief Measures of Positive and Negative Affect: The Panas Scales. *Journal of Personality and Social Psychology*, 54(6), 1063-1063 (1988).
- [31] Schunk DH & DiBenedetto MK. Motivation and Social Cognitive Theory. *Contemporary Educational Psychology*, 60, 1-10 (2020).
- [32] Di Domenico SI & Ryan RM. The Emerging Neuroscience of Intrinsic Motivation: A New Frontier in Self-determination Research. *Frontiers in Human Neuroscience*, 11, 145-145 (2017).
- [33] Fischer C & Malycha CP & Schafmann E. The Influence of Intrinsic Motivation and Synergistic Extrinsic Motivators on Creativity and Innovation. *Frontiers in Psychology*, 10, 137-137 (2019).
- [34] Eckes A & Großmann N & Wilde M. Studies on the Effects of Structure in the Context of Autonomy-supportive or Controlling Teacher Behavior on Students' Intrinsic Motivation. *Learning and Individual Differences*, 62, 69-78 (2018).
- [35] De Vet HC & Mokkink LB & Mosmuller DG & Terwee CB. Spearman-brown Prophecy Formula and Cronbach's Alpha: Different Faces of Reliability and Opportunities for New Applications. *Journal of Clinical Epidemiology*, 85, 45-49 (2017).

6.2. Books

- [3] Bang S. Students Who are into Games. Sang Sang Chanel (2017).
- [19] Korea Game Society. Game! Dream the Infinite Evolution. Hongreung Science (2018).
- [20] Game Culture Forum. Game is Game: Game X Positive Function. Korea Creative Content Agency (2021).

6.3. Conference proceedings

- [21] Kou Y & Gui X. Emotion Regulation in eSports Gaming: A Qualitative Study of League of Legends. The ACM on Human-computer Interaction Conference (2020).
- [25] Kim YJ & Engel D & Woolley AW & Lin JYT & McArthur N & Malone TW. What Makes a Strong Team? Using Collective Intelligence to Predict Team Performance in League of Legends. The 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (2017).

6.4. Additional references

- [4] <https://enews.sen.go.kr/> (2020).
- [5] <https://www.mk.co.kr/> (2020).
- [10] <https://www.serii.re.kr/> (2021).

- [11] <https://enews.sen.go.kr/> (2020).
 [27] <https://www.insight.co.kr/> (2020).
 [28] <https://www.seoul.co.kr/> (2021).

7. Appendix

7.1 Authors contribution

	Initial name	Contribution
Lead Author	JFC	-Set of concepts <input checked="" type="checkbox"/> -Design <input checked="" type="checkbox"/> -Getting results <input checked="" type="checkbox"/> -Analysis <input checked="" type="checkbox"/> -Make a significant contribution to collection <input checked="" type="checkbox"/> -Final approval of the paper <input checked="" type="checkbox"/> -Corresponding <input checked="" type="checkbox"/> -Play a decisive role in modification <input checked="" type="checkbox"/>
Corresponding Author*	SB	-Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

Robotics & AI Ethics

Publisher: J-INSTITUTE
ISSN: 2435-3345

Website: j-institute.org
Editor: admin@j-institute.org

Corresponding author*
E-mail: allee@cku.ac.kr

DOI Address:
dx.doi.org/10.22471/ai.2021.6.3.52

© 2021 J-INSTITUTE

The Effect of ARTIFICIAL INTELLIGENCE Literacy Education on University Students' Ethical Consciousness of Artificial Intelligence

Aeri Lee

Catholic Kwandong University, Gangneung, Republic of Korea

Abstract

Purpose: As a core technology of the 4th industrial revolution, artificial intelligence is rising as a crucial technology for determining the competitiveness of nations and industries at a great pace. However, students who are not majoring in it have the tendency to perceive AI technology to be difficult, and hence, a more efficient AI education is needed. The purpose of this study is to present an educational program for the artificial intelligence literacy appropriate for the learner's level, apply it to the classroom, then explore its impact in terms of the artificial intelligence ethics.

Method: In this study, an educational program for the artificial intelligence literacy which may be utilized for the non-majors using the tools of artificial intelligence has been designed. To analyze the impact of the educational program conducted in this study on the learner's perception of the artificial intelligence ethics, the single group pre- and post-test which infers the causal relationship by implementing and analyzing the questionnaires on the changed perception of the artificial intelligence ethics before and after the application of the program was applied for the design method.

Results: The impact of the education program for the artificial intelligence literacy on the perception of the artificial intelligence ethics has been analyzed through the single group's pre- and post-test by operating this program. As a result of the analysis, it has been verified that there was a positive change in the perception of the artificial intelligence ethics via the proposed educational program for the artificial intelligence literacy.

Conclusion: In this study the impact of the educational program for the artificial intelligence literacy on the learner's perception of the artificial intelligence ethics has been analyzed by proposing and applying educational program for the artificial intelligence literacy for and in college and university liberal arts classes for the non-majors. The artificial intelligence literacy education has had a positive impact on the learner's perception of the artificial intelligence ethics. For the non-major students to fully comprehend the artificial intelligence, including the artificial intelligence ethics, an education which includes experience in the use of artificial intelligence ought to be offered beyond the classes of theory which merely convey knowledge, and towards this end, it was verified that a well structured artificial intelligence literacy education which can more than adequately offer the experiences of using and utilizing the artificial intelligence is necessary.

[Keywords] Artificial Intelligence, AI Education, Education Model, AI Literacy, Artificial Intelligence Ethics

1. Introduction

Artificial intelligence is a key technology in the fourth industrial revolution, and it is predicted that it will change the social, economic, industrial structure, working environment, and the way of life of individuals. Artificial intelligence is considered to be a key technology that will lead to innovative changes in the industrial structure beyond just new technologies, and accordingly, there is a growing demand for reinforcement of curriculum in response to future changes [1][2].

In line with this trend, the Ministry of Education announced "a comprehensive plan for information education: 2020-2024"[3] to develop information and AI capabilities, create a foundation for next-generation education, and create information education for all." The plan aims to "information education to develop everyone's AI capabilities." It also plans to strengthen future competency education, create a foundation for next-generation education, and create ecosystems and cultures to foster talent in artificial intelligence and high-tech fields and foster future talent to lead a rapidly changing society. As the importance of artificial intelligence increases, various policies are being implemented to foster talented people with artificial intelligence capabilities[3][4].

As the need for artificial intelligence emerges, the perspective and direction of education should be fundamentally changed. The education so far has been about the ability to use technology and possession of information, but now it is time to move on to develop the capabilities of intelligent information society through education that enables "combined use of technologies" and "sharing and expansion of information"[5][6].

Advances in technology require constant human adaptation. Adapting to the development of technology has always been a task given to humans in that it is an adaptation to acquire convenience through the use of technology and to use it to lead the world anew. This change in the world requires greater adaptation in education, which requires the training of talented people to prepare for the future and lead. Education has always adapted sensitively to technology in terms of not just being a user, but having to study technology to apply new technology and predict the future it will create[7].

In the era of artificial intelligence, education on artificial intelligence can be thought of as learning AI technology itself and developing the power to understand the times that will change due to AI and to predict the future. This is in line with artificial intelligence literacy, which emphasizes understanding of artificial intelligence, utilization of artificial intelligence, and ethics in that it develops the ability to use artificial intelligence technology to solve problems. Artificial intelligence literacy refers to the ability to understand and utilize artificial intelligence with an ethical attitude in preparation for a future society that will necessarily coexist with artificial intelligence[8]. Artificial intelligence literacy means the ability to understand and utilize artificial intelligence with an ethical attitude in preparation for a future society that will necessarily co-exist with artificial intelligence. Therefore, the effectiveness of AI literacy education can also be confirmed through changes in the ethical attitude of AI.

Currently, there are many studies on artificial intelligence education that develop artificial intelligence education programs and check their effectiveness[9]. Kim & Mun's work found that papers dealing with the educational utilization of AI since 2016 tend to increase[10]. Reflecting this, research on AI education has been actively conducted from elementary education. Kim K & Park Y presented a step-by-step model of AI education for elementary school students[11]. Lee Y analyzed the impact of AI training programs using Machine Learning for Kids, an AI education tool, and Scratch, a block-type programming language, on elementary students' AI skills attitudes[12]. Lee S developed and applied an artificial intelligence education program based on the design thinking process and analyzed the effect on learners' perception of artificial intelligence values and sense of efficacy[13]. It can be seen that research is actively underway to develop AI education contents and programs and to verify their effectiveness by applying them to actual classes of elementary, middle, and high schools.

However, research on AI for undergraduate students for a college education is insufficient compared to research on elementary, middle, and high schools. Kim H & Jun S proposed the need for the operation of AI-based liberal arts courses with access to non-technical classes[14]. Jun S developed an experiential learning-based AI education program for non-technical students[15]. Oh K & Kim H conducted a study to verify the effectiveness of AI by analyzing learners' attitudes toward AI after running liberal arts courses to enable AI-interested learners to learn big data that is interrelated with AI[16].

Artificial intelligence technologies have difficulty in learning in a short period of time or having proficiency. There are also many difficulties in developing educational programs by organizing AI technologies that are industrially focused. In particular, the need for learning optimized for understanding artificial intelligence is very high, but research on artificial intelligence curriculum as a liberal arts education for college students with little experience and knowledge of artificial intelligence is very urgent[17]. Therefore, the composition and development of educational programs to easily understand the concepts and algorithms that are fundamental to artificial intelligence and to have knowledge of the core contents are very necessary factors in fostering artificial intelligence talent[15][18].

Thus, this study proposes artificial intelligence literacy education that is suitable for the learner level who can understand and utilize artificial intelligence with ethical attitudes in preparation for future societies that will necessarily coexist with artificial intelligence. Through this, it is possible to operate an artificial intelligence literacy education program that can be used for non-majors to guide learners in the direction of artificial intelligence learning, away from vague fears of artificial intelligence. Afterward, the effectiveness will be analyzed through the influence of artificial intelligence ethics and the direction of education for artificial intelligence will be presented[19].

2. Theoretical Background

"Literacy" is defined as "the ability to read and write" in a dictionary. Here, it is used in combination with new information, digital, ICT, etc. as technology advances[20]. According to the trend of the "Artificial Intelligence Age" in which anyone can use artificial intelligence in their daily lives, artificial intelligence literacy, which includes social participation such as understanding and utilizing artificial intelligence and communicating with people in society through this technology, is required. It is a necessary competency for students who will live in coexistence with artificial intelligence in future society.

Lee C defined "artificial intelligence literacy" as "the ability to understand the basic concepts and principles of artificial intelligence, utilize artificial intelligence tools, and produce results using data and artificial intelligence technology for problem solving purposes[21]. The Busan Office of Education explained "Artificial Intelligence Literacy" as "a practical ability to solve problems through the process of managing, utilizing, and organizing AI-related technologies and data with ethical attitudes and performing daily life as a necessary part of the AI era" [22][23].

Table 1. Sub-elements of artificial intelligence literacy[21].

Sub-elements	Content
AI basic knowledge	Ability to explain concepts and functions of key technologies such as AI and machine learning
Ability to leverage AI	Ability to apply AI tools to solve problems in one's life
AI development capabilities	Ability to use AI technology and data to produce results such as learning models needed to solve problems
AI ethics and values	Attitudes to have moral values and ethics in the use and development of AI technology and to take responsibility for the consequences

In other words, artificial intelligence literacy means the ability to understand and utilize artificial intelligence with an ethical attitude in preparation for a future society that will necessarily coexist with artificial intelligence[24].

Understanding and utilizing artificial intelligence is understanding artificial intelligence technologies that learn and predict information by understanding and utilizing digital devices. It also includes implementing necessary coding and delivering ideas through it, and it also means making outputs and utilizing and applying artificial intelligence technologies in society [17][25].

Artificial intelligence literacy includes not only an understanding of the definition of artificial intelligence, but also an understanding of artificial intelligence technology, production, utilization and evaluation of artificial intelligence output, communication through artificial intelligence technology, and social participation. In order to prevent indiscriminate and inaccurate information absorption and the use of technology that has lost its purpose, education aimed at understanding, utilizing and applying the right technology, and improving AI literacy to achieve social participation with technology is essential [21][26].

3. Research Method

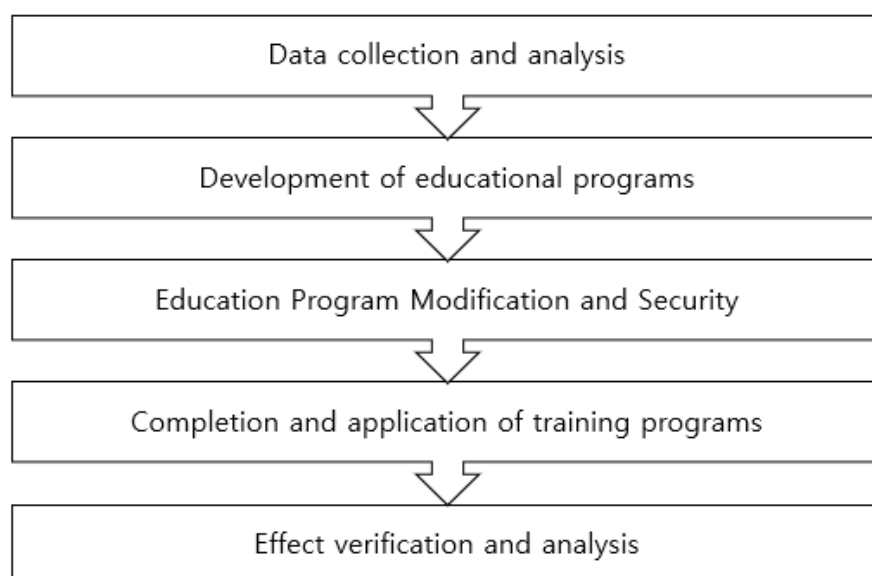
3.1. Research subjects

This study was conducted on 30 students of the "Artificial Intelligence and Coding" class, a liberal arts course at C University in Gangwon-do. They were all non-major students with no educational experience related to artificial intelligence (25 male and 15 female students).

3.2. Research procedures and designs

This study designed an artificial intelligence literacy education model for computer non-major students participating in the university's liberal arts curriculum. The development of programs for artificial intelligence literacy education was aimed at liberal arts classes for computer non-technical college students, and the research procedure was conducted as shown in <Figure 1>. We first analyzed the needs of artificial intelligence education through a prior study search for artificial intelligence literacy education and developed education programs by setting education contents and teaching methods. The program was consulted by experts related to artificial intelligence and computer education (two professors in computer education and two professors in software) to reflect the modifications and supplements, completed as a final education program, and verified its effectiveness.

Figure 1. Research procedure.



In this study, a one-group pretest-posttest design method was applied to analyze the effect of the developed AI literacy training program on the ethical consciousness of non-majors, which analyzes the changed dependent variables before and after application of the program to inferring causality (One-group pretest-posttest design).

This study was conducted in the following order for pre/post-analysis of AI ethics within a single group (N=40). 1) Conducting a preliminary survey; 2) conducting 15 sessions of the training program; 3) conducting a post-investigation. Here, AI literacy classes were conducted as independent variables.

3.3. Test tools

The test tools used in this study were used to suit the level of undergraduate students using "safety and reliability," "Responsibility & Public Responsibility," "data utilization and bias," and "transparency and explainability" as measures of change in AI ethics, referring to Kim G & Shin Y's AI ethics test tool and Bae's questionnaire. They were measured on the Likert 5-point scale [27][28]. The test tool consisted of 12 questions in all 3 per 4 subcategories, as shown in Table 2, which were measured on the Likert 5-point scale. The reliability of the test tool is set to Cronbach alpha 0.732.

Table 2. AI ethics awareness test tool questions.

Subcategories	Definition	Question number
Safety and reliability	Operations should be carried out to avoid harm to users, people involved in the use, and the environment, and to reduce unintended consequences and program operating errors, and to prepare and start preparations for controllability and against malfunction.	1, 5, 9
Responsibility & public responsibility	Assessment of artificial intelligence systems should be possible and responsibilities and accountabilities for all stakeholders and influences, including users, should be clear. Stakeholders include users, developers, researchers, and suppliers.	2, 6, 10
Data utilization and bias	Artificial intelligence systems should be available to everyone, regardless of age, gender, race, etc. and should be treated fairly and should not have unfair bias.	3, 7, 11
Transparency and explainability	Decisions by artificial intelligence systems must be understandable and traceable by humans, information related to risks shall be disclosed and shared, and the entire process of processing personal information should be made appropriately.	4, 8, 12
Total number of questions		12

To measure the effectiveness of AI literacy education programs, a response sample t-validation was conducted comparing the average of AI ethics before and after the class. SPSS 21 was used for analysis.

4. Research Findings and Discussions

4.1. Development and application of artificial intelligence literacy education programs

The proposed class model was applied to the "Artificial Intelligence and Coding" course, which was opened under the liberal arts of C University in South Korea. The target number is

30, and various students from the humanities and social studies major participated in the class. The training program was operated as shown in <Table 3> and consisted of contents for the understanding and utilization of artificial intelligence. The first period was designed with a total of 30 hours, a 15-week course consisting of two hours each class session.

The areas for each session were prepared based on the major subject of sub-elements of artificial intelligence literacy investigated in prior studies and were designed as learning contents accordingly.

Table 3. Artificial intelligence literacy education program.

AI Literacy areas	Session	Learning themes
AI basic knowledge	1	Understanding artificial intelligence, development process, and application of artificial intelligence
	2	Machine learning and learning method
	3	Artificial neural networks and perceptron deep learning
	4	The relationship between artificial intelligence dataset and predictions, decision trees
AI use	5	Understanding and utilizing artificial intelligence platforms
	6	Experiencing simple AI
	7	Natural language processing and artificial intelligence chatbot
Comprehensive	8	Mid-term exam
AI development	9	Text classification artificial intelligence project
	10	Image classification artificial intelligence project
	11	Number classification artificial intelligence project
	12	Pose classification artificial intelligence project
AI ethics and values	13	Data bias and artificial intelligence algorithms
	14	Positive and negative effects of moral machines and artificial intelligence technologies
Comprehensive	15	Presentation on artificial intelligence project development and social impact

This program covers basic knowledge areas of artificial intelligence from 1st to 4th week. Understand the basic concepts and characteristics of artificial intelligence, explore the various AI cases around it, understand the principles of AI's key technologies such as machine learning, artificial neural networks, deep learning, and data science, while also addressing ethical content about the risk of bias in data.

From the fifth week to the seventh week, students will be able to practice or experience artificial intelligence through the use of artificial intelligence platforms[29][30] where they can easily utilize artificial intelligence. They collect and prepare data. Students input data sets prepared like this through artificial intelligence platforms and train them to create artificial intelligence models themselves. It evaluates the performance of artificial intelligence models, adds data when the evaluation results are insufficient, and repeats the construction of artificial intelligence models. This process allows learners to identify real-world examples of data/algorithm bias and become aware of the importance of dataset. From Week 9 to Week 12, artificial intelligence project classes will be held as artificial intelligence development areas. Students generate artificial intelligence models through artificial intelligence platforms used in artificial

intelligence utilization areas, connect them to individual projects and produce various results through coding. In the course of Week 5 through Week 12, data and labels can be modified to different versions to produce and compare their results. Through this, the students can experience specific conditions where data bias and algorithm bias occur and experience major ethical issues of artificial intelligence. In Week 13 and Week 14, it covers areas of artificial intelligence ethics and values. Based on what the students have learned, developed, and experienced artificial intelligence models through AI platforms in previous areas, they will have time to organize major ethical issues of artificial intelligence and deal with the positive and negative influences of various artificial intelligence technologies. In the 15th week, they will develop an artificial intelligence project to create an artificial intelligence model and produce programs by setting topics that can be applied to actual problem situations. In addition, the summary and evaluation of later parts of the learning process are conducted by presenting it with an explanation of social influence.

4.2. Analysis of the effect of artificial intelligence literacy education on the ethical consciousness of artificial intelligence in college students

This study developed and applied artificial intelligence literacy education programs for non-major undergraduates to measure the degree of influence on students' artificial intelligence ethics. Artificial intelligence literacy means the ability to understand and utilize artificial intelligence with an ethical attitude as a preparation for a future society that will essentially coexist with artificial intelligence. Therefore, this study analyzed the effectiveness of artificial intelligence literacy education in terms of artificial intelligence ethics. <Table 4> represents the result of a change in AI ethics.

Table 4. AI ethics analysis result.

Factor		N	Mean	SD	t
Safety and reliability	Pre	30	2.61	.48	-11.95***
	Post	30	3.91	.22	
Responsibility & public responsibility	Pre	30	2.40	.50	-13.58***
	Post	30	3.74	.30	
Data utilization and bias	Pre	30	1.73	.48	-24.63***
	Post	30	4.03	.17	
Transparency and explainability	Pre	30	2.34	.44	-18.05***
	Post	30	3.67	.09	

Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

"Safety and reliability," "responsibility and publicity," "data utilization and bias," and "transparency explainability" all showed statistically significant differences with a significant probability of 0.000. Among the sub-elements of artificial intelligence ethics, the "data utilization and bias" part had the biggest difference before and after the class. This can be said to indicate that learners were more aware of after the class through practical hands-on experience in the areas of data utilization and bias that were unfamiliar concepts.

5. Conclusion

This study conducted artificial intelligence literacy education programs for non-major students as a college liberal arts class and analyzed the impact on learners' artificial intelligence ethics. Through this program, learners were able to understand the concept and necessity of artificial intelligence ethics.

Through this study, it was confirmed that artificial intelligence ethics is an important factor in AI literacy education, as in Park & Yi's study[9]. In addition, this study confirmed the same results as Bae's study[28], in which learners tried to practice AI ethics in their daily life, such as considering the ethical aspect and utilizing AI technology through AI literacy education.

After class, it was possible to confirm through the analysis result of artificial intelligence ethics that learners recognized the concept and necessity of artificial intelligence ethics, which was an unfamiliar concept, and were aware of the points to be aware of when using data. Although formalized theoretical education focuses on knowledge transfer, artificial intelligence literacy education through the use and practice of artificial intelligence helps them experience the procedures and principles of artificial intelligence, even though it is not a real professional process. Through this, students experienced the specific conditions under which algorithms and data bias occurred and realized the major ethical issues of artificial intelligence design. Based on this, it was confirmed that artificial intelligence literacy education affects changes in artificial intelligence ethics. In order for non-major students to fully understand artificial intelligence, including artificial intelligence ethics, education that includes experience in using artificial intelligence must be conducted away from theoretical classes that simply convey knowledge. To this end, it was confirmed that well-organized AI literacy education is necessary to fully experience the use and utilization of artificial intelligence. In addition to artificial intelligence education, the importance of artificial intelligence ethics is increasing, and this study shows that artificial intelligence ethics increases its effectiveness only when it is based on a practical understanding of AI technology. It needs to lead to further research into teaching-learning models that deal more deeply with AI ethics.

6. References

6.1. Journal articles

- [1] Han J. Changes in Attitudes and Efficacy of AI Learners according to the Level of Programming Skill and Project Interest in AI Project. *Journal of the Korean Association of Information Education*, 24(4), 391-400 (2020).
- [4] Kim S & Kim S & Lee M & Kim H. Review on Artificial Intelligence Education for K-12 Students and Teachers. *The Journal of Korean Association of Computer Education*, 23(4), 1-11 (2020).
- [5] Lee Y. Development and Effectiveness Analysis of Artificial Intelligence Steam Education Program. *Journal of the Korean Association of Information Education*, 25(1), 71-79 (2021).
- [6] Park H. Trend Analysis of Korea Papers in the Fields of Artificial Intelligence, Machine Learning and Deep Learning. *Korea Information Electronic Communication Technology*, 13(4), 283-292 (2020).
- [7] Kim Y & Park G. Rubrics and Schoolwide Approach to the Character Education and Some Implications to AI-based Character Education. *Robotics & AI Ethics*, 5(2), 19-26 (2020). [\[Article\]](#)
- [8] Lee Y & Park Y. Establishing a Definition of AI Literacy and Designing a Liberal Arts Education Program. *Journal of the Society of Korean Language and Literature*, 85, 451-474 (2021).
- [9] Park Y & Yi Y. The Education Model of Liberal Arts to Improve the Artificial Intelligence Literacy Competency of Undergraduate Students. *Journal of the Korean Association of Information Education*, 25(2), 423-436 (2021).
- [10] Kim H & Mun S. Exploring the Educational Use of Artificial Intelligence based on R Mapping -Focusing on Foreign Publication Analysis Results-. *Journal of the Korean Association of Information Education*, 24(4), 313-325 (2020).
- [11] Kim K & Park Y. A Development and Application of the Teaching and Learning Model of Artificial Intelligence Education for Elementary Student. *Journal of the Korean Association of Information Education*, 21(1), 139-149 (2017).

- [12] Lee Y. An Analysis of the Influence of Block-type Programming Language-based Artificial Intelligence Education on the Learner's Attitude in Artificial Intelligence. *Journal of the Korean Association of Information Education*, 23(2), 189-196 (2019).
- [13] Lee S. Analyzing the Effects of Artificial Intelligence(AI) Education Program based on Design Thinking Process. *The Journal of Korean Association of Computer Education*, 23(4), 49-59 (2020).
- [14] Kim H & Jun S. Artificial Intelligence Curriculum Design for Liberal Arts Education. *Korean Association of Artificial Intelligence Education Transactions*, 1(10), 93-100 (2020).
- [15] Jun S. Development of Artificial Intelligence Education Program based on Experiential Learning for Liberal Art Education. *The Journal of Korean Association of Computer Education*, 24(2), 63-73 (2021).
- [16] Oh K & Kim H. An Analysis of the Influence Big Data Analysis-based AI Education on Affective Attitude towards Artificial Intelligence. *Journal of the Korean Association of Information Education*, 24(5), 463-471 (2020).
- [17] Lee A. Analyzing the Effects of AI Education Program based on AI Tools. *Robotics & AI Ethics*, 6(2), 21-29 (2021). [Article]
- [18] Woo H & Lee H & Kim J & Lee W. Analysis of Artificial Intelligence Curriculum of SW Universities. *The Journal of Korean Association of Computer Education*, 23(2), 13-20 (2020).
- [19] Lee A. Software Education Model for Artificial Intelligence Learning by Beginning Learners. *Journal of Computational and Theoretical Nanoscience*, 18(5), 1371-1376 (2021).
- [20] Burnett C & Merchant G. Literacy-as-event: Accounting for Relationality in Literacy Research. *Discourse: Studies in the Cultural Politics of Education*, 41(1), 45-56 (2020).
- [21] Lee C. Direction of Software Education in Practical Arts for Cultivating Competencies in the AI Era. *The Journal of Korean Practical Arts Education*, 26(2), 41-64 (2020).
- [22] Yi Li & Park G. AI Ethics and Privacy Right. *Robotics & AI Ethics*, 5(2), 27-33 (2020). [Article]
- [23] Ryu M & Jung J. Extraction of Learning Elements and Development of Teaching and Learning Models for AI Ethics Education. *Journal of the Korean Association of Artificial Intelligence Education*, 2(1), 45-52 (2021).
- [24] Kim T & Park G. Future Oriented Smart Society and Ethical Issues. *Robotics & AI Ethics*, 6(1), 35-44 (2021). [Article]
- [25] Kim T & Park G & Seo E. IR4.0 and Ethical Tasks of AI. *Robotics & AI Ethics*, 4(2), 6-13 (2019). [Article]
- [26] Kim G & Shin Y. Study on the Development of Test for Artificial Intelligence Ethical Awareness. *Korean Association of Artificial Intelligence Education Transaction*, 2(1), 1-19 (2021).

6.2. Thesis degree

- [28] Bae J. Development of Project-based Artificial Intelligence Ethics Education Program. Jeju National University, Master's Thesis (2020).

6.3 Additional references

- [2] <https://www.korea.kr/> (2019).
- [3] <https://www.gov.kr/> (2020).
- [22] Busan Metropolitan City Office of Education. AI-based Education Guidebook (2019).
- [29] <https://machinelearningforkids.co.uk/> (2021).
- [30] <https://teachablemachine.withgoogle.com/> (2021).

7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Author	AL	-Set of concepts <input checked="" type="checkbox"/>
		-Design <input checked="" type="checkbox"/>
		-Getting results <input checked="" type="checkbox"/>
		-Analysis <input checked="" type="checkbox"/>
		-Make a significant contribution to collection <input checked="" type="checkbox"/>
		-Final approval of the paper <input checked="" type="checkbox"/>
		-Corresponding <input checked="" type="checkbox"/>
		-Play a decisive role in modification <input checked="" type="checkbox"/>
		-Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/>
		-Participants in Drafting and Revising Papers <input checked="" type="checkbox"/>
		-Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

Robotics & AI Ethics

Publisher: J-INSTITUTE
ISSN: 2435-3345

Website: j-institute.org
Editor: admin@j-institute.org

Corresponding author*
E-mail: pgy556@daum.net

DOI Address:
dx.doi.org/10.22471/ai.2021.6.3.62

© 2021 J-INSTITUTE

Multicultural Education of South Korea through the VIRTUAL REALITY

Seongran Ha¹

Dongguk University, Seoul, Republic of Korea

Gyunyeol Park^{2*}

Gyeongsang National University, Jinju, Republic of Korea

Abstract

Purpose: The framework of online education is evolving from e-learning to XR-learning. As expectations for the educational effect and market growth of reality contents increase, the South Korean government has established related education policies and is making intensive investments. Generation C, Z, and Alpha learners, Digital Natives, are quickly responding and adapting to the concept of Metaverse. Thus, this study suggests the need for the transition of multicultural education in line with the changes in social, educational technology, and intends to present a rough direction of multicultural education.

Method: This study used the approach of literature review and document analysis. The results of this study should be supplemented by quantitative and qualitative studies in the future. For a literature-oriented approach, refer to the government agencies' presentation materials and academic studies. Document survey is mainly related to cyber education materials presented on the Internet and various resources.

Results: This study presented three ways of multicultural education using VR: First, 'Korean Culture Experience Program' offering experience of traditional Korean culture or historical facts; Second, 'Korean Life Adaptation Program' to settle down in Korean life including markets, banks, or community service centers; Third, 'education program for multicultural understanding and sensitivity' providing virtual cases of language barrier, social exclusion, and discrimination. In reality, there are still problems that require a lot of investment in content formulation, equipment purchase, maintenance, etc., and securing quality of content and finding suitable education methods.

Conclusion: This study aims to present the direction of multicultural education in Korea using the virtual reality. Producing feasible contents needs expensive and very complicated procedures. This study proposes a basic concept how multicultural education in Korean society can be made in virtual space. These VR contents have the advantage of being able to be an education suitable for the actual environment because they have the advantage of allowing learners to experience and discuss directly in virtual spaces. To this end, there remain challenges to overcome both ethical issues and budget problems of developing high-level contents.

[Keywords] Online Education, E-Learning, XR-Learning, Metaverse, Multicultural Education

1. Introduction

In 2019, the Korean government announced the '5G+ strategy to realize innovative growth'[1]. Realistic Content was selected as one of the 10 core industries in this announcement. These Realistic Content is a type of content based on ICT that stimulates human sensory organs and cognitive abilities, allowing them to feel the experiences and sensibilities similar to realities. That is, it is collectively referred to as various visual processing and representation techniques such as Augmented Reality(AR), Virtuality Reality(AR), Mixed Reality(MR), and Hologram.

Realistic content is also being paid attention to in the field of education. The Ministry of Education and the Ministry of Science and ICT are establishing and implementing realistic education policies in

elementary, middle, and high school curriculum with expectations for the effectiveness and market growth of realistic educational content. This is because Realistic Content has the advantage of encouraging learners to immerse them in their learning content, induce them to be proactive, and enhance their educational effectiveness by embodying the learning content[2][3][4][5][6][7][8].

Meanwhile, users of the Metaverse platform, so-called the 'Next-Generation Internet, continue to grow. As of January 2021, Roblox's monthly number of users exceeded 190 million, with 67 percent of the users are under the age of 16. FORTNITE has 350 million global users, and the global number of GEPETTO users has surpassed 200 million, of which about 80% are teenagers[9]. What is important fact is that Digital Natives, named as Generation C, Z, and Alpha, familiar with digital technology, are rapidly establishing the dominance of the Metaverse.

Furthermore, COVID-19 is worsening people's face-to-face contact, there is a movement to use Metaverse in education. Sonchunhyang Univ, Soongsil Univ., and Kongkuk Univ. hosted entrance ceremony and orientation for freshmen, festivals, and lectures on Metaverse. The Busan Metropolitan City Office of Education has signed a business agreement with Unity to "build a metaverse-based artificial intelligence and data education ecosystem"[10]. CMSEDU jointly launched 'codeAlive', a metaverse coding training platform, with Unity.

As such, learners are changing and educational skills are progressing. Current and future learners value fun and communication, are more familiar with visual stimuli than text, are more familiar with digital culture, and are quickly adapting to technology and digital environment. Educational institutions and businesses are rapidly changing the framework of education in line with contemporary trends. In other words, the education system is evolving beyond e-learning to XR-learning utilizing AI and Realistic Contents.

In response to these educational innovations, the multicultural education also requests the development of various educational methods. Unfortunately, Realistic Contents for multicultural education is not well conducted. Until now we could find out two researches: one is a study on the effect of art appreciation class using virtual reality on learners' multicultural acceptance[11] and another is a study on the implementation of a virtual reality-based cognitive behavioral therapy program for trauma intervention in the multicultural youth[12], etc. The former was based on their high content system and achievement standards and, according to the National Curriculum 2015 revision of teaching and learning and design conducted over the actual class and youth cultural soluble scale strip(KMCI-A) for the use of the diversity, relationships, universality, etc. And the latter showed the significant results by measuring the multicultural acceptability. It was on implementing the therapy for trauma experienced persons. And it showed the 8 steps scenario. These studies are expected to be applied directly to the field to produce significant effects. We are waiting for this kinds of further researches. Therefore, this study intends to lay the foundation for future research by presenting a feasible type of realistic content that can be applied to multicultural education.

2. Necessity to Utilize Virtual Reality for Multicultural Education

According to Edgar Dale[13], observational learning of visual phase(indirect symbols) is more effective for memory than linguistic or visual materials. Likewise, behavioral phase(direct experience) using purposive experience is even more effective for memory than the indirect method [14].

Current and future learners, so-called Gen C-Z-Alpha, have been exposed to the digital environment from their early age, are familiar with the Internet and IT technology, utilize laptop, tablet, smartphone, and they are very sensitive to new technologies. In particular, they tend to prefer audiovisual stimulation such as voice, image, and video content over text. However, it is difficult for them to concentrate on the contents when there is no interest or fun due to low concentration capacity. As such, it is difficult for them to achieve learning objectives by acquiring knowledge based on text.

In order to educate these learners and to enhance the learning effectiveness, learners need to be able to immerse themselves by doing their activities while still containing interest and fun and to acquire knowledge through their immersion. Realistic Contents including VR might satisfy the needs.

Meanwhile, it is very important to increase the acceptability of multiculturalism in multicultural education and to eliminate prejudice, prejudice, and negative perceptions. While it is important for learners to be educated in understanding and communication between cultures to solve cultural conflicts, it is also crucial to be exposed to multicultural situations directly to experience, feel, and empathize with them so that they can embody their learning.

Adolescents, the main learners, are heavily influenced by their parents and peers, both culturally and emotionally. Therefore, even if you have been educated about understanding and communication between cultures, if they learn only abstract knowledge, they are likely to forget or ignore the contents of the learning due to their surrounding environment. Therefore, education should consist of contents and methods that can be assimilated on the basis of knowledge and practical experience, and should be consistent and repetitive [15].

However, it is very difficult for learners to experience various situations in real life. In islands or mountainous areas, it is very difficult to prepare or experience the multicultural situations that teachers want to hypothesize. Even if there is an opportunity, it is difficult to expect continuous effects because it sometimes ends with a one-off experience. Moreover, it is even more difficult to create conditions optimized for the purpose of education and to control the process of training.

Therefore, it is necessary to use virtual reality to enhance the effectiveness of education and to solve the practical problems of multicultural education.

Virtual reality is a technology that allows participants to recognize, experience, and interact with digital spaces, environments, and situations that are artificially created as if they were real experience of five senses. It allows participants to view, manipulate, and recognize situations or environments that are difficult to experience in their daily lives as if they were in that situation or environment without having to face them directly. In other words, virtual reality makes it possible to understand and acquire meanings through experience of seeing, hearing, and feeling, rather than understanding and realizing meanings by interpreting language or visual symbols.

Virtual reality is 100% imagination and fiction, however, it allows the participant feels like interacting with the situation or person in virtual reality by capturing the participant's senses. In addition, virtual reality prevents humans from distinguishing between the self of reality and the virtual self by intercepting the proprioception which is an ability to recognize their bodies [16]. As a result, participants can acquire embodied knowledge rather than externally injected learning.

3. Ways to Use Virtual Reality in Multicultural Education

3.1. Korean culture experience program

This is a way to increase understanding of culture by experiencing culture directly through virtual reality. Currently, museums and exhibition halls embody relics and spaces as well as traditional events and games using virtual reality or augmented reality. In other words, it implements virtual reality or augmented reality in which participants experience the process of reenacting events or games that cannot be made due to environmental, materials, tools, etc.

For example, you can experience spaces such as Gyeongbokgung Palace, Seokuram Grotto, Goguryeo Mural Tomb, Former Seodaemun Prison, Geumgangsan Mountain, or Kite Flying, Chajeon Nori (Chariot Battle), Pungmul-Nori. In addition, historical events such as Imjin War and the Korean War (June 25, 1950) can be reproduced as virtual reality to make it more vivid <Figure 1>, <Figure 2>.

Figure 1. Kite flying(Korea creative content agency)[17].



Figure 2. Andong chajeon nori(traditional play)[18].



If this content is shared online and can be experienced virtually at school and at home, it can be more vividly experienced and understood than if it is learned through pictures, photos or videos, and VR, AR programs would be very effective in achieving educational goals.

3.2. Korea life adaptation program

Even if immigrants, intermediate immigrants, and foreigners learn Korean grammatically through school, language school, and online learning, it is very difficult to apply what they have learned in everyday life. Even if the classroom creates simulated situations or environments such as markets, banks, and community service centers, it is difficult to provide on-site education. Difficulties at these sites can be supplemented using virtual reality. By experiencing a system or culture that need to be known to adapt to Korean society in advance, one can relieve anxiety about social adaptation and settlement.

For example, an immigrant can experience situations such as using ATM devices or opening bank accounts and exchanging money at banks through virtual reality. In the case of immigrant women, banking is difficult and it hinders them to become economically independent. If they can experience essential situations of life in Korea through virtual reality, they can relieve these difficulties or fears of social adaptation <Figure 3>, <Figure 4>.

Figure 3. ATM system(for the blind)[19].



Figure 4. VR based purchasing contents(for the blind)[20].



The experience of Korean language and Korean life using virtual reality will be very effective not only for multicultural education, but also for foreigners to learn Korean culture even when they stay in their own countries.

3.3. Education to improve multicultural understanding and acceptability

The ultimate expectation that people have in virtual reality is an 'empathic machine'. Participants in virtual reality observe, manipulate, and talk with people from the 'first person perspective'. At that time, if people gets immersed in virtual reality and feel as if they exist in virtual reality, they may realize the different point of existence. By doing so, they will experience the

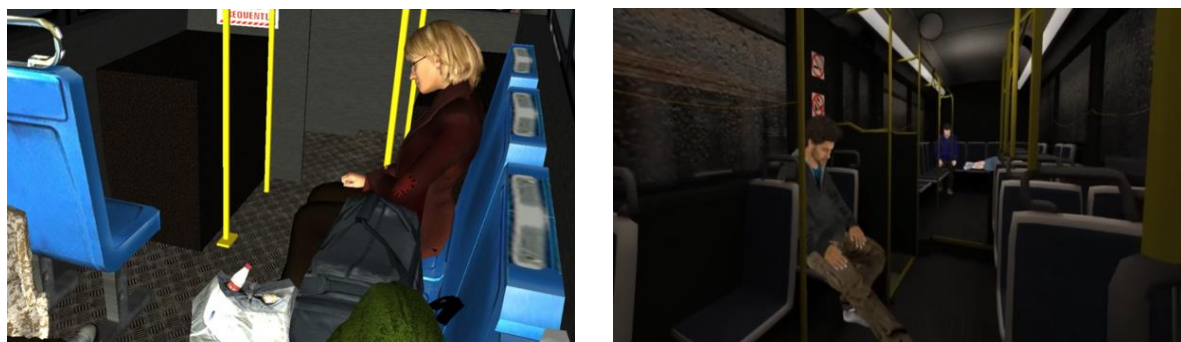
experiences of others that they have not experienced in real life through the virtual reality environment. Then people can better understand the situation of others, and more likely to participate in pro-social activities that help others.

Experiments to demonstrate the effectiveness of this virtual reality are already underway. Sun Joo Ahn experimented with red-green blindness in virtual reality situations[21], and Stanford Univ's Virtual Human Interaction Lab experimented with watching VR <Becoming Homeless> for seven minutes[22][23]. As a result, it was found that in real-life situations, the participants tend to help the blind and homeless more eagerly. VR experiments changed people's attitudes and behaviors in a positive way.

Using these characteristics of virtual reality, two ways of multicultural education will be possible. First, an education program to be familiar with multicultural situations and foreigners. Learners who have not experienced foreigners or multicultural situations tend to have fear or curiosity toward them. Or sometimes, if they don't have a positive interaction, they will form a negative perception. Such case of virtual reality can help them to overcome the negative perception or fear by creating opportunities to contact and interact with them.

Second, an education program could be created through virtual reality to understand the minorities of disability, foreign language, social exclusion, discriminatory remarks and prejudices. For example, Cyberball(ball-tossing game) experimented by psychologist Kipling D Williams could be used. This Cyberball is a situation game that three people play a ball; at first, three people play the ball fairly, but at some point, only two people exchange the ball and do not throw a ball at the third person. Those who do not receive the ball touch will experience bullying or alienation. That experiment could be carried out in real life, but it can improve multicultural understanding and acceptability by allowing avatars of various ethnicities and genders to be set up in virtual spaces <Figure 5>.

Figure 5. Empathy education by VR(becoming homeless)[24].



4. Conclusion

The government has selected virtual reality and other realistic contents as the top 10 core industries, and has established related education policies and intensive investments in anticipation of the effectiveness of educational contents and market growth. Generation C, Z, and Alpha learners, Digital Natives, are quickly responding and adapting to Metaverse. The framework of education is changing in line with the changes and needs of learners in this era. In other words, it is evolving from e-learning to XR-learning. Multicultural education needs to be transformed according to these changes in social and educational technologies, and learners' needs.

Until now, multicultural educators have used mainly textbooks and e-learning contents of photography or video. On the other hand, VR content can give much higher learning effectiveness and sustainability by allowing learners to experience and discuss directly, and can understand multiculturalism as an experience and way of life and apply it to life.

This study suggested three ways of multicultural education using VR: Korean culture experience program to experience traditional Korean culture or historical facts, Korean life adaptation program to relieve anxiety about social adaptation and settle down in Korean life, and Education to improve multicultural understanding, social exclusion, and discriminatory remarks[25][26][27][28][29].

In order for such content production to become a reality in the long run, purchase and maintenance of expensive equipment and technology must be premised. For successful results, we suggest some developmental ways as follows: First, it is necessary to equip the realistic content creation and maintenance which is suitable for educational methods. Currently, education using virtual reality is not well known in the sphere of the education field. Training equipments and contents are not enough to sustain. And the readiness of teachers for the virtual reality based education is very weak. Second, VR and more advanced education should be supported by variety of contents. The developmental speed of VR technology is so fast. And the societal environment and the learners' attitude are changing and the level of its diversity is very high. Third, countermeasures against the side effects of using virtual reality should be prepared. At first we can assume the physical side effects. As examples, we can find out the dizziness, headache, blurred vision, dry of eye, etc. And we can think of the psychological side effects. Because VR use imaginary data and picture, the users brain could be distorted and bring a collective confusion. In particular, youth group, the brain is easily stimulated, in the field of school system, we need to approach very carefully. Finally, we need focus on the ethical issues. Until now most of ethics are based on real contacts and communication. VR can give people the lot of quantitative enlargement of thoughts. If VR's sphere can hold the mind of human being, it also could be dealt with in the scope of ethics. Especially we need to focus on the data ethics which means to match the transparency and trustfulness of data, and how to lessen harmfulness to human being[25][26][27][28][29][30][31][32].

5. References

5.1. Journal articles

- [3] Choi JO. Effects of Family Crisis on Offline School Bullying in Elementary School Students in Korea: Mediating Effects of ADHD Symptoms, Cyber Bullying Victimization, and Anger. *International Journal of Crisis & Safety*, 5(1), 43-57 (2020). [\[Article\]](#)
- [4] Ha KW. Changes in Private Security Industry according to the Enactment and Amendments of South Korean "Security Services Industry Act". *International Journal of Criminal Study*, 3(2), 23-29 (2018). [\[Article\]](#)
- [5] Lee JY. A Proposal of Webhard Monitoring System against Cyber Sexual Violence. *International Journal of Police and Policing*, 5(1), 8-15 (2020). [\[Article\]](#)
- [6] Lee S. AI-based Cybersecurity: Benefits and Limitations. *Robotics & AI Ethics*, 6(1), 18-28 (2021). [\[Article\]](#)
- [7] Song SE. Internet Gambling Policy: Prohibition Versus Legalization. *International Journal of Justice & Law*, 2(2), 22-27 (2017). [\[Article\]](#)
- [8] Kim TW & Park GY & Seo ES. IR4.0 and Ethical Tasks of AI. *Robotics & AI Ethics*, 4(2), 6-13 (2019). [\[Article\]](#)
- [11] Shin SH & Him HJ. Study on the Effects of Art Appreciation Class on Multicultural Acceptability: Focused on High School Using Virtual Reality. *Journal of Product Research*, 37(5), 233-243 (2019).
- [12] Kim KS & Song EJ. Virtual Reality Program Model for Trauma Intervention in Multi-cultural Adolescents. *Journal of the Korea Institute of Information and Communication Engineering*, 21(2), 361-366 (2017).
- [15] Ha SR & Park GY. Multicultural Society and Multicultural Education. *The Journal of Humanities and Social Sciences* 21, 12(4), 2239-2249 (2021).
- [16] Lee HJ. Virtual Reality and Human Body. Identity and Interaction. *Cogito*, 91(1), 7-26 (2020).

- [21] Ahn SJ & Le AMT & Baileson J. The Effect of Embodied Experiences on Self-other Merging, Attitude, and Helping Behavior. *Media Psychology*, 16(1), 7-38 (2013).
- [25] Borenstein J & Howard A. Emerging Challenges in AI and the Need for AI Ethics Education. *AI and Ethics*, 1(1), 61-65 (2021).
- [26] Dubov A & Shoptawb S. The Value and Ethics of Using Technology to Contain the Covid-19 Epidemic. *The American Journal of Bioethics*, 20(7), 1-5 (2020).
- [27] Maccari L & Cagno V. Do We Need a Contact Tracing App?. *Computer Communications*, 166, 9-18 (2021).
- [28] Owen R & Macnaghten P & Stilgoe J. Responsible Research and Innovation: From Science in Society to Science for Society, with Society. *Science and Public Policy*, 39(6), 751-760 (2012).
- [29] Rigby MJ. Ethical Dimensions of Using Artificial Intelligence in Health Care. *AMA Journal of Ethics*, 21(2), 121-124 (2019).
- [30] Li Y & Park G. AI Ethics and Privacy Right. *Robotics & AI Ethics*, 5(2), 27-33 (2020). [\[Article\]](#)
- [31] Kim Y & Park G. Rubrics and Schoolwide Approach to the Character Education and Some Implications to AI-based Character Education. *Robotics & AI Ethics*, 5(2), 19-26 (2020). [\[Article\]](#)
- [32] Kim H & Park G. Ethical Issues on AI Equipped Combat Robots. *Robotics & AI Ethics*, 5(2), 1-7 (2020). [\[Article\]](#)

5.2. Books

- [13] Edgar D. Audio-visual Methods in Teaching. Dryden (1969).
- [14] Jason J. The VR Book: Human-centered Design for Virtual Reality. Morgan & Claypool (2015).
- [23] Bailenson J. Fearful but Attractive-humanistic Imagination of Cognition and Experience Opened by Virtual Reality. Dongasiabook (2019).

5.3. Additional References

- [1] Ministry of Science and ICT. 5G+ Strategy to Realize Innovative Growth. The Government the Republic of Korea (2019).
- [2] Beom WT & Kim JY & Kim NJ. Analysis of Policy Trends and Case Studies of Realistic Educational Contents Using VR·AR. Issue Report 2019-15, National IT Industry Promotion Agency, 1-19 (2019).
- [9] Park JH. The Upcoming Metabus Age, Directions and Implications of Next Generation Content Industry. KIET Industrial Economic (2021).
- [10] Busan Metropolitan City Office of Education. Busan School Board's Metaverse-based Business Agreement with Unity Korea (2021).
- [17] <https://www.youtube.com> (2019).
- [18] Official Blog of Gyeongangbuk-do. Digital Museum VR Experience. Naver Blog (2020).
- [19] <https://www.youtube.com> (2021).
- [20] <https://www.youtube.com> (2021).
- [22] Shashkevich A. Virtual Reality can Help Make People more Compassionate Compared to Other Media. New Stanford Study Finds (2018).
- [24] <https://www.youtube.com> (2021).

6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Lead Author	SH	<ul style="list-style-type: none"> -Set of concepts <input checked="" type="checkbox"/> -Design <input checked="" type="checkbox"/> -Getting results <input checked="" type="checkbox"/> -Analysis <input checked="" type="checkbox"/> -Make a significant contribution to collection <input checked="" type="checkbox"/> -Final approval of the paper <input checked="" type="checkbox"/> -Corresponding <input checked="" type="checkbox"/> -Play a decisive role in modification <input checked="" type="checkbox"/>
Corresponding Author*	GP	<ul style="list-style-type: none"> -Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/>

6.2. Funding agency

This work was supported by the Ministry of Education of the Republic of Korea and National Research Foundation of Korea(NRF-2020S1A5C2A04092485).