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Analysis of the Effectiveness of SOFTWARE LIBERAL EDUCATION in a Non-Face-To-Face Environment

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Abstract

Purpose: *Based on the previous studies, in this study, and in order to confirm the effect of the university's software liberal education in a contactless environment, as for the specific factors influencing the satisfaction of learning and academic achievement, the quality of classroom instruction, motivation for learning, convenience of time, and the immersion for learning were derived as the major factors according to the details of classroom instruction and learning contents. In this study, it is intended to examine the effectiveness of the university's basic software education in a contactless environment via the relationship between such factors and their influence on the satisfaction of learning and academic achievement.*

Method: *In order to validate the effect of the university's basic software education in a contactless environment, this study has analyzed the differences between the subjects' general characteristics, quality of classroom instruction, motivation for learning, convenience of time, immersion for learning, satisfaction of learning, and academic achievement by using the descriptive statistics of error, percentage, mean and standard deviation. The correlation of the quality of classroom instruction, motivation for learning, convenience of time, immersion for learning, satisfaction of learning, and academic achievement was analyzed by the Pearson's correlation, and the effect of each factor on the satisfaction of learning and academic achievement was analyzed by performing the multiple regression.*

Results: *It was evaluated that the satisfaction of learning enhanced as the quality of classroom instruction improved and the immersion for learning worked well. It was also evaluated that, as the high quality details of classroom instruction and learning contents were provided, and the higher the motivation for learning, the higher the academic achievement, and the higher the convenience of time, the lower the academic achievement. Even in a contactless environment, the quality of classroom instruction is very important, and it may be said that it is the variable which has the largest influence on the effectiveness of the classroom instruction.*

Conclusion: *It was confirmed that it has had a positive effect on the students' satisfaction of learning and academic achievement by causing high quality classroom instruction, motivation for learning, and active immersion for learning in a contactless environment. Based on such results of this study, it is expected that assistance may be provided for developing and promoting various online education programs.*

[Keywords] ***Software Liberal Education, Non-Face-To-Face Environment, Learning Efficiency, Programming Education, Learning Achievement***

1. Introduction

Recently, as the role of software has become crucial not only across various industries but also across the society as a whole, there is a growing movement to consider software as a basic skill in education, and implement it as a mandatory education. Accordingly, the research on various learning models for the effective coding education is being actively carried out. The

existing coding education was intended for the software development by the engineering majors, yet recently, software education has been carried out to help improve creative thinking skills and problem solving skills for the non-majors or in the fields of liberal arts education, without being limited to the engineering majors[1].

The non-majors who are new to the software education often face great difficulties in understanding the basic programming grammars. The non-majors must put in a lot of effort and practice to acquire the basic knowledge, yet there is not enough time for them to practice. Some of the students tend to become disappointed and lose their confidence after trying out programming without gaining enough practice[2][3].

Meanwhile, due to the COVID-19, which caused the world to fall into a pandemic situation in 2020, all work, communication activities, and education are carried out in an online contactless form, bringing significant changes to the university education. The expansion of the contactless classroom instruction has presented a new challenge for both the professors and learners at the universities who have maintained the existing face-to-face educational method[4].

While the contactless class has the advantages of being free from time and space restrictions, repetitive learning and self-directed learning are made possible, it also has a disadvantage in that it lacks immediate feedbacks and interactions by and between the professors and the learners because the learning space is limited online[5]. In a situation where the share of the contactless classroom instruction has inevitably increased due to the COVID-19, the contactless online classes have limitations due to the students' dissatisfaction and the lack of communication between the professors and learners, thereby causing various problems[6][7].

Currently, software education is also conducted contactless online. Since the software education carries with it different characteristics from other forms of education, there are many positive aspects which emerge when the software education is conducted online compared to before when it was conducted offline. First, in a contactless online classroom environment, the class video may be watched repeatedly many times as an advantage[8]. Even if it is an intuitive and easy educational programming language, the non-majors need to secure a certain amount of time to understand and apply the basic grammars. In the online learning environment, the cognitive burdens for the learners may be reduced because the curriculum may be structured in a form which repeatedly expands the core concepts and principles. Through such repetitive learning, it is expected that the gap between the learners can be reduced, for which the learners could not keep up with the learning progress in the existing face-to-face classroom instruction[9][10].

As the current face-to-face classroom environment is shifting from the existing face-to-face classroom environment to a contactless classroom environment, the professors and learners are required to make a lot of change and interest[11]. This study seeks to analyze the effects of the quality of classroom instruction, motivation for learning, convenience of time, and the learning immersion on the academic achievement and satisfaction of learning to articulate the effectiveness of the university's basic software education in a contactless environment, and contribute to the qualitative improvement of the effects of the applicable contactless university's basic software education even after the post-coronavirus era.

2. Theoretical Background

The learner's satisfaction and performance in learning in a contactless educational environment are considered among the major predictive variables, and studies have been actively conducted to identify the factors influencing the online education performance and satisfaction. Han[12] validated the effects of the attitude towards e-learning on the academic performance, and also measured the ease of use and utility of e-learning learning management system, motivation for learning, and the information quality of learning contents as the prerequisites for the attitude towards e-learning.

Lee and Kim[13] classified and analyzed the factors influencing the online education satisfaction into the four categories of learner factors, professor factors, content factors, and system factors. Noh and Lee[14] analyzed the factors influencing the performance in learning and learner's satisfaction of online education into the external factors(educational support service), professor factors(interaction), learner factors(motivation for learning, media efficacy, and self-direction). Kim & Kang[15] analyzed the relationship between the quality of classroom instruction, self-efficacy, and learner loyalty.

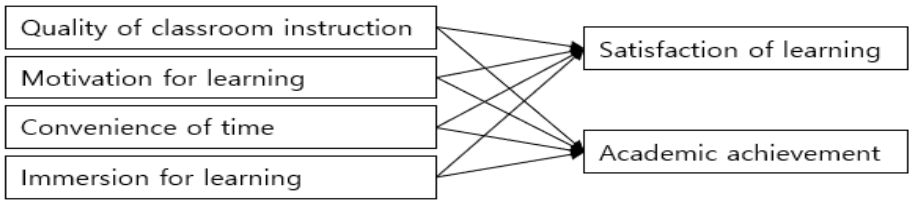
The satisfaction of learning and performance in learning of the contactless classroom instruction depend on various factors. Based on the previous studies, and in this study, to verify the effect of the contactless software related liberal arts classes, the quality of classroom instruction, motivation for learning, convenience of time, and the immersion for learning were derived as the specific factors influencing the satisfaction of learning and academic achievement.

3. Research Method

3.1. Research model

In this study, a research model was proposed as shown in <Figure 1>.

Figure 1. Research model.



3.2. Research subjects and the data collection method

For the purposes of this study to validate the effect of the university's basic software education in a contactless environment, a software related liberal arts course called “Creative Thinking and Coding” opened during the second semester of 2020 at University C located in Gangwondo was selected, and a study was conducted targeting the non-major students taking the relevant course. Accordingly, in this study, a questionnaire survey was conducted targeting 152 students taking 'Creative Thinking and Coding' during the second semester of 2020, which were selected as the research subjects. In the questionnaire, the details of the study and explanations of the questions were adequately provided, and out of the 152 copies of the questionnaires collected, excluding 21 copies which were prepared unfaithfully, a total of 131 copies of the questionnaires were used for the analysis.

3.3. Curriculum

The “Creative Thinking and Coding” course aims to enable the students to learn the basic concepts and principles of programming and also cultivate computational thinking skills by learning basic coding using Scratch, an educational language. Computational thinking is defined as a problem solving using the technologies used in computer science, process of solving problems through the computers, and the problem solving methods using the computer science technology[16]. The previous studies related to the computational thinking were primarily the studies related to teaching and learning for cultivating computational thinking skills[17] and the studies analyzing the effectiveness of classroom instruction to improve computational thinking in the university software education related situations[18][19].

In this study, as a liberal arts class for the non-majors, education was provided for a semester according to the programming curriculum. The entire curriculum was consisted of 15 weeks, and the training was conducted for a total of 13 weeks, excluding the midterm and final exams. Classroom instructions were conducted in a contactless environment, once a week for two hours, and the non-real-time online classes were conducted.

3.4. Research tools

The questionnaires used as a research tool for this study was prepared through the revision and supplementation after the evaluation of the appropriateness of the variables used in the previous studies. The questionnaires were consisted of 6 questions related to the quality of classroom instruction(details of classroom instruction, and learning contents), 3 questions for the motivation for learning, 2 questions for the convenience of time, 5 questions for the online immersion for learning, 5 questions for the satisfaction of learning, 15 questions for the academic achievement, and 3 questions related to the characteristics of the subjects, for a total of 39 questions. As for the measurement tool, a 5-point Likert scale("Strongly disagree" to "Absolutely agree") was used.

As for the quality of classroom instruction, the questions used for the studies of Lee[20], and Park[21] were used in this study consistent with the situation. It was consisted of the details of classroom instruction and learning contents. The reliability(Cronbach's α) is .927.

In this study, the intrinsic motivation for learning measurement tool was restructured into the questions appropriate for the academic situation of contactless classroom learners, and a total of 3 questions were structured with 2 questions from the intrinsic motivation for learning of Hwang and Kim[22] and 1 question from the intrinsic motivation of Lee[23]. The reliability(Cronbach's α) is .872.

The convenience of time in this study is the motivation to listen to the lectures at a convenient time and place regardless of time and place, and hence, 2 questions were constructed following revision in line with this study based on the research questions of Park[21]. The reliability(Cronbach's α) is .885.

In this study, the immersion for learning was deemed to be an increase in learning time through the contactless classroom, attention paid to learning, effort and persistence to achieve, and the increase in class participation, and five questionnaire questions were structured based on the research questions of Kim and Oh[24]. The reliability(Cronbach's α) is .908.

The main variables used as the grounds for the learning satisfaction are the overall satisfaction for the online curriculum, intention to continue taking courses, intention to recommend, educational effectiveness, and the extent of participation in learning[14][25]. As for the satisfaction of learning, 5 questions were structured in line with this study based on the research questions of Noh[14]. The reliability(Cronbach's α) is .937.

The questionnaire developed to measure the academic achievement has a total of 15 questions, and is also divided into the computational thinking area and the programming area. As for the questions on the computing thinking area of the developed questionnaire tool, the research questions developed by Hong[26] were revised and used in line with the context of this study, and the questions of the programming area were developed through appropriate discussion with computer engineering experts by considering the fact that the programming education was conducted for the non-majors. The reliability(Cronbach's α) is .894.

3.5. Method of data analysis

The data processing of this study was performed by using the SPSS 23.0 statistical program. The difference between the subjects' general characteristics, quality of classroom instruction(details of classroom instruction, and learning contents), motivation for learning, convenience of time, immersion for learning, satisfaction of learning, and academic achievement was analyzed by using the descriptive statistics of error and percentage, mean and standard deviation. The correlation between the quality of classroom instruction, motivation for learning,

convenience of time, immersion for learning, satisfaction of learning, and the academic achievement was analyzed by the Pearson's correlation, and the effect of the quality of classroom instruction, motivation for learning, convenience of time, and the immersion for learning on the satisfaction of learning and academic achievement was analyzed based on the multiple regression. The difference in the satisfaction of learning and academic achievement after classroom instruction according to the subjects' general characteristics was verified by Scheffe for the independent t-test, one way ANOVA, and the ex post validation. At which time, the significance level of all statistics was set to $p<.05$.

4. Research Results

4.1. Descriptive statistics

The descriptive statistics were performed to examine and understand the trend of the collected data, and the specific results are as illustrated in Table 3. The average value of the quality of classroom instruction(details of classroom instruction, and learning contents) determined by the students in this study was analyzed to be 4.10(SD=.71), intrinsic motivation for learning was 3.71(SD=.83), convenience of time was 4.35(SD=.86), immersion for learning was 3.55(SD=.87), contactless satisfaction of learning was 4.03(SD=.75), and the academic achievement was 4.02(SD=.68).

Table 1. Descriptive statistics(N = 131).

Variable	M	SD
Quality of classroom instruction (details of classroom instruction, and learning contents)	4.10	.71
Motivation for learning(intrinsic motivation)	3.71	.83
Convenience of time	4.35	.86
Immersion for learning	3.55	.87
Satisfaction of learning	4.03	.75
Academic achievement	4.02	.68

4.2. Correlation analysis

The Pearson's correlation analysis was performed to verify the correlation between the main variables of this study, which are the quality of classroom instruction(details of classroom instruction, and contents), motivation for learning, convenience of time, immersion for learning, satisfaction of learning, and the academic achievement.

Table 2. Inter-variable correlation analysis.

	1	2	3	4	5	6
1. Quality of classroom instruction	1					
2. Motivation for learning	.705***	1				
3. Convenience of time	.684***	.555***	1			
4. Immersion for learning	.571***	.705***	.542***	1		

5. Satisfaction of learning	.859***	.724***	.623***	.652***	1	
6. Academic achievement	.640***	.623***	.353***	.479***	.695***	1

Note: ***p<.001.

As a result, the quality of classroom instruction demonstrated a positive(+) correlation with all of the motivation for learning(r=.705, p<.001), convenience of time(r=.684, p<.001), immersion for learning(r=.571, p<.001), satisfaction of learning(r=.859, p<.001), and the academic achievement(r=.640, p<.001), and the motivation for learning demonstrated a significantly positive(+) correlation with the convenience of time(r=.555, p<.001), immersion for learning(r=.705, p<.001), satisfaction of learning(r=.724, p<.001), and the academic achievement(r=.623, p<.001). The convenience of time demonstrated a significantly positive(+) correlation with the immersion for learning(r=.542, p<.001), satisfaction of learning(r=.623, p<.001), and the academic achievement(r=.353, p<.001), while the immersion for learning demonstrated a significantly positive(+) correlation with the satisfaction of learning(r=.652, p<.001) and the academic achievement(r=.479, p<.001). The satisfaction of learning demonstrated a significantly positive(+) correlation with the academic achievement(r=.695, p<.001).

4.3. The effect of the quality of classroom instruction, motivation for learning, convenience of time, and the immersion for learning on the satisfaction of learning

To validate the effectiveness of the quality of classroom instruction, motivation for learning, convenience of time, and the immersion for learning on the satisfaction of learning, the multiple regression analysis was performed. As a result, the regression model turned out to be statistically significant(F=113.373, p<.001), and the explanatory power of the regression model turned out to be approximately 77.6%(the revised R square was 78.3%) (R2=.776, adjR2=783). Meanwhile, the Durbin-Watson statistics was 1.821, which was close to 2, and hence, it was evaluated that there was no problem in the assumption of the independence of the residuals, and the variance inflation index(VIF) also turned out to be small with less than 10, and hence, it was determined that there was no multi-collinearity problem.

As a result of the significance validation of the regression coefficient, the quality of classroom instruction(β=.667, p<.001) and the immersion for learning(β=.184, p<.01) all turned out to have a positive(+) effect on the satisfaction of learning. The motivation for learning(β=.125, p>.05) and the convenience of time(β=.-037, p>.05) turned out to be the factors which did not have an influence on the satisfaction of learning.

That is, it was evaluated that the satisfaction of learning increases as the quality of classroom instruction such as the details of classroom instruction and learning contents improves and the immersion for learning works well. Comparing the sizes of the standardization coefficient, it was validated that the quality of classroom instruction(β=.667) and the immersion for learning(β=.184) had a significant effect on the satisfaction of learning.

Table 3. The effect of variables on the satisfaction of learning .

Dependent variable	Independent variable	B	S.E	β	t	p	VIF
Satisfaction of learning	(Constant)	.198	.188		1.053	.294	
	Quality of classroom instruction	.698	.071	.667	9.891***	.000	2.638
	Motivation for learning	.112	.061	.125	1.828	.070	2.725
	Convenience of time	-.002	.051	-.002	-.037	.970	2.007
	Immersion for learning	.158	.052	.184	3.034**	.003	2.129

Note: F=113.373(p<.001), R^2=.776, adjR^2=783, D-W=1.821.

4.4. The effect of the quality of classroom instruction, motivation for learning, convenience of time, and the immersion for learning on the academic achievement

To validate the effectiveness of the quality of classroom instruction, motivation for learning, convenience of time, and the immersion for learning on the academic achievement, the multiple regression analysis was performed. As a result, the regression model turned out to be statistically significant(F=30.655, p<.001), and the explanatory power of the regression model turned out to be approximately 49.3%(the revised R square was 47.7%) (R2=.493, adjR2=477). Meanwhile, the Durbin-Watson statistic was 2.068, which was close to 2, and the variance inflation index(VIF) also turned out to be small with less than 10, and hence, it was determined that there was no multi-collinearity problem.

Table 4. The effect of variables on the academic achievement.

Dependent variable	Independent variable	B	S.E	β	t	p	VIF
Academic achievement	(Constant)	1.552	.263		5.892***	.000	
	Quality of classroom instruction	.498	.099	.519	5.039***	.000	2.638
	Motivation for learning	.272	.086	.331	3.160**	.002	2.725
	Convenience of time	-.179	.072	-.224	-2.497*	.014	2.007
	Immersion for learning	.056	.073	.071	.773	.441	2.129

Note: F=30.655(p<.001), R^2=.493, adjR^2=477, D-W=2.068.

As a result of the significance validation of the regression coefficient, the quality of classroom instruction(β=.519, p<.001) and the motivation for learning(β=.331 p<.01) all turned out to have a significantly positive(+) effect on the academic achievement, and the convenience of time(β=.-224, p<.05) turned out to have a significantly negative(-) effect on the academic achievement. The immersion for learning(β=.773, p>.05) turned out to be a factor which did not have an influence on the academic achievement.

That is, it was evaluated that, as the quality of classroom instruction such as the details of classroom instruction and the learning contents improved, and the higher the motivation for learning, the higher the academic achievement. It also turned out that the higher the convenience of time, the lower the academic achievement. Comparing the sizes of the standardization coefficient, it was validated that the quality of classroom instruction(β=.519), motivation for learning(β=.331), and the convenience of time(β=.-224) had a significant impact on the academic achievement.

4.5. Analysis of the difference between the satisfaction of learning and the academic achievement according to the college of affiliation

The colleges of affiliation of the study subjects are the College of Tourism and Sports, College of Social Sciences, College of Aviation, and College of Engineering, of which the College of Engineering was the Department of Entrepreneurship and Intellectual Property and the Department of Architecture, who are the non-computer majors. <Table 5> illustrates the results of the one-way ANOVA analysis performed to examine the differences between the satisfaction of learning and the academic achievement by group. In the results of <Table 5>, it turned out that there was a significant difference in the satisfaction of learning according to the college of affiliation(p<.05), and examining the post validation results, the College of Tourism and Sports' students demonstrated lower scores than those of the College of Aviation's and College of

Engineering's students. Meanwhile, there was no significant difference in the academic achievement(p>.05).

Table 5. One way ANOVA result according to the affiliated college.

Dependent variable	Group	N	M	SD	F	p	Scheffe
Satisfaction of learning	College of tourism and sports(a)	32	3.45	.72	2.835	.041*	a<c,d
	College of social sciences(b)	38	3.47	.67			
	college of aviation(c)	29	3.72	1.02			
	College of engineering(d)	32	3.55	1.04			
Academic achievement	College of tourism and sports(a)	32	3.87	.73	1.763	.158	-
	College of social sciences(b)	38	3.93	.62			
	college of aviation(c)	29	4.17	.58			
	College of engineering(d)	32	4.16	.75			

4.6. Analysis of the difference between the satisfaction of learning and the academic achievement according to gender

Table 6. Analysis of the difference between the satisfaction of learning and the academic achievement according to gender.

Dependent variable	Group(gender)	N	M	SD	t	p
Satisfaction of learning	Male	88	4.0114	.73296	-.461	.645
	Female	43	4.0756	.77830		
Academic achievement	Male	88	4.0176	.71713	-.227	.821
	Female	43	4.0465	.61797		

The independent sample-t test was performed to validate as to whether there was a significant difference in the satisfaction of learning and the academic achievement according to gender. As a result, the satisfaction of learning(t=-.461, p>.05) and the academic achievement(t=-.227, p>.05) did not demonstrate a significant difference according to gender.

5. Conclusion

The satisfaction of learning and the performance in learning in the contactless classroom instruction depend on various factors. Based on the previous studies, in this study, and to verify the effect of the university's basic software education in a contactless environment, and as the specific factors influencing the satisfaction of learning and the academic achievement, the quality of classroom instruction(details of classroom instruction, and learning contents), motivation for learning, convenience of time, and the immersion for learning were derived as the key factors.

The questionnaire survey was conducted targeting the students who took the "Creative Thinking and Coding" course at University C located in Gangwon-do, and the responses of 131 students were used for the final analysis. As for the statistical method used to this end, the average and standard deviation of the subjects' general characteristics, quality of classroom

instruction, motivation for learning, convenience of time, immersion for learning, satisfaction of learning, and the academic achievement were analyzed by using the descriptive statistics, and based on the reliability analysis, the validity of the questionnaire questions was examined. The correlation between the quality of classroom instruction, motivation for learning, convenience of time, immersion for learning, satisfaction of learning, and the academic achievement was analyzed by the Pearson's correlation, while the effect of the quality of classroom instruction, motivation for learning, convenience of time, and the immersion for learning on the satisfaction of learning and the academic achievement was analyzed through the multiple regression. The difference in the satisfaction of learning and academic achievement after the classroom instruction according to the subjects' general characteristics was verified by Scheffe for the independent t-test, one way ANOVA, and the ex post validation. At which time, the significance level of all statistics was set to $p<.05$. The conclusions confirmed through such are as follows.

First, examining the descriptive statistics results, the convenience of time(M=4.35), quality of classroom instruction(details of classroom instruction, and learning contents) (M=4.10), contactless satisfaction of learning(M=4.03), academic achievement(M=4.02), intrinsic motivation for learning(M=3.71), and the learning immersion(M=3.55) demonstrated 3.55 to 4.35, with the scores slightly higher than normal based on a 5 point scale.

Second, examining the correlation between the quality of classroom instruction, motivation for learning, convenience of time, immersion for learning, satisfaction of learning, and the academic achievement recognized by the subjects, the quality of classroom instruction, motivation for learning, convenience of time, immersion for learning, satisfaction of learning, and the academic achievement turned out to have a positive relationship, and it means that the higher the quality of classroom instruction, motivation for learning, convenience of time, and the immersion for learning, the greater the satisfaction of learning and academic achievement for the contactless classroom instruction. This is consistent with the study[27] which claimed that the immersion for learning has a positive effect on the satisfaction of classroom instruction in the flipped learning classes, supportive of the results of this study. Hence, in order to increase the satisfaction of learning of the contactless classroom instruction, it is necessary to develop and apply various pedagogies to increase the learner centric performance in learning and immersion for learning, by breaking away from the traditional teaching pedagogy.

Third, as a result of analyzing the effects of the quality of classroom instruction, motivation for learning, convenience of time, and the immersion for learning on the satisfaction of learning, it turned out that the explanatory power was 77.6%, and both the quality of classroom instruction and the immersion for learning had an effect on the satisfaction of learning. The motivation for learning and the convenience of time turned out to be the factors which did not have an influence on the satisfaction of learning. That is, it was evaluated that the satisfaction of learning increases as the quality of classroom instruction(details of classroom instruction, and learning contents) improves and the immersion for learning works well. Even in a contactless environment, the quality of classroom instruction is very crucial, which is consistent with the study[28] claiming that the variable which has the largest influence on the effect of classroom instruction is the details of classroom instruction.

Fourth, as a result of analyzing the effects of the quality of classroom instruction, motivation for learning, convenience of time, and the immersion for learning on the academic achievement, it turned out that the explanatory power was 49.3%, indicating that it had a significant effect on the quality of classroom instruction, motivation for learning, and the academic achievement, while the convenience of time had a significantly negative(-) effect on the academic achievement. The immersion for learning turned out to be a factor which did not have an influence on the academic achievement. That is, it was evaluated that the higher the quality of classroom instruction(details of classroom instruction, and learning contents) and the higher the motivation for learning, the higher the academic achievement. It also turned out that the higher the convenience of time, the lower the academic achievement. Unlike the general e-learning classroom instruction, the contactless classroom environment caused by the COVID-19 was not

anything chosen by the students, and hence, the convenience of time seems to be the cause of lowering the students' academic achievement in the contactless class situation. The rewards and feedbacks for the learning achievement which can strengthen the motivation for learning are needed. As examined in the previous studies, the intrinsic motivation of individual learners for the learning activities may be said to be the most crucial factor in the learning process [29]. That is, it seems to be the study result supportive of the previous studies which claimed that the performance in learning improves when the motivation for learning is high [12].

Fifth, examining the result of comparing the differences between the satisfaction of learning and the academic achievement according to the general characteristics of the subjects, it turned out that there was a significant difference in the satisfaction of learning according to the college of affiliation. Examining the post validation results, it turned out that the College of Tourism and Sports' students have lower scores that the College of Aviation's and the College of Engineering's students. This demonstrated that over half of the students taking courses at the College of Tourism and Sports are the students specializing in physical education, and since there are the students who have an objection to taking the software related liberal arts classes, their level of satisfaction is lower than that of the students of the other colleges. However, there seems to be no difference by the college of affiliation in terms of the satisfaction of learning except for the special students specializing in physical education. In terms of the academic achievement, no significant difference by college was demonstrated. As a result of analyzing as to whether there is a difference between the satisfaction of learning and the academic achievement according to gender, no significant difference was demonstrated between the satisfaction of learning and the academic achievement. This is a result consistent with the study [30], which interpreted that it was not relevant to the characteristics of the students and their programming achievements. Regardless of the students' characteristics such as the college of affiliation or gender, it may be interpreted that the factors such as self examination and motivation for learning are related to the academic achievement.

In general, the contactless classroom instructions allow the students to yield a high level of satisfaction for the time convenience since they take the course with the complacent attitude that they can conveniently earn credits regardless of time and place. However, it may be deemed that the extent of the motivation for learning is lower than that of the offline classroom instruction. Hence, the professors preparing for the contactless classroom instructions would need to design their classes more carefully to ensure that the motivation for learning can be caused for the students. Furthermore, the professors ought to make efforts to develop high quality details of classroom instruction and learning contents to ensure that the learners can feel satisfied and performance in a contactless environment by using a classroom instruction strategy which can increase the satisfaction of learning and the academic achievement.

Moving forward, empirical analysis ought to be conducted for the learners at the universities across the nation who are carrying out the basic software education in a contactless environment, and the research model should be generalized, while numerous factors which influence the satisfaction of learning and the academic achievement need to be further studied in greater depth.

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7. Appendix

7.1. Authors contribution

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

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A Study on the Development of Data COMMUCATION MODULE within Construction

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Abstract

Purpose: *As for the safety related technologies in the field of construction and site, and in order to implement an optimal communication transmission and reception related environment, an environment which can help prevent a loss of data ought to be structured. Hence, the purpose of this paper is to identify and remove the noise elements which cause the loss of data via empirical experiments, examine the elements which can help improve communication performance within the range of radio regulations, and develop the communication module appropriate for the relevant environment.*

Method: *The validation methodology of this paper is as follows. A comparison validation test of the customized communication environment compared to the existing communication equipment related application environment, a validation test as to whether a loss of data occurs between the AR devices, a correlation validation test between the occurrence of a loss of data due to a noise increase, a validation and development methodology for identifying the correlation between the transmission distance and the amount of data transmission and reception related variation via the validation test for the impact of data transmission are presented.*

Results: *Since the data transmission and reception volume relatively increases in the customized communication related environment compared to the existing communication equipment related application environment for a certain period of time, it is apparent that the data transmission and reception volume between the AR devices is reduced by causing a network delay due to the overload of network equipment. Hence, it is expected that, in order to address such problems, a communication module appropriate for the environment will be developed, and the noise will be reduced via the validation.*

Conclusion: *As it is necessary to derive the customized values for the communication equipment applicable for the construction site through this study, it is necessary to calculate the quantitative values for the improvement of the data transmission and reception volume during the radio wave amplification, and it has also been derived that it is necessary to derive the quantitative values between a loss of data due to the generation of noise. In the future studies, it is considered that a comparative validation test will be needed in an indoor and outdoor test environment in which an interference from the existing communication environment occurs and an anechoic testing environment in which an interference does not occur whatsoever from the existing communication environment.*

[Keywords] ***Transmission and Reception of Communication, AR Device, Network Equipment, Noise, Loss of Data***

1. Introduction

In order to enhance safety and productivity within the construction site, it is necessary to implement an optimal communication transmission and reception environment appropriate for the environment. In particular, as for a construction site, there are numerous factors which

generate the communication noise due to the buildings undergoing construction and the construction materials, and since the relevant size is very large, the loss of data is very significant when they are implemented based on the general communication data environment. Hence, in this paper, since a series of processes performed on the construction site are implemented via the data communication, it is apparent that in the event of a loss of data, not only will the safety issues occur between each person in charge, but also the possibility of high risk disasters arising will be very high[1].

Figure 1. Construction site where the tower crane is installed.

In order to prevent a loss of data within the construction site of <Figure 1> above, it is necessary to identify the characteristics of clutter occurring at the construction site and identify the propagation parameters which influence the occurrence of clutter in a communication environment, further to the need to structure a communications environment in which the loss of clutter can be prevented[2].

Furthermore, it is necessary to identify the characteristics of clutter via the data transmission and reception fluctuations, data transmission and reception fluctuations according to the increase in the number of routers, and the data transmission and reception fluctuations' trend according to the noise increase according to the distance within the testing environment of <Figure 2> assuming the specificities of the construction site, and identify the propagation parameters according to the result values[3].

Figure 2. Structure of the testing environment for identifying clutter characteristics.

2. Main Body

2.1. Research methodology

The correlation between the transmission distance and the volume of data transmission and reception fluctuation according to the size of the construction site may be identified, and by changing the number of routers performing the role of main host and radio wave amplification, the correlation was identified and the methodology was presented [4].

Table 1. Correlation between AR device, AP, and PC transmission and reception fluctuations.

Case 1	
Case 2	
Case 3	
Case 4	
Case 5	
Case 6	
Case 7	
Case 8	

Case 1 : AR Device <---> AR Device

Case 2 : AR Device <---> AP (Main Host) <---> AR Device

Case 3 : AR Device <---> AP (Main Host) <---> AP (Amplification) <---> AR Device

Case4 : AR Device<--->AP (Amplification) <--->AP (Main Host) <---> AP (Amplification) <---> AR Device

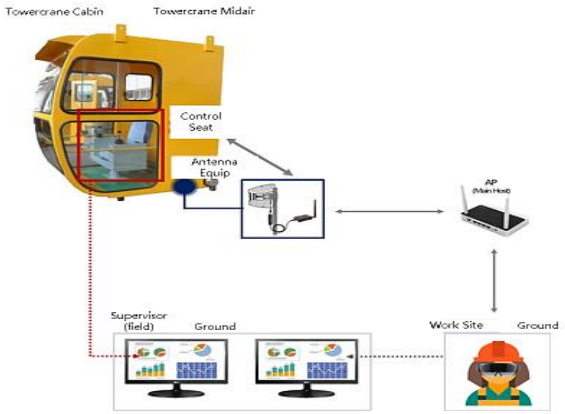
Case 5 : AR Device <---> PC

Case 6 : AR Device <---> AP (Main Host) <---> PC

Case 7 : AR Device <---> AP (Main Host) <---> AP (Amplification) <---> PC

Case 8 : AR Device <---> AP (Amplification) <---> AP (Main Host) <---> AP (Amplification) <---> PC

Figure 3. Diagram of the tower crane's environment.



2.2. Research application

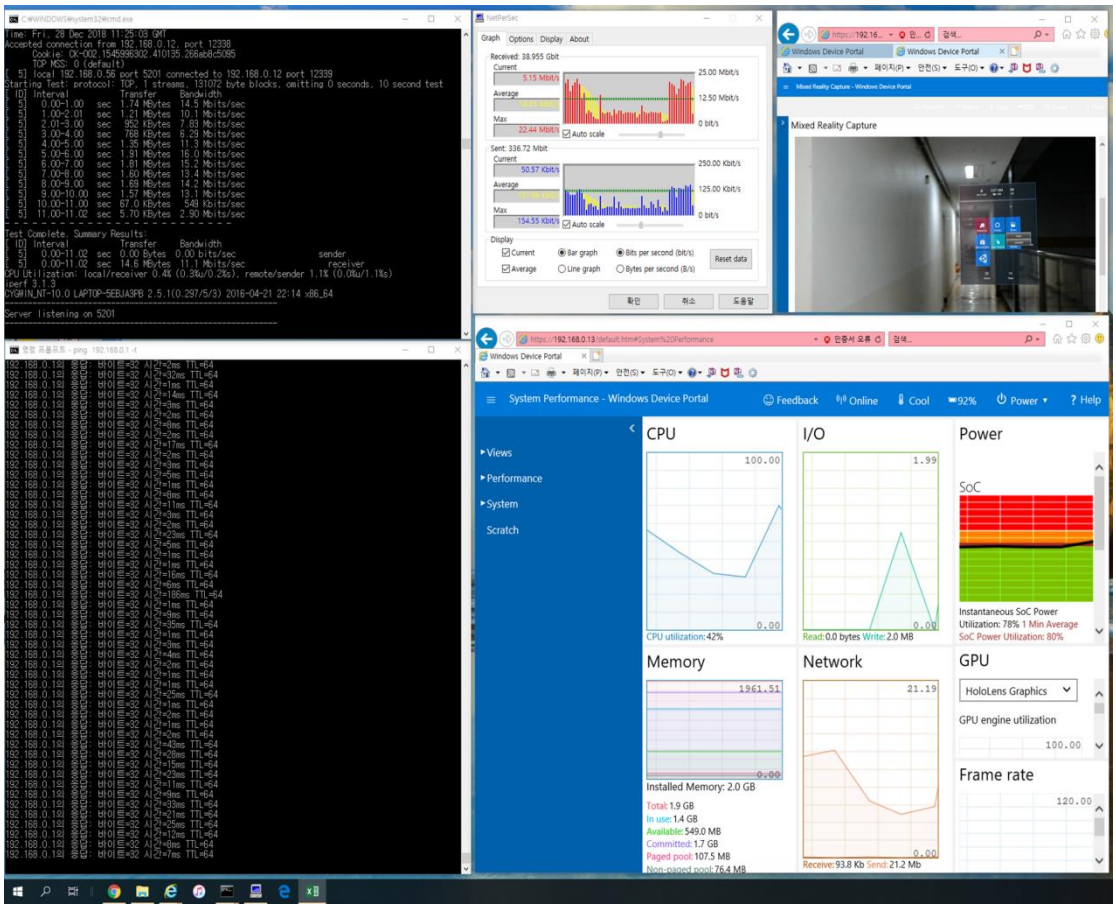
To devise a radio signal optimization plan applicable for a remote environment in a special construction environment, it is necessary to define the AR device's specification, derive the communication relay device's specification, review the AR device's coverage expansion plan in the field, and derive an optimization plan for the communication distance extension [5].

3. Analysis of the Measurement Results

The tower crane's environment diagram of <Figure 3> illustrates X, while <Figure 4> illustrates the comparison validation test for the customized communication environment vis-a-vis the existing communication equipment related application environment of <Figure 3>. The experimental results of <Figure 4> illustrates the comparative validation and analysis of the extent of improvement for the data transmission volume in the customized communication environment compared to the environment in which the existing communication equipment is applied within the line-of-sight(LOS) and the data transmission and reception between the AR devices within the line-of-sight(LOS), and the verification of whether the data transmission and

reception are executed and of whether a loss of data is generated as well as the data analysis are as illustrated in <Figure 4>[6].

Figure 4. 40M testing data analysis within the line-of-sight(LOS) environment.



3.1. Existing equipment's testing data

Table 2. Existing data.

Session 1	Time: Fri, 28 Dec 2018 11:25:03 GMT
	Test Complete. Summary Results:
	[ID]Interval Transfer Bandwidth
	[5] 0.00-11.02 sec 0.00 Bytes 0.00 bits/sec sender
	[5] 0.00-11.02 sec 14.6 MBytes 11.1 Mbits/sec receiver
	CPU Utilization: local/receiver 0.4%(0.3%u/0.2%s), remote/sender 1.1%(0.0%u/1.1%s)
Session 2	Time: Fri, 28 Dec 2018 11:25:55 GMT
	Test Complete. Summary Results:
	[ID]Interval Transfer Bandwidth
	[5] 0.00-10.11 sec 0.00 Bytes 0.00 bits/sec sender
	[5] 0.00-10.11 sec 20.8 MBytes 17.2 Mbits/sec receiver

	CPU Utilization: local/receiver 0.4%(0.2%u/0.2%s), remote/sender 0.9%(0.4%u/0.5%s)
Session 3	Time: Fri, 28 Dec 2018 11:26:36 GMT
	Test Complete. Summary Results:
	[ID]Interval Transfer Bandwidth
	[5] 0.00-10.03 sec 0.00 Bytes 0.00 bits/sec sender
	[5] 0.00-10.03 sec 20.6 MBytes 17.2 Mbits/sec receiver
	CPU Utilization: local/receiver 0.6%(0.2%u/0.3%s), remote/sender 0.8%(0.3%u/0.5%s)
Session 4	Time: Fri, 28 Dec 2018 11:27:15 GMT
	Test Complete. Summary Results:
	[ID]Interval Transfer Bandwidth
	[5] 0.00-10.07 sec 0.00 Bytes 0.00 bits/sec sender
	[5] 0.00-10.07 sec 17.4 MBytes 14.5 Mbits/sec receiver
	CPU Utilization: local/receiver 0.2%(0.0%u/0.2%s), remote/sender 1.2%(0.2%u/1.1%s)
Session 5	Time: Fri, 28 Dec 2018 11:27:46 GMT
	Test Complete. Summary Results:
	[ID]Interval Transfer Bandwidth
	[5] 0.00-10.07 sec 0.00 Bytes 0.00 bits/sec sender
	[5] 0.00-10.07 sec 22.2 MBytes 18.5 Mbits/sec receiver
	CPU Utilization: local/receiver 0.6%(0.4%u/0.3%s), remote/sender 0.8%(0.2%u/0.6%s)
Session 6	Time: Fri, 28 Dec 2018 11:28:16 GMT
	Test Complete. Summary Results:
	[ID]Interval Transfer Bandwidth
	[5] 0.00-10.08 sec 0.00 Bytes 0.00 bits/sec sender
	[5] 0.00-10.08 sec 16.4 MBytes 13.7 Mbits/sec receiver
	CPU Utilization: local/receiver 1.1%(0.6%u/0.5%s), remote/sender 0.9%(0.2%u/0.8%s)
Session 7	Time: Fri, 28 Dec 2018 11:29:04 GMT
	Test Complete. Summary Results:
	[ID]Interval Transfer Bandwidth
	[5] 0.00-10.11 sec 0.00 Bytes 0.00 bits/sec sender
	[5] 0.00-10.11 sec 16.2 MBytes 13.4 Mbits/sec receiver
	CPU Utilization: local/receiver 0.4%(0.2%u/0.2%s), remote/sender 0.6%(0.2%u/0.5%s)
Session 8	Time: Fri, 28 Dec 2018 11:29:36 GMT
	Test Complete. Summary Results:
	[ID]Interval Transfer Bandwidth

	[5] 0.00-10.09 sec 0.00 Bytes 0.00 bits/sec sender
	[5] 0.00-10.09 sec 16.2 MBytes 13.5 Mbits/sec receiver
	CPU Utilization: local/receiver 0.8%(0.6%u/0.2%s), remote/sender 0.6%(0.1%u/0.5%s)
Session 9	Time: Fri, 28 Dec 2018 11:30:31 GMT
	Test Complete. Summary Results:
	[ID]Interval Transfer Bandwidth
	[5] 0.00-10.06 sec 0.00 Bytes 0.00 bits/sec sender
	[5] 0.00-10.06 sec 17.9 MBytes 14.9 Mbits/sec receiver
	CPU Utilization: local/receiver 0.3%(0.1%u/0.1%s), remote/sender 0.6%(0.2%u/0.4%s)

3.2. Comparison of data : transfer : 8.7% increased / bandwidth : 8.6% increased

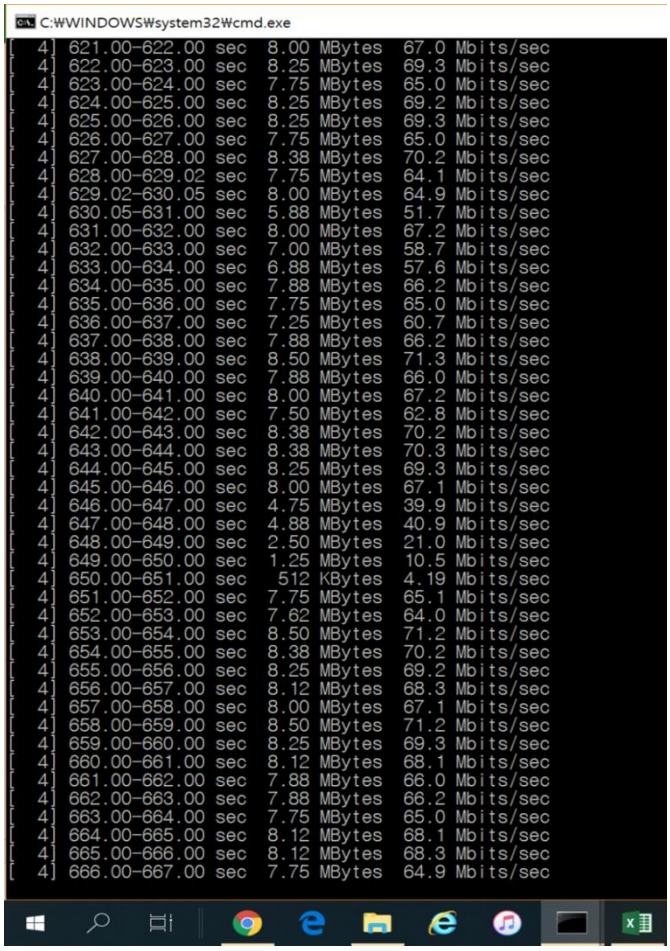
Table 3. Augmented data comparison.

	Existing equipment				Customized equipment			
	Transfer		Bandwidth		Transfer		Bandwidth	
Session 1	14.6	MBytes	11.1	Mbits/sec	21.2	MBytes	17.6	Mbits/sec
Session 2	20.8	MBytes	17.2	Mbits/sec	18.5	MBytes	15.4	Mbits/sec
Session 3	20.6	MBytes	17.2	Mbits/sec	17.5	MBytes	14.6	Mbits/sec
Session 4	17.4	MBytes	14.5	Mbits/sec	21	MBytes	17.5	Mbits/sec
Session 5	22.2	MBytes	18.5	Mbits/sec	18.5	MBytes	15.4	Mbits/sec
Session 6	16.4	MBytes	13.7	Mbits/sec	22.5	MBytes	18.8	Mbits/sec
Session 7	16.2	MBytes	13.4	Mbits/sec	26.5	MBytes	22.1	Mbits/sec
Session 8	16.2	MBytes	13.5	Mbits/sec	25.3	MBytes	21.1	Mbits/sec
Session 9	17.9	MBytes	14.9	Mbits/sec	15.8	MBytes	13.2	Mbits/sec
Average	18.0	MBytes	14.9	Mbits/sec	20.8	MBytes	17.3	Mbits/sec

3.3. Test to validate as to whether the data transmission volume is influenced by the interference of the existing communication environment

Such are the testing results compared to the indoor and outdoor environments where an interference from the existing communication environment has continuously occurred and the existing communication. In order to secure the objectivity and reliability based on the results of this testing data, the indoor and outdoor testing environment where the interference from the existing communication environment occurred and the indoor and outdoor testing environment where the interference does not occur from the existing communication environment whatsoever, the results of a comparative validation test conducted in an anechoic chamber testing environment are illustrated[7][8].

Figure 5. Indoor/outdoor environment's data transmission volume.



4. Conclusion

This study has verified that the data transmission volume has relatively improved in the customized communication environment compared to the existing environment in the line-of-sight(LOS) environment and the non-line-of-sight(NLOS) environment. However, in order to customize the communication equipment to enhance the radio wave performance and prevent the loss of data within the construction site, it is necessary to derive the quantitative numerical values according to the accurate setting of the environmental variables[9][10].

Based on this experiment, it was confirmed that the transmission distance between the AR devices increased during the radio wave amplification. However, as the increase took place, the network equipment became overloaded and the resulting network delay caused a decrease in the data transmission and reception between the AR devices due to the network delay, and it is also apparent that in order to calculate the quantitative range, it is necessary to define the standard regulations for the construction site's size and the elements which are installed and applied in a standard manner in the construction site. In particular, it is necessary to calculate quantitatively the extent of the data transmission and reception volume related improvement during the radio wave amplification[11].

In order to accurately validate as to whether the construction site is influenced by the data transmission distance and the loss of data according to the generation of noise, the noise generation related value per unit of the generated noise variable needs to be measured. Furthermore, the data transmission distance's decrease following the gradual increase needs to be

verified, and it is also necessary to check the section where the loss of data occurs. In the future paper, it will be necessary to derive and improve the quantitative numerical values between the generation of the loss of data due to the generation of noise.

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6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Author	CK	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑ -Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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The Relationship Between the Perception of Participation and SELF-DIRECTED LEARNING of the Women Senior Citizens Participating in Health Qigong

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Abstract

Purpose: *In this study, as an opportunity for the active health maintenance, the relationship of perception of participation on the self-directed learning attitude has been analyzed and investigated targeting the women senior citizens who have performed the Health Qigong program.*

Method: *According to the judgement sampling method and the convenience sampling method, the women senior citizens participating in Health Qigong in Seoul, Korea, were selected as the participants, and 183 units of data were used for the analysis. As for the data processing, the multi-way ANOVA was performed to learn about the differences in the program participation according to the educational and athletic background of the women senior citizens, and the multiple regression analysis was performed to validate the influence of the perception and self-directed learning. The statistical level was validated at p<.05.*

Results: *First, the differences between the perception of participation and the self-directed learning according to educational background and athletic experience, which are the background variables, were examined. Physical and social factors demonstrated significant differences for the educational background, and the self-directed learning demonstrated significant differences in the learning initiative, learning attachment, and the problem-solving skill factors. Second, among the results of the multiple regression analysis performed, and among the variables for the women senior citizens' perception of program participation for the self-directed learning, the physical and educational perceptions turned out to be significant, and the psychological and social perception turned out to be statistically insignificant.*

Conclusion: *Health Qigong should be actively used for health promotion in the old age, and the integrated self-directed learning promotion program ought to be prepared to help increase the exercise participants' perception of participation and adequately demonstrate their inner characteristics.*

[Keywords] ***Health Qigong, Women Senior Citizens, Perception, Self-Directed Learning, Experience***

1. Introduction

With Koreans in their 60s are the age group who were born during the era of baby boom immediately after the Korean War, who are also called baby boomers, and have made their contribution to the population growth. However, given the low birth rate and the aging population, the number of senior citizens has increased at an exponential rate from about 2020, and if the current trend continues, the proportion of senior citizens in Korea is expected to reach 40% by 2050[1][2].

The perception of problem caused by the rapidly aging society can be discovered across many studies related to senior citizens. Many studies, including those conducted on the successful aging of senior citizens, on the well-being and quality of life of the leisure education programs conducted for senior citizens, life satisfaction for the old age, adaptation to old age, and the

health care for the old age, have played a role as a driving force leading to highlighting and improving their quality of life. Furthermore, the integration of lifelong education for the senior citizens may be evaluated as an innovative change in the senior citizens' education, which was passive in terms of the senior citizens' welfare[3][4].

However, the women senior citizens, in particular, fear learning on their own in the evolutionary times of the 4th industrial revolution, and are also essentially unable to adapt to the modern life. In fact, as the population of senior citizens has steeply increased, the number of women senior citizens is significantly higher than that of men senior citizens at the social welfare facilities such as welfare centers[5][6]. In addition, the reality is that the Korean women senior citizens did not receive much education due to the influence of the Confucian lifestyle in the past, and are also living in a much more marginalized society such as facing the prohibition of the women's activities. In the light of such reality, it would be a daunting task for the women senior citizens to engage in health care or enjoy leisure on their own and be proactively looking after their health amidst the rapid social changes[7][8].

Until now, self-directed learning attitude means that the learner leads and causes his or her own learning. The self-directed learning attitude carries on the characteristics which emphasize spontaneity in the learning motivation, autonomy in the learning process, goal achievement orientation, value orientation in learning contents, and the playfulness and pleasure in the learning activities rather than other forms of learning[9][10][11]. Spontaneity refers to the intrinsic motivation of humans, while autonomy refers to the actions, thoughts, and independent actions of the learner through the self-determination. The goal achievement orientation emphasizes the virtuous cycle of planning, practice, and evaluation to ensure that the learners can feel the satisfaction, confidence, and the joy of achieving the learning goal itself. Value orientation is about trusting the value of self-learning, being certain of self-help, and enabling the learning to take place in the direction of further strengthening the learning activities[12][13].

In modern society, As for the senior citizens, it is very difficult for an individual to take proactive actions, continue to participate in the physical education for leisure, and achieve self-directed learning for the leisure satisfaction and health care. The senior citizens movement participants are exposed to external obstacles which influence their thoughts about exercise and internal disturbances such as the lack of energy, lack of motivation and desire, chronic pain, and health problems such as fatigue, and the fear of sudden death or falling during the exercise, which constantly exist, it may be said that the participation in sports as a leisure life is quite limited[14][15].

Hence, it is necessary to consider the ways to support self-directed learning by integrating the concept of self-directed learning to the education of women senior citizens to lead their independent lives in the old age. There ought to be a self-directed learning study concerning the physiological characteristics of only the senior citizens to help improve the quality of their lives for the old age. Health Qigong is a health method which encompasses mind and body, and its effectiveness is incrementally validated by numerous researchers. The Health Qigong, which has been around for long, is characterized by its slow and simple operation, which makes it very easy to learn and delivers excellent health promotion effects[16][17][18].

As the modern society has become an aging society, it is such a great task to improve the quality of life of the senior citizens and help maintain their health. Therefore, it is necessary to study the self-directed learning attitude as an effective strategy for promoting health and well-being in the old age. Accordingly, in this study, as an opportunity for the active health maintenance, the relationship of perception of participation on the self-directed learning attitude has been analyzed and investigated targeting the women senior citizens who have performed the Health Qigong program.

2. Methods

2.1. Participant

According to the judgement sampling method and the convenience sampling method, the women senior citizens participating in Health Qigong in Seoul, Korea, were selected as the participants, and 183 units of data were used for the analysis. Among the women senior citizens who participated in the study, it turned out that 125 women(68.3%) were aged 65 to 74, followed by 51 women(27.9%) aged 75 to 84, and 7 women(3.8%) aged 85 years old or older, each respectively. As for their educational background, 13 women(7.1%) had no education, 61 women(33.3%) graduated elementary(grade) school, 46 women(25.1%) graduated from middle school, 50 women(27.3%) graduated from high school, and 13 women(7.1%) graduated from college or a higher institution of learning, where it was investigated that those who graduated from elementary(grade) school were the largest in number. As for the qigong athletic experiences, 85 women(46.4%) had the most experiences with 1 to 2 years, followed by 56 women(30.6%) with 2 to 3 years of experiences, and 25 women(13.7%) with 3 to 4 years, and 17 women(9.3%) with 5 years or longer, each respectively.

2.1. Instruments

In order to measure the participation awareness of the women senior citizens participating in Health Qigong, it was revised and supplemented appropriately for the women senior citizens based on the survey of the actual status of the sports activities among the surveys of the participation in the national life and sports conducted by the Ministry of Culture, Sports and Tourism of Korea. The participation perception related variables are psychological, physical, social, and educational perception factors, and the related questions are consisted of a 5-point Likert scale. The exploratory factor analysis was performed to confirm the perception of participation factor structure, and after removing one question with an initial commonality value of less than 0.4, four factors with an eigen value of 1.0 or higher were extracted as the sub-factors for the participation perception variable. The total variance explained turned out to be significant at 68.130%, the Kaiser-Meyer-Olkin(KMO) measurement was .824, and the Bartlett's X2 test was 616.285(df=55, p<.001). The reliability test was also performed for the extracted factors, and Cronbach's α values turned out to be psychological perception of .711, physical perception of .767, social perception of .799, and educational perception of .784, which confirmed that the measurement tool was reliable.

The measurement tool used to measure the self-directed learning variable was supplemented with a questionnaire appropriate for the senior citizens based on the Self Directed Learning Scale(SDLRS) of the previous studies and was supplemented to conform to this study[19]. The exploratory factor analysis was performed to confirm the factor structure of the variable, and after removing one question with an initial commonality value of less than 0.4 and two questions loaded with the other factors, as the sub-factors of the self-directed learning variable, four factors were extracted with an eigenvalue of 1.0 or higher. It turned out significantly that the total variance explained was 72.665%, the Kaiser-Meyer-Olkin(KMO) measure was .905, and the Bartlett's X2 test was 1385.884(df=78, p<.001). The reliability test was performed for the extracted factors, and the Cronbach's α values were verified to be .803 for the learning opportunities, .794 for the learning initiative, .798 for the learning attachment, and .809 for the problem solving skills, which confirmed that the measurement tool was reliable.

2.2. Data analysis

As for the data processing, the multi-way ANOVA was performed to learn about the differences in the program participation according to the educational and athletic background of the women senior citizens, and the multiple regression analysis was performed to validate the influence of the perception and self-directed learning. The statistical level was validated at p<.05.

3. Results

3.1. Correlation analysis of measurement variables

The correlation analysis was performed to verify the participation perception of the women senior citizens participating in the health qigong program and the direction of the self-directed learning variables, and the results demonstrated that both the perception of participation of the women senior citizens and the measurement factors of the elf-directed learning variables yielded a positive(+) correlation, which suggest that each component has the same direction as presented in the study and that the conceptual relevance between the variables is very high. The correlation analysis of measurement variables is shown in <Table 1>.

Table 1. Correlation analysis of the measurement variables.

Division		1	2	3	4	1	2	3	4
Perception	Psychological perception	1							
	Physical perception	.385**	1						
	Social perception	.367**	.549**	1					
	Educational perception	.236**	.413*	.643**	1				
Self-directed learning	Learning openness	.275**	.431*	.435**	.539**	1			
	Learning initiative	.291**	.495	.400**	.539**	.710**	1		
	Learning attachment	.214*	.429**	.454*	.472*	.695**	.690**	1	
	Problem solving	.192*	.407*	.411*	.457**	.607*	.642**	.697**	1

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

3.2. Differences in the perception of participation and self-directed learning according to the academic background

As a result of analyzing the differences by academic background for the variables of perception of participation, which are the psychological, physical, social, and the educational perception, it turned out that there was a significant difference at the 95% of confidence level(Wilk's Lamda=.830, p=.007). Following which, as a result of analyzing the differences by academic background concerning the learning openness, learning initiative, learning attachment, and the problem solving skills, which are the variables of self-directed learning, it turned out that there was the significant differences(Wilk's Lamda=.795, p=.000).

Examining the test effect by factor according to the educational background, there was the significant differences in the physical perception factor(F value = 2.694, p = .033) and the social perception factor(F value = 2.604, p = .037) among the variables of the perception of participation. All of the self-directed learning variables demonstrated significant differences except for the learning openness factor(F value = 1.825, p = .126). Examining eta-square(η2), which demonstrating the relative influence of the independent variable for the dependent variable, the influence of the physical perception factor(.057) of the perception of participation variable turned out to be significant, and the self-directed learning variable had the problem-solving skill factor(. 150) demonstrating to be the largest. The differences between variables according to academic background are shown in <Table 2>.

Table 2. Results of difference in perception and self-directed learning according to the academic background.

Dependent variable	Independent variable	Degree of freedom	Mean Square	F	Significance probability	η^2	Wilks' Lamda
Perception	Psychological perception	4	.608	1.584	.181	.034	.830 (p=.007)
	Physical perception	4	1.192	2.694	.033	.057	
	Social perception	4	.959	2.604	.037	.055	
	Educational perception	4	.595	1.782	.134	.039	
Self-directed learning	Learning openness	4	.695	1.825	.126	.039	.795 (p=.000)
	Learning initiative	4	2.881	5.190	.001	.104	
	Learning attachment	4	2.134	4.019	.004	.083	
	Problem solving	4	4.996	7.848	.000	.150	

Note: p<.05.

3.3. Differences between the perception of participation and self-directed learning according to the athletic experiences

As a result of analyzing the differences by athletic experiences for the variables of perception of participation, which are psychological, physical, social, and educational perception, it turned out that there was a significant difference at the 95% of confidence level of significance(Wilk's Lamda=.910, p =.011). <Table 3> shows the differences between variables according to exercise experience.

Table 3. Results of difference in perception and self-directed learning according to the athletic experiences.

Dependent variable	Independent variable	Degree of freedom	Mean Square	F	Significance probability	η^2	Wilks' Lamda
Perception	Psychological perception	3	.210	.535	.659	.009	.910 (p=.011)
	Physical perception	3	.651	1.429	.236	.023	
	Social perception	3	1.448	3.988	.009	.063	
	Educational perception	3	.575	1.713	.166	.028	
Self-directed learning	Learning openness	3	1.355	3.643	.014	.058	.920 (p=.007)
	Learning initiative	3	.912	1.517	.212	.025	
	Learning attachment	3	1.943	3.577	.015	.057	
	Problem solving	3	.960	1.318	.270	.022	

Note: p<.05.

Following which, as a result of analyzing the differences by academic background concerning the learning openness, learning initiative, learning attachment, and the problem solving skills,

which are the variables of self-directed learning, it turned out that there were the significant differences(Wilk's Lamda=.795, p=.000). Examining the test effect by factor according to the educational background, there were the significant differences in the physical perception factor(F value = 2.694, p = .033) and the social perception factor(F value = 2.604, p = .037) among the variables of the perception of participation. All of the self-directed learning variables demonstrated significant differences except for the learning openness factor(F value = 1.825, p = .126). Examining eta-square(η2), which demonstrating the relative influence of the independent variable for the dependent variable, the influence of the physical perception factor(.057) of the perception of participation variable turned out to be significant, and the self-directed learning variable had the problem-solving skill factor(. 150) demonstrating to be the largest.

3.4. Relationship of effect between the health qigong perception of participation factors and self-directed learning

The multiple regression analysis was performed to analyze the relationship of effect between the perception of participation of the women senior citizens participating in Health Qigong on the self-directed learning. As for the analysis, psychological perception factors, physical perception factors, social perception factors, and educational perception factors were set as the independent variables, and the self-directed learning variables were analyzed as the dependent variables. As a result of the study conducted, 42% of the total change was explained for the regression model, and the model conformity was turned out to be good at the 95% of confidence level(p<0.5, F=32.716, R2=.424). Examining the statistical significance of each variable, the physical perception factor(β=.291, p=.000) and the educational perception factor(β=.419, p=.000) turned out to be significant for the self-directed learning dependent variable, and the psychological and social perception factors turned out to be statistically insignificant. The results of multiple regression analysis of self-directed learning variables and cognitive factors are shown in <Table 4>.

Table 4. Results of multiple regression analysis of perceptions on self-directed learning.

Dependent variable	Independent variable	B	SE	β	t	p
Self-directed learning	constant	.295	.320		.923	.357
	Psychological perception	.056	.065	.054	.854	.394
	Physical perception	.277	.067	.291	4.130	.000
	Social perception	.041	.086	.040	.479	.633
	Educational perception	.464	.083	.419	5.616	.000

Note: F=32.716, R^2=.424, Durbin-Wason = 1.778, p<0.5.

4. Conclusion and Recommendations

This study sought to examine and understand the internal and external characteristics of the women senior citizens, and what kind of perception they have towards participating in the Health Qigong program, and in what form the self-directed learning is manifested. Self-directed learning is a form of learner centric learning by which the learner takes the initiative in the learning progress, makes overall decisions, conducts learning, and evaluates the learning outcomes. Self-directed learning, which has been primarily discussed for the elementary, middle, and high school students, has brought about a new perspective on the educational practice across all age groups as the learner centric education has expanded. Recently, it has been recognized as a universal educational theory which is comprehensively applied throughout life, including adulthood, and the target age group has also diversified[9][11][20].

As a result of the study, first, the differences between the perception of participation and the self-directed learning according to educational background and athletic experience, which are the background variables, were examined. Physical and social factors demonstrated significant differences for the educational background, and the self-directed learning demonstrated significant differences in the learning initiative, learning attachment, and the problem-solving skill factors.

The results of this study are similar to those of the study on the relationship between the senior citizens' art education and self-directed learning. As for the art education, self-directed learning and age had little relationship, and the most important predictors of the self-directed learning were the level of art education and that of general education. Furthermore, the learner's personal experience related to education is important, and in particular, a higher education experience is an important factor in broadening the perception of growth potential and enhancing the personal value for learning[21]. According to the previous studies, in terms of the self-directed computer learning experience of the senior citizens, the senior citizens who were ready to be responsible for learning, when accompanied by the provision of meaningful activities, technical support, investment of time, network construction, and computing repertoire development, self-directed learning was said to be possible[22][23].

Therefore, comparing the results of the previous studies with those of this study, it may be said that the women senior citizen's educational background as a past educational experience and athletic experience as a time investment for Health Qigong could increase their perception of participation and also form a positive relationship for the self-directed learning. It is apparent that the higher the education level of the women senior citizens and the better structured the program, the more the self-directed learning can be expanded. Furthermore, even if the level of educational background is low, and if the exercise support program and instructional methods are well structured so that participants can continue to exercise, the self-directed learning of the women senior citizens could be further expanded[24][25].

Second, among the results of the multiple regression analysis performed, and among the variables for the women senior citizens' perception of program participation for the self-directed learning, the physical and educational perceptions turned out to be significant, and the psychological and social perception turned out to be statistically insignificant. Such research results may be said to demonstrate such a strong significant difference in the self-directed learning through the skills of Health Qigong as the physical factors are learning and recognizing the exercise with the body. Such research results may be said to be partially consistent with the results of the previous studies which suggested the improvement of physical ability as a major determinant of the successful aging in the old age[1][26][27]. The participation in Health Qigong was perceived to be self-healing, and it was also verified that the concept of self-management was introduced. Hence, it may be said that the physical perception factor explains the self-directed health care.

As for the educational factors, memorization is among the essential requirements since a certain type of pattern is learned given the nature of exercise learning of Health Qigong, and it is so determined since it requires the effort to memorize each technique. Furthermore, it may be said that the relative depth of competition caused by comparing and performing their own movements with those of other participants also has had a certain influence on the participants who practiced together. Verifying the research results, in order to expand and promote the self-directed learning of the women senior citizens, it would be necessary to develop effective guidelines or exercise programs which focus more on the self-directed learning than which has been used for the education of the senior citizens to date[28].

Meanwhile, the psychological perception factors which are analyzed as statistically insignificant may be said to be so since it was thought that Health Qigong was not considered to be the essence of the East Asian culture, but rather as a part of the physical activities to enjoy a kind of leisure. It is presumed that the social perception factor is difficult to identify because of

sociality by Health Qigong itself, and it is far from the creative learning attitude of the self-directed learning which is achieved based on fun and immersion.

The Health Qigong exercise is very effective in recovering from the chronic diseases and promoting a healthy life since the movements are carried out by moving slowly according to the overall rhyme[29][30]. Hence, Health Qigong should be actively used for health promotion in the old age, and the integrated self-directed learning promotion program ought to be prepared to help increase the exercise participants' perception of participation and adequately demonstrate their inner characteristics. Furthermore, future studies should also follow the development of the self-directed teaching methods which can help encourage the senior citizen learners' independent performance and responsibility in the Health Qigong program operation while encouraging the cooperative learning activities as well.

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6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Lead Author	MP	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Corresponding Author*	JL	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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The Effects of Immersive Learning for Poetry Writing via a VR GAME for Generation Z Students' Creativity: Focusing on "Forum VR: Artist of Oz"

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Abstract

Purpose: *This study aims to examine and understand the effect of immersive learning in poetry writing by using VR games to enhance the creativity of Generation Z.*

Method*: To examine and understand which emotions among the positive and negative emotions the participating students experienced with respect to playing the VR games, the PANAS scale was used for the investigation. Also, this case study was carried out where a semi-structured interview was conducted to examine and understand the effect of immersive learning for poetry writing to foster creativity via VR games.*

Results: *As a result of the investigation conducted via the PANAS scale, it turned out that the Generation Z students experienced positive affection(PA) for the immersive learning via the VR games, and experienced nearly no negative affection(NA). Plus, a semi-structured interview was conducted to examine and understand the immersive learning effect of the participating students. Keywords were extracted from the transcribed interview details by the inducive coding. The extracted themes are 1 fun, 2)collaborative problem solving, and 3)creativity.*

Conclusion: *As the interest in the "metaverse", which refers to the world of virtual reality has heightened, many of Generation Z are visible as they engage in even economic activities there. It is necessary to pay more attention to designing the learning experience of Generation Z by combining the unique experiences of virtual reality with creativity education. In this respect, it would be worth noting that the opportunities for research findings that the powerful experiential learning provided through immersive learning had a positive effect on the creative poetry writing activity in this study, and such discovery opportunities are quite educationally meaningful.*

[Keywords] ***VR Game, Immersive Learning, Creativity, Generation Z Students, Poetry Writing***

1. Introduction

The 21st century has ushered in a society that is faced with highly sophisticated informatization, industrialization, liberalization, and globalization, and is also an era that requires creative talents to play an active role. The intensified international competitiveness demands a higher level of knowledge and skills, and toward this end, various attempts and efforts at the social and national level are urgently called for. In keeping pace with the needs of the time, fostering talented people with creative abilities to flexibly respond to such rapid global changes has become a high-priority role for the field of education. Creative ability refers to the ability to critically accept information and respond in an appropriate manner to changes while forming new knowledge and information. To foster talented people with such creative abilities, new changes are urgently called for in the way of learning and teaching as well as in the educational environment. In Korea's curriculum, too, creativity education is emphasized based on the ideological

basis of fostering autonomous and creative Koreans who will lead the 21st century toward globalization and the information age[1].

The current elementary, middle, and high school students who need to undergo creativity education intensively are "Generation Z," who were born in the 2000s. They are familiar with the digital environment having been exposed to it since their birth, pursue the latest trends and unique experiences, and find meaning through such colorful experiences[2]. As the educational environment is undergoing a period of transition, in the current environment for educating Generation Z with such characteristics, "The 20th century teachers are teaching students who will live in the 21st century in the 19th century classrooms"[3]. Although the COVID-19 pandemic is negative, looking on the bright side to find the positives, the pandemic did allow the opportunities to emerge that turned out to be positive to materialize the discourse to call for the creation of a digital education environment. Given the parallel of contactless education and face-to-face education, the use of digital devices has become a daily routine, and the teachers' experimental attempts and challenges are continuing in pedagogy. The pattern of changes expected after a decade has seen advancement by at least 5 years. This is a time of desperation to find a realistic guide for how the children, who will live in the 21st century, should grow up and with what kinds of capabilities, and for how digital immigrants will lead such digital natives amidst such evolutions. Based on this study, it is intended to examine and understand the effect of immersive learning in poetry writing by using VR games to enhance the creativity of Generation Z.

2. Literature Review

2.1. Creativity and poetry writing

Creativity has been studied and defined from a very wide variety of perspectives. It is generally defined as the "*creation of novel and useful products which are recognized, supported, or satisfied by people at a specific time*"[4][5][6].That is, creativity is the act of creating novel and unique ideas that are realistically appropriate in terms of content and effect. The components of creativity are flexibility, originality, elaboration, development, fluency, courage, curiosity, entrepreneurship, optimistic attitude, immersion with work, use of intuition, independence of thinking and judgement, and the perspective of viewing objects[7]. Furthermore, creativity, which is a divergent way of thinking, is also classified by the components of originality, flexibility, sophistication, sensitivity, fluency, and redefinition of thinking[8]. Currently, creative people who have creative personalities are classified based on the "*4 Ps*" of creativity: product, person, process, and press[9]. The 4P's of a creative product are only possible when a creative person undergoes a creative thinking process in a creative press.

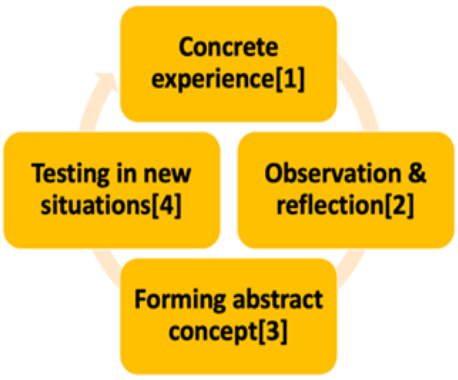
Creativity has been dealt with across various fields of education, with especially significant focus in the language field. A series of the linguistic activities of listening, writing, speaking, and reading constitutes the creative intellectual process that forms meaning through the various mental processes[10]. Hence, the process of "*comprehension*," which involves listening and reading, and the process of "*expression*," which incorporates speaking and writing, would naturally vary depending on one's point of view or worldview, and the very individual nature of the process of reconstructing meaning is absolutely crucial[11]. In particular, poetry helps one to develop creativity by stimulating the imagination and making one curious about new and different worlds, and brings enjoyment through the works embodied in language. That is, the series of the processes of reading, appreciating, and creating poetry stimulates curiosity and the imagination, helping one to develop creative thinking, which can lead to new perspectives. However, in the current field of Korean language education, poetry education is not conducted in a manner that enhances creativity, but rather is focused on the knowledge, memorization, and use of poetry, and hence, it is necessary to find venues in which poetry writing can be taught in a way that fosters creativity[12].

2.2. Experiential learning

Various attempts have been made to connect the unique experiences pursued by Generation Z with learning experiences[13][14]. Such an educational challenge sheds a new light upon John Dewey's empiricist educational theory, which stresses "*learning by doing*." According to John Dewey[15][16], "*experiential learning*" is a process of "*trying*" and "*undergoing*," recognizing issues, gaining ideas, thoroughly testing a response, experiencing the results, and confirming or modifying the previously held concepts, based on which meaningful learning takes place. Such meaning-making induces learning for one to learn through experiences and also stresses that it is more important to create the new knowledge and change oneself via learning to play a new role than to simply learn what to do[17][18].

David Kolb claimed that true learning occurs through the process of changing experiences to form new knowledge[19]. The 4-step cycle of experiential learning claimed by David Kolb is "*concrete experiences → reflective observation → abstract conceptualization → active experimentation*" <Figure 1>. For instance, if students go on a field trip(concrete experiences), they can experience reflective observation while keeping a journal or diary about the field trip, and after returning to school, through additional readings and discussions of each other's findings, "*abstract conceptualization*" will be experienced. Thereafter, if the students went on a field trip to another place to test the newly established hypothesis arrived at through the discussions, it would be an active experiment they carried out. David Kolb claimed that only concrete experiences or learning activities by themselves are not very useful, and that learning takes on meaning when reflective observation, critical analysis, comprehensive thinking, and active experimentation are sequentially performed[20]. For the Generation Z students who seek unique experiences and engage in "*learning by doing*," the experiential learning theory not only sets the stage for an enjoyable experience, but offers implications such as how the experience can be developed into meaningful knowledge, and when connecting and integrating the previously acquired knowledge and the experience gained this time, and when thinking about this, what kind of active experimentation can be attempted.

Figure 1. David Kolb's experiential learning cycle.



2.3. Immersive learning

Immersive experiences offer us the feeling that we are moving somewhere else or are focused on a certain action, and that we have control over what will happen next to some extent[21]. Immersive learning, which makes us feel in this manner, allows us to use our knowledge and resources to resolve problems or hone skills, as if we were there, to create memorable learning experiences. Immersive learning mostly uses augmented reality or virtual reality technologies to enable us to experience the powerful fun that feels like a real experience in an environment

that is difficult to experience in reality[22]. Such immersive learning can induce the active and in-depth participation of the learners, increase the quality of group discussions, and enhance understanding, and hence, it can positively appeal to the Generation Z learners who are seeking unique experiences. In particular, immersive learning provides us with the experience of moving to another location or environment in a variety of ways, and is also appropriate for learning related to specific contexts or situations where specific skills and strategies are attempted or practiced[23][24][25]. Immersive learning experiences are fun, engaging, and very intense. There are very few examples of immersive learning in the field of language education that take advantage of such strengths. Hence, through this study, it is intended to examine and understand how the immersive learning using VR games that can enhance creativity through poetry writing and language activities influences the Generation Z learners.

3. Methodology

3.1. Participants

A total of 9 students participated in this study, including 4 students from grade 4, 2 from grade 5, 1 from grade 6, and 2 from grade 7. They were all born in or after the 2000s and are among the Generation Z, who are familiar with the digital environment and seek special experiences. This study participated in this VR experience program by visiting municipal and district libraries offline twice in 2020, at the height of the COVID-19 pandemic. Given the frequent closures of the libraries since the outbreak of COVID-19, only 9 people participated in the 2 sessions. Prior to participating in the VR experience and discussion program, a language background survey of the participating students was conducted. Seven of the students disliked writing, and 8 liked reading.

3.2. Research instruments

In this study, the educational effectiveness was examined by focusing on the “Forum VR: Artist of Oz”(developed by Studio Coin Co., Ltd.) (hereinafter, “Forum VR”, http://www.forumvr.co.kr/?lang=en) program through which one experiences and discusses the VR games, which are of an interactive narrative game genre. “Forum VR” is a future-oriented discussion program where multiple participants play VR games together and continue their discussion activities . Forum VR introduced the MR(Mixed Reality) system and the multi-player online system to synchronize the experiences of the experiencers and the participants; in particular, the MR system can implement a multi-player online system in which a person who experiences VR games and a participant who makes decisions with a tablet PC would simultaneously communicate among themselves while looking at the screen. Such a system played a role in strengthening the situational judgement skills and cooperative decision-making process for both the experiencer and the participant, thereby making it possible to connect with the discussion class through their common experiences. Furthermore, including the latest technology, it is designed as a future-oriented discussion program that links to the topic after the multi-participation VR experience activities.

Forum VR consists of a total of 3 volumes, and for this study, the “Artist of Oz” program, which can discuss culture and art , was selected. It is a cooperative learning type of VR program where a team consists of 1 experiencer, 5 to 10 participants undertake conversations and discussions, and the VR device-wearing experiencer and the participant with a table PC take turns experiencing the VR <Figure 2>. In particular, considering the cybersickness of the experiencer wearing the VR device, it is designed in such a way that each person would undergo the experience for 10 to 15 minutes, and then take turns with another participant when the scene changes, thereby minimizing cybersickness. Furthermore, the VR experiencer is the protagonist who experiences the virtual world at the participant’s choice, and the participants play a role in judging and deciding the experiencer’s story via voting while watching the various situations taking place as the story unfolds <Table 1>.

Figure 2. The system of VR experiencer and participants.

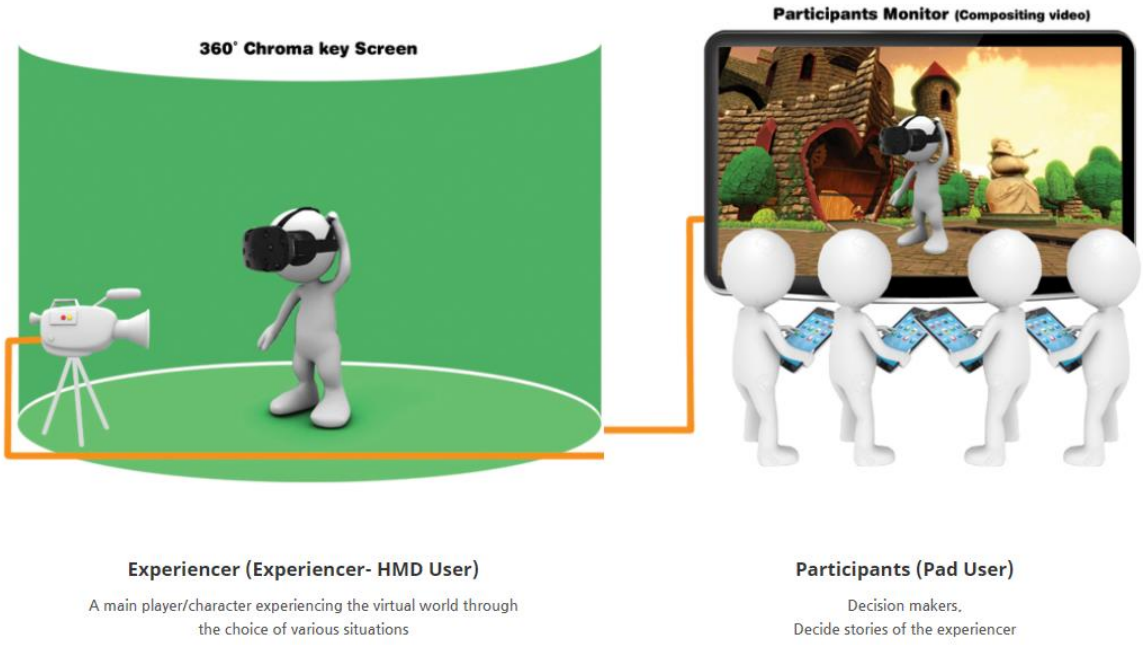


Table 1. The role of VR experiencer and participants.

VR experiencer	Participants
Experiences the virtual world at the participant's choice	Play the role of judging and deciding the story of the experiencer via voting while watching the various situations taking place as the story unfolds.

Hardware consisted of the VIVE set VR equipment, MR equipment ZED Camera, screen, five Android tablet PCs, which are network equipment, and the wireless router. As for the software, among the three titles of Forum VR, for this study, Artist of Oz, in which the acceptability of culture and art could be discussed, was selected. The Artist of Oz is a program for 10- to 14-year-olds <Figure 3>. The Artist of Oz, which is based on the "Wizard of Oz" as a motif, unfolds as a story of solving a situation where a hot air balloon returning home after an adventure in Oz does not work. One can choose a character from among Dorothy and her friends, take care of a mission related to literature, dance, music, and art, and then return home by launching a hot air balloon as a reward. During the discussion session , the topic of "imitation and creation" was discussed in the field of literature, and the "Writing Poetry for a Depressed Witch" activity was carried out while understanding the characteristics of poetry.

Figure 3. The artist of Oz.

3.3. Research procedure

This study was conducted over a total of two sessions and four instructions for the elementary and secondary school students who applied for the VR discussion programs at the municipal and district libraries. Prior to experiencing the VR game program, a survey was conducted on the language background of the students. The 1st and 2nd instructions were offered on the 1st day of the VR discussion program, and the 3rd and 4th instructions were held on the 2nd day. On the 1st day, they experienced the VR game for 50 minutes with the students who applied for the 1st instruction, following which during the 2nd instruction of the 1st day, they performed work for 50 minutes to understand the discussion agenda . After preparing the materials for discussions by using library materials, and during the 3rd instruction on the 2nd day, they had 50 minutes of discussion based on the prepared materials. During the 4th instruction, while experiencing the VR game again for 50 minutes, the participants were asked to confirm and develop their thoughts through the discussions and compare them with the previous experiences <Table 2>.

Table 2. Program sequence.

	1st day			2nd day	
Instruction	1st instruction	2nd instruction	*Preparation of materials	3rd instruction	4th instruction
Sequence of experiences	Experience VR	Understand discussion agenda	Prepare materials for discussion	Proceed with discussion	Re-experience VR
Details	Experience forum VR with the peers who petitioned	Understand details to discuss together by undertaking various activities	Prepare discussion materials by using library materials	Conduct discussion with the prepared materials	Compare past experiences while re-experiencing Forum VR

Time consumed	Approximately 50 minutes	Approximately 50 minutes	Until next class	Approximately 50 minutes	Approximately 50 minutes

The Forum VR program made it possible for the elementary and middle school students among Generation Z to immerse themselves in various situations encountered in the virtual reality while playing the VR games with fellow learners, and then to review their experiences in detail while undertaking the discussion activities . During the 2nd instruction, they proceeded in the sequence of having opportunities to validate the ideas discovered via reflective observation and abstract conceptualization while playing the VR game once again. This was designed based on David Kolb's experiential learning cycle, which proceeds in the phases of "*concrete experiences → reflective observation → abstract conceptualization → active experimentation*"[20].

3.2. Research method

3.2.1. Survey using the PANAS scale

To examine and understand which emotions among the positive and negative affections the participating students experienced with respect to playing the VR games, the PANAS scale was used for the investigation. The PANAS scale has been validated as a globally valid and reliable scale among the scales that confirm the positive and negative affections of the subjects given any experiences[14]. Using the PANAS scale of a 7-point Likert scale, the students were asked to select the extent to which they felt certain emotions regarding the VR game experience by looking at 16 questions consisting of adjectives. The 16 questions consisted of selected adjectives describing 8 positive affective(PA) expressions and 8 negative affective(NA) expressions <Table 3>.

Table 3. Configuration of the PANAS scale.

Positive affection(PA)		Negative affection(NA)	
1. Fun	5. Easy	1. Worried	5. Difficult
2. Happy	6. Interesting	2. Anxious	6. Depressed
3. Proud	7. Exciting	3. Frustrated	7. Shameful
4. Pleasant	8. Involved	4. Tough	8. Lonely

3.2.2. Semi-structured interview about immersive learning via the VR game

A case study was carried out where a semi-structured interview was conducted to examine and understand the effect of immersive learning for poetry writing to foster creativity via VR games. The case study is a research method with which one explores a specific research subject, and using a case study method, a semi-structured interview was conducted to discover the understanding and meaning of the participating students' program experiences[26]. In this study, the specific experiences of the participating students' individual poetry writing activities were investigated based on the discussions of group poetry writing activities and "imitation and creation" in the VR game experience process. The one-on-one interview was conducted after they experienced the 2nd VR game during the 4th instruction, and then the voice-recorded interview was transcribed, and the results were analyzed by inducive coding.

4. Research Results

4.1. Results of the students' affective domain using the PANAS scale

Among the affective domains of the students, it was examined as to whether the affections toward immersive learning using VR games were positive or negative. The Cronbach alpha coefficient was 0.837 for 16 questions, which was very reliable. As a result of the investigation conducted via the PANAS scale, it turned out that the Generation Z students experienced positive affection(PA) with a score of 6.8 out of 7 points for the immersive learning via the VR games, and experienced nearly no negative affection(NA), with 6.1 points <Table 4>.

Table 4. Results of analysis with the PANAS scale.

Forum VR game experiences	Frequency	Min.	Max.	M	SD	Reliability cronbach's alpha value
PA	9	6. 7	6.9	6.8	3.8756	.837
NA		5.8	6.3	6.1	2.1795	
Effective no.		.	.	.	.	

4.2. Results of the semi-structured interview about immersive learning experiences

A semi-structured interview was conducted to examine and understand the immersive learning effect of the participating students. Keywords were extracted from the transcribed interview details by the inducive coding. The extracted themes are 1)fun, 2)collaborative problem solving, and 3)creativity.

1) Fun

All of the students who participated in the VR game said that their VR game experience related to this discussion was very interesting. They said that they focused on the situation as if it had actually happened to them and also replied that they felt like they became the protagonist of the video game.

[S1's extracted text]

"It was fun to choose music and match the rhythm with my friends. I'll have to read 'The Wizard of Oz' again. I became curious about the contents after playing this (VR game).

It was fun, and I want to participate again."

[S3's extracted text]

"It was so much fun since I felt like I became the protagonist in the game when I wore the VR (on my head). I wanted to play for a long time, but too bad it was too short. Time flew so fast in the blink of an eye. It was so much fun, and I want to participate again."

[S9's extracted text]

"The entire process was fun. It's sad that it was so short. It was especially fun talking about the 'Witch of the East.'"

In particular, it was confirmed that the students lost the sense of time and immersed themselves in the VR game and discussion time. It is apparent that this is a powerful immersive experience in which the experiencer identifies themselves with their avatar in the virtual world, and this avatar identity is quickly assimilated into the narrative of the game.

2) Collaborative problem solving

The students who participated in this study were primarily those who applied to participate in the VR program at public institutions, including municipal and district libraries. Hence, a team was formed from different schools and grade levels, and the students replied that the experience of solving problems by collaborating with the team members they met for the first time was very fun and helped them develop a cooperative spirit.

[S5's extracted text]

"The experience of collaborating with friends to solve problems while exploring the VR was so much fun. It was absolutely nice to be able to develop a cooperative spirit."

[S7's extracted text]

"Collaborating and solving problems while listening to the stories of friends who have different opinions than me, and making decisions and choices, was very fun. This program seems to be very helpful in growing a cooperative spirit."

3) Creative thinking

The VR game selected for this study is a game among those of the interactive narrative game genre, and is also a game with a structure through which the players create stories while interacting with each other. The participating students were able to strengthen their creative thinking by thinking and imagining in various directions while conversing with their team members.

[S4's extracted text]

"I was thrilled because this game gave me the confidence and the ability to imagine with freedom. I think I have become an even more creative person."

[S8's extracted text]

"As I conversed more with my friends, I got to do a lot more imagining. What I imagined was helpful when I was writing poems and creating content. In particular, it was really helpful to listen to other friends discussing what I hadn't thought about."

The students replied that the VR game discussion program was fun and also helped them to think creatively and solve problems through cooperation.

5. Discussion and Educational Implications

The students who experienced the VR game of Forum VR: Artist of Oz came to have positive affections toward the program, and it was discovered that they had "fun" the most, among others. Furthermore, after playing the game and completing the writing, they replied that they were able to further strengthen their immersion in the story by playing the game again and discovering the changed thoughts of themselves and their peers. Moreover, they replied that they did not feel any pressure when they experienced immersive content and undertook the writing, which previously they had not usually liked. It has been analyzed that the amusement provided by the game significantly lowered the psychological burden, thereby enabling even more flexible thinking activities, and that it connected to creative thinking more promptly. In particular, it may be interpreted that the various contexts provided by the game stimulated the students' imagination and also created active opportunities to think in a very new way through discussions with their peers. Such research results provide such meaningful implications that the limitations of the methods of formal classroom learning in analyzing poetry and acquiring information about the poetry or poets can be overcome with realistic experiential discussion classes . Furthermore,

through non-formal learning in discussion classes , it is possible to significantly reduce the burden of viewing poetry, which can enhance creativity and allow students to feel the emotions of poetry and express them freely through the VR games, whereby educational implications are offered in which learning can occur through memorable experiences.

During the interviews, the students replied that they were able to promptly feel intimacy with peers that they had met for the first time in the VR experience, mutually communicating to achieve a common goal, respecting each other's opinions, and completing every mission and quest safely. This is a strong advantage of the interactive narrative game, and it has also been analyzed that players were able to immerse themselves in the narrative elements of the game much faster and more deeply through their interactions. Furthermore, it is also worth paying attention to the students' responses that they identified both with themselves in the real world and with the character in the game they had chosen, and that they remembered the flows and contents of the story, even after the games were played, as a meaningful part in terms of language learning. Based on such experiences, more stories can be created by imagining various matters, and this can also be a meaningful resource in generating creative content not only for writing but also across other genres, including music, art, and dance. Moreover, it is worth noting that the game of the Artist of Oz is a creative story based on the original work of The Wizard of Oz, and also worth noting the fact that the students paid attention to the original work and confirmed the possibility of connecting with it, with intentions of reading it. The VR game experience was held at the municipal and district libraries, and based on the experiential learning, it was also possible to verify the possibility of creating an environment in the future that would make reading more interesting. Furthermore, if this program were used in schools, the project-based learning(PBL) that can be connected with various subjects, such as reading, music, art, physical education, Korean literature, and English, will be made possible, and it is also expected that it will be able to meet the educational goal of fostering the talented human resources. Through the follow-up studies, it would be necessary to study the various effects of the immersive learning experience in greater depth, and it would also be necessary to review the learning performance results of the learners.

Generation Z, who pursue unique experiences, are living as prosumers who create and consume various types of creative content in the virtual world. In particular, as the interest in the metaverse has heightened, many of Generation Z are visible as they engage in even economic activities there. "Metaverse" refers to the world of virtual reality under the concept that there is another universe above the earth we live on[27]. It is necessary to pay more attention to designing the learning experience of Generation Z by combining the unique experiences of virtual reality with creativity education. In this respect, it would be worth noting that the opportunities for research finding that the powerful experiential learning provided through immersive learning had a positive effect on the creative poetry writing activity in this study, and such discovery opportunities are quite educationally meaningful.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Author	JC	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑ -Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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The Effect of ARTIFICIAL INTELLIGENCE and Child Life Guidance Subject on Pre-Service Teachers

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Abstract

Purpose: *The purpose of this study is to investigate the effects of AI and child life guidance subject on pre-service teachers.*

Method: *AI and child life guidance subject was conducted for one year. The feeling of contents of AI and child life guidance subject was investigated, the opinions of the students and the experience of operating the curriculum for children's life guidance for decades. The instructional design was reconstructed. AI and child life guidance subject was applied for one semester to 40 third - year university students attending , 10 of them were selected as research participants. For data collection, in-depth interviews were conducted with the 10 students who experienced. Qualitative content analysis were collected the opinions of the students and the experience to closely examine their thoughts and attitudes*

Results: *Pre-service teachers reported the importance of AI and child life guidance subjects. They understood the AI robot to be used in the field well, acknowledged the value of the robot as an assistant teacher, and said that the method of cooperating with the robot is a future-ready capability. It was said that the AI movie seemed to have provided the motivation for the learning contents of AI and children's life guidance. Children's life guidance learning using robots became interested in the children's life guidance subject.*

Conclusion: *First, If the teacher's competency of using robots, which is an assistant tool for tutors, is developed, pre-service teachers will be able to grow further in the AI era through efforts such as fostering professionalism, teachers should be nurtured to provide guidance by using big data of AI to focus on expanding children's thinking and social relationships. supporting children's thinking expansion, and providing positive life guidance. Second, In accordance with the direction of AI education policy, teachers should be nurtured to provide guidance by using big data of AI to focus on expanding children's thinking and social relationships. Third, A teacher's ability to guide children's life with delicate sensitivity that cannot be aided by robots will be an effective way to guide children's life. The use of robots will enable customized guidance for each child. Fourth, Teachers should develop the capacity of life guidance for child-led interaction to promote the development of children's autonomy. Fifth, Teachers should have an opportunity to check the political and cultural context of teaching-learning through self-reflection because the value and belief system of teachers also affect the interaction with children.*

[Keywords] ***Artificial Intelligence, Child, Life Guidance, Pre-Service Teacher, Instructional Design***

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][3][4]. AI and robotics technologies that will have significant impact on the development of humanity in the future[5]. The case of Child Life

Guidance is no exception, and the recent rapid development of AI-based advanced technology[3][4]. This university is also requesting each department to develop new subjects that match our university's talents, emphasizing the necessity of the proposed major courses, differentiation from previously opened major courses, and the operation plan for the development of lesson design(teaching methods)[3][4].

The development process of the 4th Industrial revolution can be found in the appearance of becoming a mature woman because of the care of the robot mother in the AI movie 'My Mother'[6]. Another movie, 'Black Panther', you can find the role of AI in which clothes are worn by touching buildings and vibranium-based buildings(airplane, mobiles), and autonomous transportation[7]. This phenomenon can be expected to be possible in kindergarten field when going to kindergarten and when coming. Currently, when I go to kindergarten and come, the driver and assistant teacher are accompanied by me. It can be imagined that a kindergarten autonomous driving car equipped with a destination setting system can come and go home-kindergarten without a driver. And in the movie 'Ready Player One', you can design virtual reality classes. Virtual reality can be designed to design interesting education that infants and young children can fully work by utilizing the fact that there is no space constraint[8]. Hiro, a genius engineer, tries to reveal the secret of his death as a therapeutic robot left by his brother after the death of his brother's question. Then a masked villain who does not know the identity related to his brother's death appears, and Hiro confronts the villain of the question[9]. Even if the virtual reality covered in AI movies can be a reality now, it is important to develop a curriculum for future preparation. These VR contents have the advantage of beingable 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[10].

From the end of 2019, TV programs, radio, and social media platforms have covered the novel corona virus infection(Corona 19) as the most important article[11]. In particular, the method of teaching children's life can be observed by setting up the virtual reality situation, and the pre-service teacher's life guidance method will be learned as a pre-service situation. In order to solve interrelated problems such as cooperation, help, and negotiation in a new environment, we will be able to practice learning social skills through talking to others[5]. The development process of the 4th Industrial revolution. Teachers will be able to watch the children and intervene according to the situation to communicate with the children and draw the cooperation of the children.

Robots judge and guide children only with data, but the delicate parts and sensitive emotions found in each infant may be limited. However, if robots are used as assistant teachers in the era of the 4th Industrial Revolution, it is expected that the maximum educational effect will be obtained as a customized life guidance teacher for infants and toddlers. Therefore, in order to develop the competence of pre-service early childhood teachers compared to the future society, it is necessary to develop a curriculum that develops expertise to prepare for the future society by learning coding education and ICT education in advance.

Recently, the Korean government has emphasized the cultivation of creative and convergent talents that live together with information and computing skills by strengthening SW-AI education. For this purpose, we proposed computing thinking ability, information culture literacy, digital collaboration ability, and convergent problem solving ability as important competences(Korea Government Education Policy)[12]. When developing new subjects that meet the talents of our university according to the direction of the government's education policy, our university requires that the contents of education that fit the changes in the life of the Internet of things and AI should be included in preparation for the 4th industrial revolution. In order to have the ability of future life guidance of pre-service teachers, it is necessary to improve the contents of the curriculum for child life guidance

Therefore, it can be said that it is now inevitable to develop AI robot utilization and Child Life Guidance Subject for the future direction. Especially, in the early childhood education department, robot utilization, which has educational value for early childhood teachers, plays a role as an assistant to teachers, so we want to develop a curriculum that develops the ability of preliminary teachers to provide customized guidance for each child[13]. It is important to examine what efforts and preparations should be made to develop the capacity of pre-kindergarten teachers in the AI era. In order to

develop the preliminary teacher capacity of the AI era, which is the fourth industrial revolution, we will develop the subject of AI robot utilization for the future that is suitable for our university talent. The proposed Korean majors have significance in using them as basic data for the development of class design with the differentiation from existing subjects. Therefore, this study intends to analyze the various experiences students have in child life guidance subject using the AI robots by applying to the school education field in the era of the 4th industrial revolution.

Pre-service teachers should prepare for future life guidance ability in preparation for the educational environment of the 4th Industrial Revolution era. In the educational environment of the 4th Industrial Revolution era, educational robots are likely to be used as teacher robots. In the future, educational robots will be able to form teacher robots and teach children's lives. The operation of AI and child life guidance subject is meaningful according to the social relationship with human beings in the form of teacher support. The purpose of this study is to investigate the effects of AI and child life guidance subject on pre-service teachers.

2. Method

2.1. Content composition of AI and child life guidance subject

The contents of the child life guidance can be divided into basic life habit instruction, sociality-related problem behavior instruction, and emotional problem behavior instruction. Among them, this study suggests traditional child life guidance method and AI robot-based child life guidance method for emotional problem behavior guide[5][14][15].

Table 1. Comparison of the plans for traditional child life guidance and AI robot-based child life guidance through cases.

Sort	traditional teaching method of children's life	Method of child life guidance using AI robot
Life guidance content	Relational formation environment	AI robot relational formation
	Basic life habit guidance	The difference between robot role and teacher role
	Emotional problem behavior	The difference between robot role and teacher role
	Emotional problem behavior	The difference between robot role and teacher role
	Social problem behavior	The difference between robot role and teacher role
	Social problem behavior	The difference between robot role and teacher role
	Effect of child life guidance (logical, rational guidance, etc.)	The effect of child life guidance using AI robot (instruction of improvisational alternatives, creative alternatives, etc.)

The educational plan that is designed to demonstrate the field application of pre-service teachers based on the experience of operating AI and child life guidance courses during one semester is as follows <Table 2>. This is done through face-to-face classes and non-face-to-face classes in order to cultivate the life guidance capacity of the pre-service teachers.

Table 2. Plans for plan for AI and child life guidance.

Subject name		AI and child life guidance	
Object		3rd graders of early childhood education class	
Class operation		During the curriculum of the 1 semester(from first session - seventh session)	
Operation method		Understanding of face-to-face, non-face-to-face, AI movie survey, field application	
Task	AI movie viewing	AI tools, AI media	. Study on the application possibility of life guidance or the future . A virtual room application class design
	Black panther	1. Self-driving means of transportation (airplanes, automobiles); 2. If the building itself of a kindergarten becomes an AI convergence assembly, infants can easily experience future technology;	1. AI The advantage of being able to come and go home-kindergarten without a driver by the destination setting system of autonomous kindergarten car 2. Oil with safe adaptability to reality in the future educational environment; classes using parishes in virtual reality;
	Ready player one	VR games combined with science	The conversion of virtual reality and reality The importance of creativity for future preparation
	My mother	Robot mom and human daughter Robot mom's care, her daughter grows up.	Emphasizing the importance of cultivating human sensibility and interaction ability while recognizing the ability of AI robot
	Big hero	. Healing robot .The role of a family-only healing robot as a physician;	. Application of safety education; . Preparation for a life that thrives on physical health and safe living;
	Sort	Traditional teaching method of children's life	Child life guidance method using AI robot
	Primary time	A summary of the Child Life guidance.	.Brainstorming, team-by-team discussions. .Team-by-tea brainstorming .Presentation(10 minutes per subject) applicability of educational field .Case study of the traditional teaching method of children's life using AI robots
	Second time	AI data collection (art, education, social economy, etc.)	
	Third time	Analysis of data collection using AI (art, education, social economy, etc.)	
	Fourth time	Traditional teaching method of children's life	
	Fifth time	A method of child life guidance using AI	A proposal for child life guidance using AI
	Sixth time	A comparative study on the cases of traditional life guidance and the proposed child life guidance using AI	
	Seventh session	The development of pre-service teachers' professionals for preparing for the competence of future teachers	

2.2. Participant

It is predicted that AI and child life guidance subject, which are combining AI technologies, will change the paradigm of child life guidance itself in the future as a future-oriented education. Therefore, a deep understanding of the phenomenon is urgently needed based on exploration of common experiences through a qualitative approach. Accordingly, preservice teachers' class was selected AI and child life guidance was applied to third-year university students, and 10 of them were selected as research participants, and individual in-depth interviews were conducted.

As shown in <Table 3>, the participants of this study were third - year university students who were enrolled in AI and child life guidance. The researcher explained the an purpose of this study to the students who will participate in the research and obtained consent for participation in this study. In this process, 10 participants who will sincerely participate in this study and show an active attitude.

Table 3. Participant.

Student	Experience the application of AI and child life guidance	Experience of child life guidance	Choice method	Experience attending AI subject
A	No	No	AI movie (choose one self)	No
B	No	No	AI movie (choose one self)	No
C	No	No	AI movie (choose one self)	No
D	No	No	AI movie (choose one self)	No
E	No	No	AI movie (choose one self)	No
F	No	No	AI movie (choose one self)	No
G	No	No	AI movie (choose one self)	No
H	No	No	AI movie (choose one self)	No
I	No	No	AI movie (choose one self)	No
J	No	No	AI movie (choose one self)	No

2.2. Data collection and analysis

This study was conducted to explore specific views based on a qualitative research method using interviews with preservice teachers(third - year university students) who have experienced AI and child life guidance. Through a qualitative approach, we would like to explore the direction of efficient traditional child life guidance and robot-based child life guidance. AI and child life guidance are to develop child life leadership by predicting the direction of child life guidance for future society after watching robot movies. The subject of AI and child life guidance consists of robotic movie appreciation and traditional child life guidance. Therefore, interviews were conducted to closely examine the individual thoughts and feelings of the participants who experienced the subject of AI and child life guidance.

Interviews were conducted after class participation during the semester, and were conducted over the report, non-face-to-face due to COVID-19. 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 question[3].

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[3].

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[3].

3. Results and Discussion

Table 4. Report of participant.

Student	AI movie	After experience of the application of AI and child life guidance	Improvement of child life leadership in future
A	Ready player one	Interaction of teaching methods	A study on the importance of child life guidance direction with AI robot
B	Ready player one	Interaction of teaching methods No	Possibility of customized teaching for children
C	My mother	Interaction of teaching methods	Understanding of virtual reality class design
D	My mother	Child-directed interaction	A study on the Importance of child life guidance direction with AI robot
E	My mother	Child-directed interaction	Understanding of virtual reality class design
F	Black panther	Robot assistant teacher and companion guidance	Understanding of virtual reality class design
G	Big hero	Robot assistant teacher and companion guidance	A study on the importance of child life guidance direction with AI robot
H	Big hero	Robot assistant teacher and companion guidance	Possibility of customized teaching for children
I	Black panther	Preparation for future education	Possibility of customized teaching for children
J	Black panther	Preparation for future education	A study on the importance of child life guidance direction with AI robot

3.1. AI and child life guidance according to prediction of child life guidance for the future

As a result of the interview, the students mentioned that they seem to be improving their traditional child life guidance skills, especially in the prediction of child Life guidance for the future. Also, through AI robot movie appreciation students were able to have more opportunities to In order to implement life guidance, teachers recognize that children can make mistakes in the process of acquiring social skills.

3.2. Interaction of teaching methods

I understood the general interaction method of teaching methods. I learned the teaching method of children through basic skills, discussion, live modeling and role play. The decided regulation is offered and the adaptive behavior of child is multiplied[5]. Teachers form positive teacher-child relationship. Teachers use solution-oriented intervention method. Teachers cooperate with parents. Discipline is used when a particular behavior of an infant is a wrong behavior. predict Direction of In order to maintain positive relationships with children, children should understand their interests, interests, family background, and cultural environment. Experience of positive relationships can be a foundation for forming positive interpersonal relationships, helping children develop positive characteristics such as cooperation, consideration, tolerance, etc. rather than competition or conflict. Teachers should understand themselves before understanding children. Understanding the teacher himself is because he or she makes the infant look at it without distortion. Child Life Guidance for the Future[5]. It is also important for teachers to help children's parents recognize their strengths and attractive parts[16].

3.3. Child-directed interaction

We understood traditional child play skills to improve parent-child relationships. We use praise, reflection, follow-up, and enjoyment. Teachers selectively reduce maladaptive behavior through the activity of showing interest)[5]. The child-led interaction goal improves the self-esteem of the child, improves the teacher-child perspective, helps the child to concentrate on the play activity, reduces the anger of the child, and improves the power to withstand frustration. Remember what teachers should and should not do and use strategic attention and selective neglect to create behavior. It is especially important to praise and reflect[5][15].

3.4. Robot-based child life guidance

When dealing with the new developmental problems facing children, robots can be used as assistant teachers to provide customized guidance for individual children, which enables efficient life guidance. Kindergarten teachers should develop their ability to understand and utilize the AI. Therefore, we think that we should be able to understand and handle AI more than anyone else. Since it is our society that is changing rapidly, we should learn how to handle and utilize information technology and programs well. The most important thing is that AI should play the role of assistant teacher, not the teacher who plays the main role. In case of children's emotional stability, sociality, ethics, morality guidance and parent counseling, it will be a good role sharing for kindergarten teachers to use AI well to conduct classes that are appropriate for each level of children. There are things that humans have and AI doesn't. Humans have the power to think and creativity. Therefore, AI should be a helper who fills and supports the points that should be supplemented to humans, not completely replace our humans.

3.5. Limitations of AI robot utilization

A new generation of ethical standards in robotics and AI is emerging as a direct response to a growing awareness of the ethical, legal and societal impact of the fields[17]. As of 2021, more than 30 countries have released national AI policy strategies. These documents articulate plans and expectations regarding how AI will impact policy sectors, including education, and typically discuss the social and ethical implications of AI. This article engages in thematic analysis of 24 such national AI policy strategies, reviewing the role of education in global AI policy discourse. It finds that the use of AI in education(AIED) is largely absent from policy conversations, while the instrumental value of education in supporting an AI-ready workforce and training more AI experts is overwhelmingly prioritized. Further, the ethical implications of AIED receive scant attention despite the prominence of AI ethics discussion generally in these documents[18]. There were opinions that AI Robot 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 accuracy about future guidance. And there was a response that they could not answer when asked about certain things in class, such as movies or teachers,

because It depends on who the ai-robot producer is. In school students, it is important to teach emotion control and aggression control[19]. Robots are hard to teach emotion regulation.

AI/robotics have had a strong impact, in education and finance this impact is also likely to Increase in the future. In education—be it in the classroom or in distance-learning systems, focused on children or on training and retraining of adults—robotics is already having an impact. With the addition of AI, robotics offers to expand the reach of teaching in exciting new ways. At the same time, there are also concerns about new dependencies and unknown effects of these technologies on minds[19]. Child education as a special case, due to it involving emotions as well as knowledge communicated between children and adults. He examines some of the modalities of teacher substitution by AI/robotic resources and discusses their ethical aspects. He emphasizes positive aspects of computer-aided education in contexts in which teachers are lacking. The technical possibilities combining AI and teaching may be large, but the costs need consideration too. The ethical questions raised by these developments need attention, since children are extremely vulnerable human beings. As the need to develop education worldwide are so pressing, any reasonable solution which benefits from the technological advances can become helpful, especially in the area of computer-aided education. AI, Robotics, and Humanity: Opportunities, Risks, and Implications for Ethics and Policy[17].

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[4][20], 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[4][21]. As the AI system is widely used in various fields, the demand to apply and utilize it in early childhood education is increasing. Therefore, this study guided the method of traditional child life guidance and child life guidance by using AI Robots. Child life guidance by using AI Robots is a virtual child life guidance method for future society through watching AI-related movies. The learning experiences of learners through interviews are summarized as.

Through the results of this study, it showed the development of the 4th industrial revolution can transform the present virtual reality into reality.

First, If the teacher's competency of using robots, which is an assistant tool for tutors, is developed, kindergarten teachers will be able to grow further in the AI era through efforts such as fostering professionalism in the era of the 4th In accordance with the direction of AI education policy, teachers should be nurtured to provide guidance by using big data of AI to focus on expanding children's thinking and social relationships. industrial revolution, supporting children's thinking expansion, and providing positive life guidance.

Second, In accordance with the direction of AI education policy, teachers should be nurtured to provide guidance by using big data of AI to focus on expanding children's thinking and social relationships.

Third, A teacher's ability to guide children's life with delicate sensitivity that cannot be aided by robots will be an effective way to guide children's life. The use of robots will enable customized guidance for each child.

Fourth, Teachers should develop the capacity of life guidance for child-led interaction to promote the development of children's autonomy.

Fifth, Teachers should have an opportunity to check the political and cultural context of teaching-learning through self-reflection because the value and belief system of teachers also affect the interaction with children.

Therefore some of the outcomes in this study change as new discovers.

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6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Author	YC	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑ -Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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Entrepreneurial Marketing in the Era of Multicultural METAVERSE

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Abstract

Purpose: *This study aims to inquiry the trend of Entrepreneurial Marketing(EM) from the 1987 advent of EM to 2021. We feature how marketing and entrepreneurship interface has evolved over about the past thirty years. Furthermore we will show the some suggestion for EM in the era of Multicultural Metaverse.*

Method: *For the research procedure, the search term EM was searched as the title keyword of entrepreneurial marketing. The research history of EM was about 30 years. The papers were researched for three decades from 1987 to 2021.*

Results: *As a result of the survey, out of a total of 155 papers in the SCOPUS journals, an oversea's journal site, and 1 article from the RISS in domestic journal. The papers were researched for three periods in 10-year increments. As a result of the survey, out of a total of 155 papers from the SCOPUS journal site, an overseas journal site, 4 papers from 1987 to 1999, 21 papers from 2000 to 2009, 101 papers from 2010 to 2019, 27 papers from 2020 alone, and 2 papers from Jan. 2021. Each papers includes the chronical characteristic of EM.*

Conclusions: *Each decade is characterized by the vision and leadership of representative researchers and their influence on the development and growth of EM. Lately, EM belongs to the growth step of the life cycle. EM has gained significant scholars and practitioners' attention due to its strong effect on organizational sustainability leading to creating the value.*

[Keywords] ***Co-Creating, Entrepreneurial Marketing(EM), Multicultural Metaverse, Business Opportunity, Sustainability***

1. Introduction

Due to the rapid change in technology and environment, not only SMEs and venture companies, but also global companies including public organizations are paying attention to the importance of entrepreneurial marketing from a strategic level[1]. In other words, companies with limited resources, especially SMEs, to create a competitive advantage amid social, cultural, technological, and political changes for sustainable management, customers, create new values for customers, suppliers in the supply chain and society by taking and accepting risks so that SMEs can respond sensitively to the needs of stakeholders and changes in the market.

Under these internal and external environments, entrepreneurial marketing(EM) provides an important potential to develop marketing theory by providing a theoretical basis for growth as one of the axes of the marketing field[2]. Further, EM is a unique result of the synthesis of marketing and entrepreneurship fields and can create new values[3].

However, although research on entrepreneurial marketing has been conducted for about the past 30 years, it is strange that it has not received much attention in academia and practice[4], and for this reason, research on entrepreneurial marketing is very lacking[2]. In practice, it can

be confirmed that there are hardly any domestic studies compared to overseas studies, and overseas research has been actively conducted as a topic that has received a lot of attention after 2020. Therefore, it is required to domestic research on entrepreneurial marketing.

Thus, as the first step on entrepreneurship research, this paper is to investigate the trend of entrepreneurial marketing through key-words analysis for the next research related to an empirical study that examines the relationships between factors such as entrepreneurial marketing, management performance, competitive advantage, and sustainability.

2. Literature Review

2.1. The process of research for the stream entrepreneurial marketing(EM)

This paper summarized the stream of EM studies based on 155. EM research papers in Scopus over period the 1987 to 2021 about for 30 years. The procedure of research is as follows. First, the search terms 'entrepreneurial marketing' are put in Scopus in a distinguished overseas journal as well as RISS in a domestic journal over period 1987 to 2021. Second, we exclude the articles that don't have full text and are not written in English and Korean. Third, the results of searches are 155 papers excluding 1 domestic paper. Final papers of 155 are classified into three groups by periods over 1987 to 2021.

2.2. The definition of EM

A growing awareness of the importance of entrepreneurship and innovation to marketing, and of marketing to successful entrepreneurship, has recently led to attempts to combine the two disciplines as entrepreneurial marketing. The first American Marketing Association(AMA) Research Symposium on Marketing and Entrepreneurship was held in 1987, and has become an annual event as the AMA's Research at the Marketing-Entrepreneurship Interface Conference. In the UK, a Special Interest Group was established within the Academy of Marketing as a focus for research in this area in 1994[5][6]. The main thrust of entrepreneurial marketing is an emphasis on adapting marketing to forms that are appropriate to small and medium-sized enterprises(SMEs), acknowledging the likely pivotal role of the entrepreneur in any marketing activities[7].

In addition, Hills and Hultman[8] defined that EM is a spirit, an orientation as well as a process of passionately pursuing opportunities and launching and growing ventures that create perceived customer value through relationships by employing innovativeness, creativity, selling, market immersion, networking and flexibility. Whalen et al.[2] defined that EM is a combination of innovative, proactive, and risk-taking activities that create, communicate, and delivers value to and by customers, entrepreneurs, marketers, their partners, and society at large.

Definition of EM changes since the early definitions, as an agent of change, someone who does not seek to perfect, or optimize existing ways of doing things, but searches instead for new methods and new markets[9]. Drucker[10] has developed this theme by defining an entrepreneur as someone who not only searches for change, but also responds to it in an innovative way, exploiting it as an opportunity. After Drucker[10], as time goes, EM concept has evolved. Namely, some academic researchers keep developing EM concept to involve some other terms of customer orientation[11], customer value[8], opportunity focus[12][13], customer intensity and value creation[14], networks[12], resource leveraging[4]. More recently, Alqahtani and Uslay[12] found that entrepreneurial marketing is the pragmatic use of resources, the use of networks, and accepting risks to actively exploit innovative co-creation opportunities and to engage stakeholders including customers, employees and platform alliances. It is defined as an agile mindset that delivers value.

As such, the concept of entrepreneurial marketing is changing with the trend of the time. Based on previous research, it is defined as a concept of entrepreneurial marketing in this study

accepts risks, makes the most of its resources, and develops networks and platforms with agile thinking and attitude to create shared value with stakeholders

2.3. The trend of EM

EM has a very short research period as an academic area and has a short history of about 30 years since the concept of EM was first presented. To review the prior research on EM, the previous research on EM was investigated targeting RISS, a representative domestic journal site, and SCOPUS, an overseas journal site, among major domestic and foreign journal sites.

For the research procedure, the search term EM was searched as the title keyword, and the research history of EM was about 30 years. The papers were researched for three periods in 10-year increments. As a result of the survey, out of a total of 155 papers from the SCOPUS journal site, an overseas journal site, 4 papers from 1987 to 1999, 21 papers from 2000 to 2009, 101 papers from 2010 to 2019, 27 papers from 2020 alone, and 2 papers from Jan. 2021.

Research on EM has suddenly increased since 2010, and the rate of increase has been rapid since 2018. On the other hand, only one paper was published during the same period(1987-2021) as a result of a search for a paper on EM on the RISS journal site for domestic papers. As a result of domestic and foreign thesis research on EM, EM is a new concept in domestic studies compared to overseas research conducted actively after 2020.

Therefore, compared to overseas studies, there have been few studies on entrepreneurial marketing in domestic studies. shows that it is very necessary. <Table 1> shows the publication status of theses on entrepreneurial marketing.

Table 1. Overview of entrepreneurial marketing articles published.

Year	SCOPUS (overseas journal)	RISS (domestic journal)	Total
2020 to Jan. 2021	29	0	29
2010-2019	101	1	102
1987-2009	25	0	25
Total	155	1	156

2.3.1. The topic areas of EM papers over 1990 to 2009

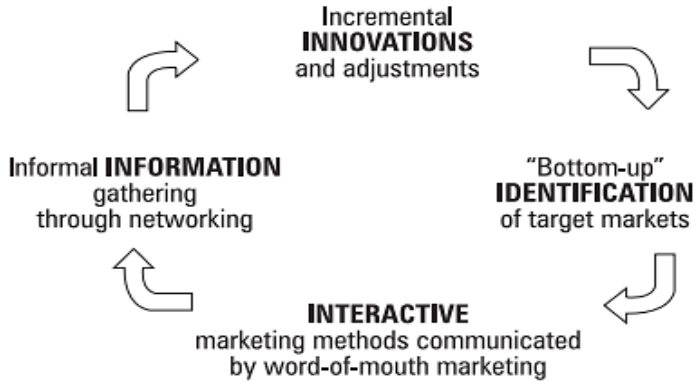
Before 2000, as the beginning of EM, EM doesn't have much attention from scholars and only a few articles are published. In this period, the concept of EM is not unclear and is an ambiguous step. In fact, since 1999, EM gradually began to receive attention from various scholars. In this period, Stokes[7], one of the represented scholars of EM, provides a comparison of traditional marketing to entrepreneurial marketing as presented in <Table 2>. Moreover, in another study on a conceptualization of EM. Stokes[7] suggests that the four main elements of this process of entrepreneurial marketing can be conceptualized as shown in <Figure 1>.

His concepts of EM include four elements of incremental innovations and adjustments, bottom-up identification of target markets, interactive marketing methods communicated by word-of-mouth marketing.

Table 2. Comparison of traditional marketing to entrepreneurial marketing.

Marketing principles	Traditional marketing	Entrepreneurial marketing
Concept	Customer-orientated: market-driven, product development follows	Innovation oriented Idea-driven, intuitive assessment of market needs
Strategy	Top-down segmentation, targeting, and positioning	Bottom-up targeting of customers and other influence groups
Methods	The marketing mix four/seven P's	Interactive marketing methods word-of-mouth marketing
Market intelligence	Formalized research and intelligence systems	Informal networking and information gathering

Figure 1. Process of entrepreneurial marketing.



Especially, entrepreneurs, attempting to conduct entrepreneurial marketing, tend to focus first on innovations to products and services, and only second on customer needs. They identify customer groups through a bottom-up process of elimination because the bottom-up process has advantages over the top-down approach[7], rather than more deliberate segmentation, targeting and positioning strategies. They rely on interactive marketing methods communicated largely through word-of-mouth, rather than a more controllable and integrated marketing mix.

By exploring the ingredients for its successful entry and growth, Fisher and Stanton[14] seek to show through one longitudinal case, how entrepreneurship, innovation and marketing were inseparable in contributing to the competitive advantage developed by this business. Their results showed two inter-related and timeless features stand out in John Pottie's successes[15][16][17][18][19]. First, is the manner in which he acted as an entrepreneur, responding to the circumstances of the time and seizing the opportunities presented by changes on both the supply and demand sides in the market for veterinary services and products. Second, is the stress he placed on his own name as a brand, guaranteeing the quality of the integrated package of veterinary products. Further, Miles and Darroch[20] proposed that EM increases a positive effect on competitive advantage by showing how large firms might leverage entrepreneurial marketing processes to gain and renew competitive advantage. Large firms adopting entrepreneurship marketing process will engage in the marketing process that emphasizes opportunity creation and exploitation[21]. Therefore, large firms will innovate to meet expressed and potential needs of customers as well as leverage the innovation of services and products.

In this period of 2000 to 2009, some scholars first propose differentiation points of traditional marketing and EM by showing the process of EM and try to examine the EM's effect on

performance through the case study. However, there is no EM's empirical research of the relationships between EM and performance, and research presented constructs of EM.

2.3.2. The topic areas of EM papers over 2010 to 2019

In this period of 2010 to 2019, there is a lot of research such as empirical studies that never been presented before. In fact, in 2019 many scholars pay much attention to EM and its effect on how EM influences performance and competitive advantage, etc. Further, some authors proposed different sub-dimensions of EM such as network, value creation, etc.

Some main papers of this period are as follows. In 2011, Gilmore[22] asserted that EM is based on the adaptation of standard marketing textbook frameworks, uses networking to build and support marketing activity, is based on the use and development of marketing management competencies and tries to be innovative where it can. Moreover, due to the societal context impacting the nature of entrepreneurial activity within a given region, he emphasized that entrepreneurship needs to create social value. Namely, EM offers added value and is influenced by competitor activity, industry and market considerations. Solé[23] proposed, in the study on EM linking to performance, that this study highlights the synergies between both marketing and entrepreneurship on performance through two distinct paths: improved marketing outcomes with entrepreneurial marketing and improving entrepreneurship outcomes with marketable entrepreneurship.

Additionally, some authors attempted to examine the relationships between EM and performance such as sustainable competitive advantage, management. For instance, Fard and Amiri[24] proved whether EM had a positive and significant effect on different aspects of market and innovative performance of Iranian halal food SMEs, which results in financial performance. While they proposed seven sub-dimensions of EM(innovation-focused, pro-activeness, opportunity-driven, calculated risk-taking, customer intensity, resource leveraging, and value creation), highlight that SMEs should be innovative, proactive, opportunist, risk-taker and customer-oriented to achieve better market and innovative performances and consequently earn higher profits. Another instance, in study on Entrepreneurial marketing dimensions and SMEs performance, Sadiku-Dushi et al.[25] examine that whether EM dimensions influence SMEs performance. They suggested 7 sub-dimensions of EM, EM(innovation-focused, pro-activeness, opportunity-driven, calculated risk-taking, customer intensity, resource leveraging, and value creation. They proved that while value creation is seen as a very important entrepreneurial marketing dimension, respondents are reserved concerning taking risks; furthermore, they do not tend to be proactive, innovative nor customer-oriented.

2.3.3. The topic areas of EM papers over 2020 to 2021

In this period of 2020 to 2021, Following the previous period, it is a period in which EM is enriched quantitatively as well as qualitatively including a lot of empirical research applied to various organizations by many researchers.

As the representative research of this period, Fink et al.[26] examine the long-term effect of Facebook-based celebrity endorsement on purchase intention among 234 members of a Facebook fan community in a two-wave longitudinal design. They argue that this relationship is mediated by a sponsor's brand image and moderated by brand differentiation, as well as how EM influences social media. Further, Bachmann et al.[4] analyze EM effect regarding environmental competitiveness and firm sizes, presenting 7 sub-dimensions of EM; pro-activeness, innovation orientation, risk-taking orientation, opportunity focus, resource leveraging, customer satisfaction orientation, and value creation. They prove the relationship between EM and exploitative and exploratory innovation under conditions of high and low environmental competitiveness and high and low levels of firm size. They find, further, that under conditions of high competitive intensity, the effects of EM on exploratory innovation strengthen, while low levels of competitive intensity do not affect the relationship between EM and exploratory innovation. Their results also show that for larger firms, the positive effects of EM on exploitative innovation are

weaker, while for smaller firms, those effects are stronger. Lately, Sarwoko and Nurfarida [27] examine the role of EM in business performance and the role of entrepreneurial personality traits as antecedents of EM for 187 SMEs owner/managers in Indonesia. The results indicate that EM has a positive effect on business performance. SMEs owners/managers with the characteristics of extraversion, agreeableness, and conscientiousness can encourage the implementation of EM, which impacts business performance.

3. Request of EM in the era of METAVERSE

Recently, some government proposed a new scientific policy called society 5.0 by Japanese, industrial 4.0 by Germany etc. These societies are characterized as highly integrating cyberspace and physical space beyond society 4.0 which has some weak points of Iot (Internet of things). Further, society 5.0 produce new societal values such as robotic technology and self-driving cars driven by AI technology, METABERSE that is the three-dimensional world where avatars are active on behalf of users in the real world[28].

Most recently, METABERSE is one of the characteristic trend to represent a near future society that will come soon. In the view of this vein, some global company such as Facebook now pursuit. Therefore, an entrepreneur emerges new business opportunities, challenges and ethical implications in METAVERSE through EM that includes opportunity focus, innovations, proactiveness, risk-taking and network etc.[26]. Further, METABERSE is populated by “content” and “experiences” created and operated by an incredibly wide range of contributors, some of whom are independent individuals, while others might be informally organized groups or commercially-focused enterprises. METABERSE as the new business area that goes with society 5.0. The characteristics could be summarized as follows.

- Be persistent – which is to say, it never “resets” or “pauses” or “ends”, it just continues indefinitely

- Be synchronous and live – even though pre-scheduled and self-contained events will happen, just as they do in “real life”, the Metaverse will be a living experience that exists consistently for everyone and in real-time

- Be without any cap to concurrent users, while also providing each user with an individual sense of “presence” – everyone can be a part of the Metaverse and participate in a specific event/place/activity together, at the same time and with individual agency

- Be a fully functioning economy – individuals and businesses will be able to create, own, invest, sell, and be rewarded for an incredibly wide range of “work” that produces “value” that is recognized by others

- Be an experience that spans both the digital and physical worlds, private and public networks/experiences, and open and closed platforms

- Offer unprecedented interoperability of data, digital items/assets, content, and so on across each of these experiences – your *Counter-Strike* gun skin, for example, could also be used to decorate a gun in *Fortnite*, or be gifted to a friend on/through Facebook. Similarly, a car designed for Rocket League (or even for Porsche’s website) could be brought over to work in *Roblox.* Today, the digital world basically acts as though it were a mall where every store used its own currency, required proprietary ID cards, had proprietary units of measurement for things like shoes or calories, and different dress codes, etc.[29].

Figure 2. Picture of metaverse and its visitors.

Note: Visitors are pictured in front of an immersive art installation titled "Machine Hallucinatins-Space: Metavers" by media artist Refik Anadol, which will be converted into NFT and acutioned online at Sotheby's, at the Digital Art Fair, in Hong Kong, China September 30, 2021. REUTERS[30].

4. Conclusion

This study shows the trend of EM from 1987 of EM to 2021. We feature how the marketing and entrepreneurship Interface has evolved over about the past thirty years. Each decade is characterized by the vision and leadership of representative researchers and their influence on the development and growth of EM. The first period(1987-1990) was characterized by a few authors introducing interface with marketing and entrepreneurship due to the emergence of EM. In the second decade(2000-2009), some authors debate about this unique interface, they proposed inconsistent, different definitions of EM. In the period(2010-2019), a number of authors pay attention to EM research including empirical research and theoretical research. Since 2020, many authors highlight how widely EM has been adopted and EM is one of the core factors of performance that increase value creation. Now, EM belongs to the growth step of the life cycle. In the future, EM has gained significant scholars and practitioners' attention due to its strong effect on organizational sustainability leading to creating the value that emerges new business opportunity of multicultural METABERSE[31][32][33][34][35].

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6. Appendix

6.1. Authors contribution

	Initial name	Contribution
Lead Author	WB	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑
Corresponding Author*	GP	-Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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Instructional Systems Design to Reflect ETHICS in AI's Rules of Engagement Learning for Future Warfare

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Abstract

Purpose: *Rules of Engagement(ROE) refer to rules or directives that define the circumstances, conditions, extent, manner, etc. of the application of force or action that can be considered provocative by the armed forces. ROE do not explain how results are achieved, but rather indicate what judgments are unacceptable. Focusing this, the purpose of this study is to propose an Instructional Systems Design(ISD) configured to reflect ethics in AI's ROE learning for future warfare.*

Method: *This study uses Development Research Method for develop and propose an ISD. ISD refers to the creation of guidelines into smaller units of teaching or learning. If some guidelines are created for such ISD, it would set the composition and application of ROE, and AI will learn that guidelines through deep learning. And the AI makes a decision with this in the hypothetical dilemma situation where the application of the ROE is requested. Finally, human experts review and supplement the learning results of these neural networks. The sophistication of the AI's learning and applying ROE would be achieved by feeding back this result to the ISD.*

Results: *This study understands that ROE would also be essential for AI or AI-equipped military robot systems. In this process, AI performs the task of making judgments related to applying ROE, which is the principle of action in specific situations. To do this, Ai's deep learning first collects necessary information and makes decisions based on it. Next, the results of this learning are applied in a new hypothetical dilemma situation. Finally, human experts' evaluation and feedback on the results are continuously made. This series of processes can be presented as a model of ISD oriented towards the moral development of AI.*

Conclusion: *AI's ROE learning converges to the learning of moral values. It focuses on the cognitive aspect of morality. Therefore, it would be possible to refine the cognitive moral judgment of deep learning by applying the learning hierarchy of taxonomy of educational objects and the logical test of validity of moral judgment oriented toward social justice. And the moral development of the neural network can be performed by modifying and complementing the results of human experts and feeding them back.*

[Keywords] ***Artificial Intelligence, Military, Rules of Engagement, Ethics, Instructional Systems Design***

1. Introduction

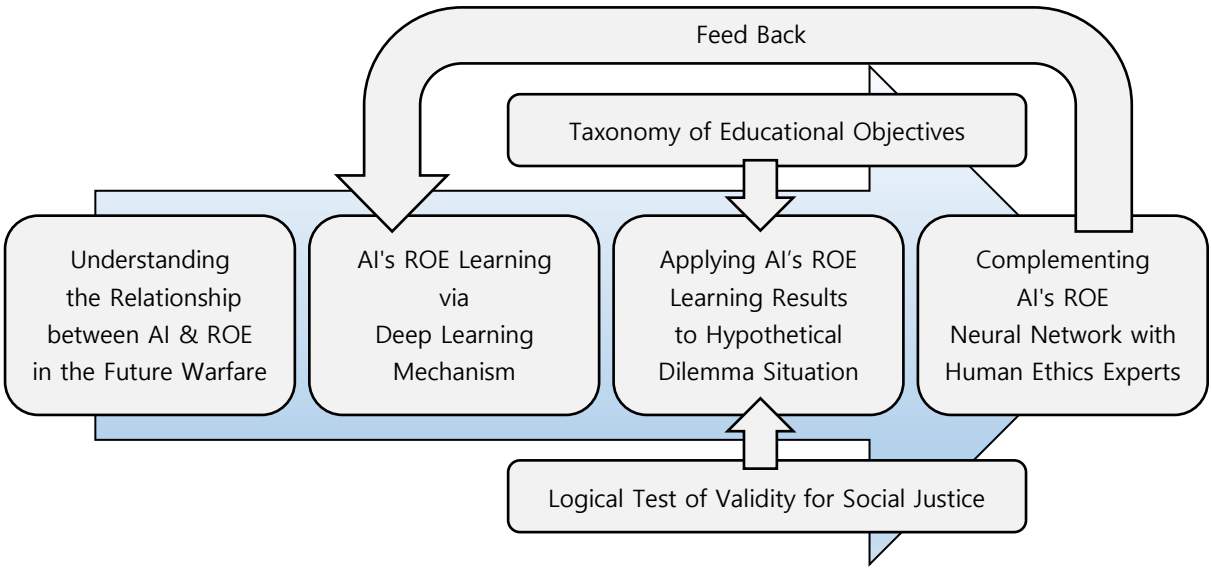
Research on AI in the military domain tends to start by focusing on aspects related to the achievement of military goals or achievements through the use of military capabilities that can be obtained mainly through the application of AI. In particular, given that future wars are developed with an asymmetric and complex character, weight can be given to the Asymmetric, Hybrid, Cyber, and Unrestricted wars among their characteristics[1]. These characteristics of future warfare require consideration of very complex and diverse matters beyond the aspect of traditional warfare in the exercise of military force.

In order to respond to the request of such a complex military situation, attempts are actively being made to utilize a mechanism that allows AI to intervene in the process of making a decision by applying a certain principle to specific matters which are connected to military operations. And these attempts are not limited only to aspects related to the use of military force in a narrow sense, but are being made in a more expansive aspect. Such kinds of research shows the trend well, as examples of a study showing that the United States Department of Defense(DOD)'s considerations related to AI intervention in the military domain that are extended to the military health care sector[2], Resource Management using Smart Operating System in Future War Research that attempts to be utilized in the part of Internet of Things(IoT) and logistics in connection[3], expanding the role of military mobilization forces in the event of a national disaster situation in reserve forces[4], etc.

On the other hand, if the meaning of the Ethics is that establishing and carrying out the principles of action based on moral judgment, these kinds of Ethics could be applied to war as well. At a macro level, this Ethics could be expressed in terms of Ethics in the War or War Ethics. Also at a micro level, it could be called Ethical Rules of Engagement(ROE) as a norm of conduct to be followed in the course of combat situation. From this point of view, the aspect of future war in which AI is utilized could be understood in connection with certain research that requires consideration of the ethical aspect of AI. For example, a study that tries to establish a operation key of Field Action Manual(FAM) that works in Disaster Sites[5] could be viewed as an indirectly suggestive case of AI's ethical intervention, and a study that attempts to approach to moral injury or suffering of soldiers during war[6] implies that AI as a Moral Agent should also be take into account as an object of moral considerations at a certain level.

Based on the above mentioned problem awareness, the things which should be considered in Future War in using AI is the learning of Rule of Engagement(ROE), which AI will ultimately establish and utilize as a principle of judgment and action. This AI's ROE learning is embodied in the Instructional Systems Design(ISD). ISD for AI's ROE learning is shown in <Figure 1>. In here, ISD is to make a plan for the purpose of maintaining the flexibility of AI as a learner and producing an enhanced learning effect. Therefore, it is also aimed at improving the learning efficiency of AI and comprehensively designing a better learning environment for AI.

Figure 1. Instructional systems design for AI's rules of engagement learning.



This study utilized Development Research Method to present a model of ISD. Development research corresponds to original research conducted mainly to acquire new scientific knowledge

for specific practical purposes and goals by using the knowledge obtained through the results of basic research. In other words, it is a research that creates the basics of a new process by applying the knowledge gained through basic research and pioneering new uses. Therefore, development research is research that produces new results using knowledge obtained from basic research, applied research, and practical experience. Development research also includes systematic activities to substantially improve something that is already in operation. Putting these points together, development research is a technological activity that establishes a new process using the results of basic research, applied research, or existing knowledge on the premise of creating new products. In this context, it would be suitable for this study, which intends to present the procedure of ISD, with utilizing Development Research Method.

By applying Development research Method, Each steps of ISD for AI's ROE learning would be as follows: First, the recognition of the interrelationship between ROE and AI. This is also to reveal the meaning of ROE for AI that intervenes in judgment and operation in combat situations. Second, the relationship between AI and ROE will lead to a review of matters to be considered in the Deep Learning Mechanism used in the process of learning ROE. Third, the ROE of AI learned in this way will be refined by applying it to a hypothetical dilemma situation that may be encountered in a battle situation. For this elaboration work, it is necessary to apply the Taxonomy of Educational Objectives and the Logical Test of Validity for Social Justice. Fourth, AI's ROE Neural Network composed of the result of such learning needs to be modified and supplemented through comprehensive judgment that reflects the affective domain that constitutes human moral characteristics. For this purpose, the intervention of Human Ethics Experts and the feedback reflecting the results should be designed to be designed so that multi-layered learning is done repeatedly.

2. Understanding the Relationship between AI & ROE in the Future Warfare

In the future warfare, the function of AI is being performed in various ways. At this time, the role of AI in military decision-making tends to be oriented towards the establishment of Military Decision Making Process(MDMP) that mainly support the execution of operations. The meaning of MDMP is that planning and scheduling the detailed tasks required to accomplish the specified Course of Action(COA), For this MDMP has the characteristics of a standardized abstract principle that serves in case of decision-making is requested. An Integrated Course of Action Critiquing and Elaboration System(ICCES) may be proposed as a method for effectively performing this. ICCES is AI-based prototype tool that helps decision-making in military operations[7]. However, in that ICCES focuses on establishing COA, conversion to ROE through supplementation in ethical aspects is required. COA is closely related to assigning missions or tasks to units by setting up a uniform pattern of actions to achieve an effective goal. However, while ROE refers to a principled and general discipline that has the character of a guideline on the use of force, it also functions as a means of controlling the use of force in policy, operational and legal terms[8].

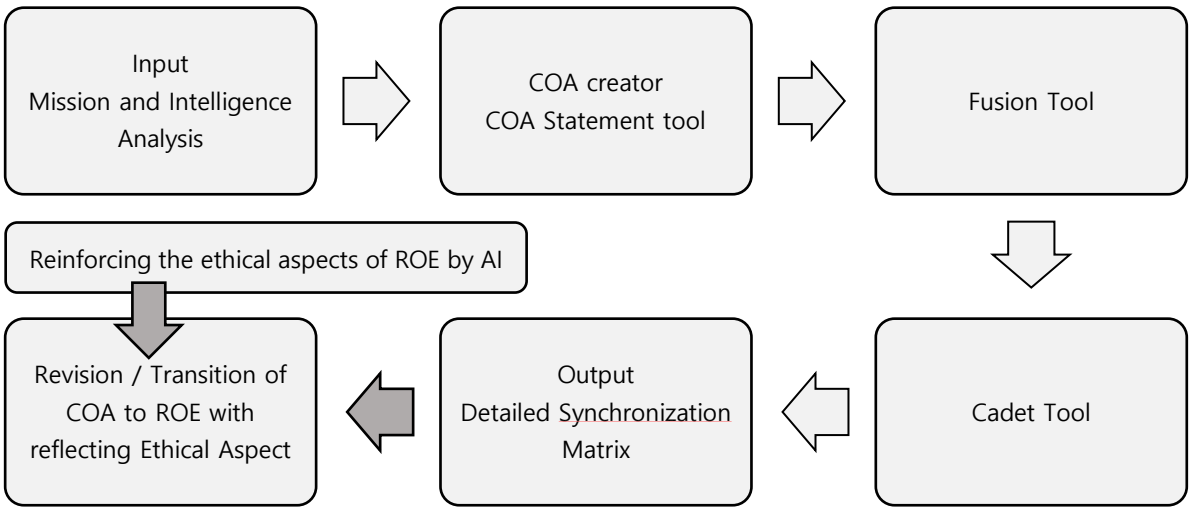
The meaning of control in the sense of ROE is that sets methodological limits of operations for mission performance. Normally, ROE reflects legal and political concerns in the use of armed force[9]. However, the actual situation in which the military operation is deployed is premised on a very urgent conflict situation. This means that missions must be performed in situations where close communication with high-level decision makers related to military issues is not possible. In this case, in order to prevent military activity from an unintended direction, it is necessary to establish certain control over the subject of the mission that directly uses armed force. These controls encompass not only granting or restricting the authority to use certain weapons or tactics, but also presenting ethical norms related to war.

On the other hand, in the process of assigning a task and performing this task, there is a subject who grants a task and a subject who performs the task. However, the subject performing the task has a kind of autonomy to think and judge for himself in the assigned task and situation.

Therefore, each of these subjects is required to think and judge for themselves, and to act with responsibility and confidence. In terms of performing such a mission, it is necessary to consider the following two points: The first is the autonomy of thinking and judging oneself. This autonomy corresponds to one of the important characteristics of AI in particular. In relation to the situation in which military confrontation is taking place, the recent study related to the use of AI in warfare can be said to be a representative case suggesting points to be considered in this regard[10]. The second is duty and responsibility derived from autonomous judgment. In some points, these responsibilities and obligations are approached from the perspective of professional ethics[11]. However, especially with regard to AI, it needs to be connected with consideration of the ethical aspects of responsibilities and obligations. As a representative example of the recent exploration of the ethical aspects of AI, there is a study that requires an in-depth approach to establish common aims and fiduciary duties in relation to AI because Ethical Principle alone cannot sufficiently guarantee Ethical AI[12]. According to this study, direct efforts related to AI education are requested to create Ethical AI, which has been actively carried out recently, including the case of research that suggested the use of the Virtue Education Method to create Ethical AI as an Artificial Moral Agent(AMA)[13].

In integrating the above discussion, future warfare will establish a COA where AI is actively involved. And this COA is converted to a higher ROE by reflecting consideration of ethical aspects based on responsibility and duty. In this transition process, AI plays a role in strengthening the ethical aspect of ROE by performing the function of processing information and learning to set and achieve ethically-reflective goals. Therefore, AI acts as a mechanism that forms the ethical basis of ROE. The architecture and process are proposed as shown in <Figure 2>.

Figure 2. The architecture and process flow of an integrated course of action critiquing and elaboration system(ICCES) and revision / transition of a specific course of action(COA) to rules of engagement(ROE).



3. AI's ROE Learning via Deep Learning Mechanism

AI's ROE learning can utilize deep learning mechanisms. As mentioned above, ethical aspects need to be reflected in ROE, which has the characteristics of a Deep Neural Network. This is an algorithm that mimics how the human brain recognizes patterns and has a certain level of complexity. Ethical decision-making can be said to be about making a judgment by confirming certain facts, searching for applicable moral principles, and making moral judgments based on this. Then, the hidden layer in the process of ethical decision-making is related to identifying the potential structure of various data related to ethical judgment. This means that various

information required for ethical judgment exists at multiple depths, and different levels of learning must be made for each layer.

These various levels of learning can be embodied as follows. For example, among various conflicting values, the utilitarian principle that judges based on the outcome and the deontological principle that judges based on the motive sometimes cause conflict. At this time, to solve this problem, mechanical application of one principle cannot solve the problem. Therefore, it is necessary to calculate by synthesizing various information necessary to interpret a given situation and various considerations necessary to apply certain ethical principles in a given situation. And in this process, by assigning weights related to specific situations to each ethical principle, the validity can be increased in solving the problem.

Such ethical decision-making requires consideration of two aspects: a given situation and an ethical principle. And this ethical decision-making does not exist alone, but develops while forming a certain correlation with the achievement of the goal of victory in battle. Therefore, ROE learning of AI is embodied in the form of learning of various non-linear relationships including multiple hidden layers. This is in the form of a deep neural network in that it includes multiple hidden layers that exist between the input layer and the output layer, and can be achieved by using deep learning's policy network learning. These learning of polity networks can be understood by being divided into the following two aspects.

3.1. ROE learning by supervised learning of policy networks

ROE Learning by supervised learning of policy networks is connected in following two stages:

First, let the AI learn certain moral principles. This corresponds to learning a roll out policy network. There may be a method of enacting ethical principles such as the constitution applied to AI from a human point of view and guiding them to AI, or a method of guiding AI with ethical principles that exist today from a moral philosophy point of view may be used. Whatever method is chosen, it can be understood from the point of view of moral socialization in terms of moral education. Moral socialization aims to actively transmit moral values to actors so that they act in a certain direction consistent with the norms or ideals of a community. This is equivalent to learning the ethical principles that are the basis of judgment in ROE learning of AI.

Next, after learning these ethical principles, supervised learning using existing big data is made for the ethical dilemma situation, the decisions made and the results so that the optimal judgment can be made. This can be seen as supervised learning in a rather narrow sense. At this time, the source of such big data corresponds to the utilization of various data including war history that exists for various decisions made in military operational situations and the results thereof. This is to imitate human thinking to make a decision in relation to the actual application of ROE, thereby increasing the ability to predict the outcome.

3.2. ROE learning by reinforced learning of policy networks

In here, It can be said that learning is carried out to apply the principles established in the upper stage to the reality of the lower stage performing individual tasks. This can be said to enhance the performance of the policy network through supervised learning through actual practice, and it is to overcome the limitation of being optimized only for established principles. In this process, AI can create and participate in War Game Simulation to directly create a model reflecting ethical decision-making and make judgments about it.

ROE Learning by reinforced learning of policy networks reflecting the ethical aspect is an international standard interworking that enables the interworking of military war game simulation models, and can be achieved through design and introduction of Parallel Simulation Engine while having a High Level Architecture structure[14]. This can be specified from the design stage of the scenario through a different set of reaction based on it, which has the characteristic that it can be used as a material for learning military ethics[15]. In this process, each choice of AI carries a reward, and the list of options they made would be listed and rated against the different factors including ethical aspects that determined its payoff.

The learning of the policy network as described above can be viewed as having the following three advantages in ethical judgment. The first is the ability to self-learn important characteristics from a low level to a high level. Second, when a new ethical problem arises, it is possible to identify and learn characteristics on its own. Third, there is an appropriate interaction with the intervention of an ethics expert. This means leveraging expert intervention, but maintaining some level of balance in the sense that it doesn't mean that the expert must identify a feature and input its variables every time.

4. Applying AI's ROE Learning Results to Hypothetical Dilemma Situation

The learning of the policy network as described above is connected to the reinforced learning of the value network in Deep Learning. Reinforcement learning of the value chain is a method of assigning weights based on data accumulated through one's own matches to proceed with the next match, and corresponds to the stage of reinforcing the prediction of results. Learning through this policy network can be applied through a hypothetical dilemma situation. This hypothetical dilemma situation allows us to predict and anticipate real life aspects so that we can focus on issues on moral stage and moral orientation[16]. In addition, the hypothetical dilemma situation works as a mechanism for adopting the role of making decisions by directly participating in non-linear decisions that cannot be calculated through calculating[17]. Having the opportunity to adopt these roles functions as an important factor in self-sustaining moral development[18]. Together with the effect of direct instruction of moral principles, these cases are also partially confirmed through discussions about the results that can be achieved in moral development by participating in the moral dilemma discussion[19]. Hence, this hypothetical dilemma is mainly used in the cognitive development theory of morality.

At this time, it can be said that the criterion for weighting in ROE learning of AI is a part related to the cognitive aspect of morality. In relation to human ethical judgment, the part related to moral development starts from the aspect of cognitive judgment. This is embodied through the theory of cognitive development on morality, which means understanding and analyzing moral development as a step-by-step deepening of cognitive judgment. Approaching AI's ROE Learning in this cognitive aspect has an advantage in that it can apply various research results of cognitive development theory. On the other hand, understanding human cognitive development in direct contrast with that of AI may be viewed as somewhat less plausible from an epistemological point of view because structural differences exist. Therefore, rather than trying to approach it from the perspective of developmental psychology, it is judged that it is more appropriate to evaluate AI learning by applying the criteria related to the evaluation of values and goal setting methods in the educational aspect related to human learning. Therefore, for the aspect related to goal setting, the Taxonomy of Educational Objectives of education theory and the Logical Test of Validity for Social Justice can be used for value evaluation.

4.1. Utilizing the taxonomy of educational objectives

The meaning of the Taxonomy of Educational Objectives is that systematically categorize and categorize the goals of education. This taxonomy serves the function of making it easier to understand systematic assessments surrounding the entire domain of cognitive processes. This Taxonomy is originally created by Benjamin Bloom for categorize the levels of reasoning skills required in classroom situations, and there are six levels which requires a higher level of abstraction from the students[20]. However, it is appropriate to understand this taxonomy as meaning a classification constructed according to a set of principles rather than a strict structure[21]. The classification of this cognitive domain consists of six cognitive levels based on a series of basic principles. In particular, the classification in the cognitive domain has been revised as follows[22]. As these contents are summarized, it can be presented as <Table 1>. these

contents can be presented in combination with Factual, Conceptual, Procedural, and Metacognitive factors if it is needed.

Table 1. Measurement tools and the questions' structure with taxonomy model in the cognitive process dimension.

Bloom's taxonomy	The Revised taxonomy	Meaning	Dimensions of sub categories
Knowledge	Remember	Retrieving relevant knowledge from long-term memory	1.1 Recognizing 1.2 Recalling
Comprehension	Understand	Determining the meaning of instructional messages, including oral, written, and graphic communication	2.1 Interpreting 2.2 Exemplifying 2.3 Classifying 2.4 Summarizing 2.5 Inferring 2.6 Comparing 2.7 Explaining
Application	Apply	Carrying out or using a procedure in a given situation	3.1 Executing 3.2 Implementing
Analysis	Analyze	Breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose	4.1 Differentiating 4.2 Organizing 4.3 Attributing
Synthesis	Evaluate	Making judgments based on criteria and standards	5.1 Checking 5.2 Critiquing
Evaluation	Create	Putting elements together to form a novel, coherent whole or make an original product.	6.1 Generating 6.2 Planning 6.3 Producing

This taxonomy evaluates the level of cognitive judgment made by AI in a hypothetical dilemma situation, and plays a role of guiding it to make higher-level judgments. If moral development is an activity oriented toward a higher cognitive level, performing higher-level judgments means that moral development has been achieved. If this perspective is applied to AI's ROE learning, it will be possible to make reinforcement learning of the value chain so that AI can perform higher-level moral judgments while considering various factors as well as simply in terms of results.

4.2. Verifying through logical test of validity for social justice

As mentioned above, if the ethical aspect must be considered in the ROE learning of AI, the consideration of the ethical aspect is characterized not only by personal judgment, but also in the context of social justice. Some attributes have been identified as defining social justice which is Equality, Reciprocity, Benevolence, Liberty, etc[23]. And it is needed that the treatment of such principles as principles that are distinct from the expectations and rules of AI's ROE Learning. On the other hand, these factors are the basis of a cognitive and rational approach to understanding values. And this understanding of value performs the function of justifying it by presenting rational and valid reasons related to moral judgment.

This value analysis is understood in terms of two aspects: the value criteria applied to the context of making a value decision, and the value principle that results from that decision. In this context, a number of different value criteria can be applied to a single value judgment. Certain criteria and conditions exist for such rational value analysis. This means that the meaningful facts supporting a judgment must be true or well verifiable, that the facts must be appropriate to be true and be meaningful for the subject making the actual judgment, other things being equal The larger the range of facts involved, the more appropriate, and the value principle implied in the judgment must be acceptable to the subject making the judgment. The procedure and conflict resolution for the rational value analysis task made based on this are to review and defend the logic and legitimacy of the value. This makes it possible to provide sufficient reasons through scientific method for a value selected by a subject, and at the same time to apply an

analytical process in the process of making a value-related decision[24]. Based on this, the procedure for the rational value analysis task is presented as shown in <Table 2>.

Table 2. Procedures for rational value analysis task and conflict resolution related to value analysis.

Procedures for rational value analysis task	Procedures for conflict resolution related to value analysis
Identifying and clarifying the value question	Seeking common ground for acceptable interpretations of value questions, seeking common consensus on values and morality
Assembling purported facts	Reducing differences between meaningful facts gathered through the distinction between fact and value
Assembling the truth of purported facts - Particular facts - General facts - Conditional facts	Understanding the differences between causation and correlation between events and reaching consensus on the standards of evidence to support the facts
Clarifying the relevance of facts	Reducing differences in the relevance of facts, taking into account differences that arise between diverse political, economic and cultural positions on a phenomenon
Arriving at a tentative value decision	Reducing differences in provisional value determinations, isolating various factors related to inconsistencies in value determinations resulting from differences in characteristics or terminology
Testing the value principles implied in the decision - New case test - Subsumption test - Role exchange test - Universal consequences test	Reducing differences in tests of acceptability of value principles, taking into account new cases, new roles, and new consequences of value judgments

If the above procedures are interpreted in direct connection with the aspect of AI's ROE learning, it is, on the one hand, to analyze the cognitive aspect of morality and, on the other hand, to suggest the direction of the development of morality. These procedures act as a reference and play an evaluating role for AI learning. This analysis is especially analyzed in connection with Kohlberg's Moral Development Stage[25], and it is also a factor in the investigation of morality in AI[26]. This value analysis was developed to solve a position that requires a choice in relation to public policy or social value, and it can be evaluated as useful in solving problems caused by the relativistic nature of values or excessive autonomy. However, this model of value analysis has a problem in that it does not deal with the emotional aspects of moral issues as a logical and cognitive approach to values. This part needs to be addressed through the complementation of Human Ethics Experts.

5. Conclusion: Complementing AI's ROE Neural Network with Human Ethics Experts

A study that predicted the aspects of future wars operated by AI predicts that future wars will show the following three trends: the acceleration of multi-domain battle, the generalization of cognitive-centered operations, and the Acceleration of Human-machine Fusion and increased ambiguity of blurring distinction between combatants and non-combatants. And The Regulation of the Use of Artificial Intelligence in Warfare needs to be approached in terms of laws that guarantee human rights and meaningful human control over them[27]. What we can pay attention to in this aspect is that military operations are conducted with a focus on the cognitive aspect. This means that, while AI has a certain level of access to the cognitive part of the human internal thinking process, a sufficient level of access to the part related to the comprehensive judgment that reflects the emotional part has not yet been made. will be. If so, it is concluded that it is necessary to take an approach, especially from a standard point of view, when the Human Ethics Experts approach this part. In particular, the case[28], where an emotional aspect is requested in education using AI tools, shows these characteristics.

The approach to perform correction by reflecting the emotional aspect in AI's ROE learning is an attempt to solve problems that may occur when cognitive results are linked to immediate actions. This starts from acknowledging that there are cases where conclusions that can be analyzed as cognitively valid in relation to moral decision-making often do not coincide with human moral sense. This also means that, in morality, cognitive and emotional elements can be distinguished, but cannot be separated. If that is the case, it can be analyzed that the emotional factor not being dealt with in AI learning is inherently error-prone. This kinds of issues are being raised sensitively now, especially that AI as an Artificial Moral Agents(AMA) gain capacity to do things that are harmful to humans and other sentient beings[29], like military warfare.

Resolving these problems requires that the ability of AI to consider ethical considerations should be expanded in proportion to its ability to perform its tasks. This expansion needs to be extended not only in the cognitive aspect, but also in the moral sentiment possessed by humans. And it is expected that the formation of this ability can be achieved through AI's deep learning that follows the mechanism of moral development and human learning about morality in AI's behavioral norm learning[30]. In particular, the formation of ethical norms of AI related to combat situations can be linked to learning the emotional aspects of humans through the process of being corrected by human experts. And This will be feed back to the Deep Learning Mechanism and need to be continuously developed through refinement work.

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7. Appendix

7.1. Authors contribution

	Initial name	Contribution
Author	HK	-Set of concepts ☑ -Design ☑ -Getting results ☑ -Analysis ☑ -Make a significant contribution to collection ☑ -Final approval of the paper ☑ -Corresponding ☑ -Play a decisive role in modification ☑ -Significant contributions to concepts, designs, practices, analysis and interpretation of data ☑ -Participants in Drafting and Revising Papers ☑ -Someone who can explain all aspects of the paper ☑

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