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The Relationship between Smartphone Overdependence and the Adolescents' Smartphone Use Time during Tasks: Moderating Effects of Purposeful Use for Tasks

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Abstract

Purpose: This study aims to examine and understand how the use of smartphones for the task affects excessive dependence on smartphones in adolescence. In particular, it seeks to verify the moderating effect of the proportion of the purposeful use for the task. It is to confirm the effect of smartphone using time during one's task on smartphone overdependence. In particular, it has been confirmed whether the proportion used to carry out the task affects the excessive dependency on smartphones by smartphone using time.

Method: The data from the survey on smartphone overdependence by the National Information Society Agency in 2018 was used, and a three-step hierarchical regression analysis was performed on middle and high school students. The dependent variable was the level of smartphone overdependence, the independent variable was the time spent on using the smartphone during the task, and the moderating variable was the proportion of purposeful use for the task.

Results: It was found that the longer the time of using smartphones during the task, the higher the level of smartphone overdependence, yet the proportion of purpose of use did not have a significant relationship with smartphone-related overdependence. Furthermore, the proportion of targeted use of the task has changed the nature of the relationship between smartphone usage time during the task and the level of excessive smartphone dependence. When the smartphone use time during the task is short, the proportion of the smartphone use for the task lowered the overdependence, but the proportion of smartphone use for their task did not affect smartphone overdependence when the smartphone use time during the task was long.

Conclusion: The time spent on using smartphones during the task increased the level of smartphone overdependence, and the level of overdependence was changed by the proportion of purposeful use for the task. This means that even if adolescents use a smartphone for tasks such as studies, it is important to create an environment that can help manage on their own to ensure that they can use their smartphones for their intended purpose, along with the efforts to shorten the time of use of a smartphone.

[Keywords] Smart Phone, Overdependence, Addiction, Adolescent, Purposeful Use

1. Introduction

Spanning from leisure activities such as playing games and watching videos, social media activities to form and maintain social relationships, and social participation, such as the information production and sharing processes, their activities with digital devices have been getting essential for adolescents. In particular, the popularization of the smartphone has increased the possibility that adolescents can freely engage in many activities without some restrictions from others.

Given such a trend, people have become interested in excessive use of smartphones or the Internet in various forms of juvenile delinquency that use of a smartphone or the Internet can

lead to[1][2][3]. Initially, the term addiction was used mainly, but it has been replaced by terms such as excessive use (dependence) or overdependence recently. Among these, there have been many studies exploring the relationship between the excessive use of smartphones, which may be easily determined by their appearance, and the negative consequences in real life. In particular, it has been reported that the length and frequency of usage of their smartphone are major variables that predict smartphone addiction[4][5][6][7][8][9].

Recent studies have shown that the different ways of using smartphones have an impact on smartphone dependence. For example, the purpose or reason for using a smartphone and the type of apps they use mainly affects the risk of smartphone addiction or excessive smartphone dependence. First, the researchers have consistently demonstrated that the excessive use of smartphones for entertainment or leisure has a negative impact on their daily lives. This means that the risk of smartphone dependence increases when smartphones are mainly used for entertainment and leisure[10][11][12][13]. In particular, it has been reported that the use of social media or game-related applications for entertainment and leisure has a positive correlation with smartphone addiction[4][5][6][9][14][15][16][17]. On the other hand, contradictory research results have been presented on the effect of the use of smartphones on excessive dependence when using a smartphone for acquiring information or communicating with others. For example, some studies have shown that using smartphones to get some information leads to excessive dependence[11][18], while others do not[10][19]. In summary, the extent to which adolescents use a smartphone in daily life may be a direct factor that increases smartphone dependence and leads to negative outcomes in daily life[20][21][22]. Nevertheless, these effects may depend on purposes or ways people use their smartphone[23][24][25][26][27][28]. In particular, the use of smartphones to find information is relatively purposeful, and this is one of the important factors in learning using a smartphone.

In this respect, the influence of teenagers using smartphones to carry out their tasks on the excessive dependence on smartphones may be different. We can infer that the level of dependence on smartphones is lower when they use smartphones for their tasks like learning. Therefore, this study has focused on the effect of smartphone usage time used while performing one's task on adolescents' level of dependence on smartphones, not smartphone usage time for leisure or games. In particular, we looked at the relationship between the time spent on smartphones during tasks and overdependence depending on the proportion of smartphones used to carry out tasks.

2. Research Method

2.1. Data collection

In this study, data from the Survey on Smartphone Overdependence by the National Information Society Agency in 2018 were used and analyzed for middle school and high school students. The survey was conducted with those who have accessed the Internet using a smartphone at least once in the past month, and families were selected using a stratified extraction based on the 2015 Census of Population and Housing. From August to October 2018, interviewers visited households and interviewed household members.

2.2. Variables and measurement tools

2.2.1. Smartphone overdependence

Smartphone dependence refers to the following conditions: smartphone salience due to excessive use and problematic consequences due to difficulties in controlling the use of smartphones. It was measured using the integrated smartphone overdependence scale developed in Korea in 2016. This scale has a total of 10 questions and consists of 3 questions on

salience, 3 questions on self-control failure, and 4 questions on serious consequences. Each question was surveyed on a four-point scale (1: Not at all - 4: Strongly agree). The average value was calculated and analyzed. And the Cronbach's alpha value, which is the reliability of a total of 10 questions, turned out to be 0.868.

Table 1. Three factors of smartphone overdependence.

Factor	Meaning
Self-control failure	A state in which the ability to self-regulate is insufficient compared to the user's subjective goals for smartphone use.
Salience	The degree to which the lifestyle pattern of using a smartphone is more prominent and the most important activity than other behaviors in an individual's life.
Serious consequences	The degree to which smartphones are used even though they experience negative physical, psychological, and social consequences due to the use of smartphones.

2.2.2. Smartphone usage time during a task and the proportion of use for a task

Smartphone usage time during a task means how many hours a day do you use your smartphone during your task. The questionnaire is: "How many hours do you use your smart phone during your studies?" This is different from previous studies that measure the time spent using a smartphone a day or for leisure and games. This is meaningful in that it analyzes the time used for a specific objective of task performance, rather than using a smartphone for purposes such as wasting time. The time to use a smartphone during the task ranged from 'less than 1 hour' to more than 4 hours in the unit of 1 hour. In addition, the proportion (0%~100%) used for purpose of the task was investigated. This is because the influence of smartphone use may vary depending on the proportion of the time spent under the purpose of the task, even if the time spent using a smartphone during a day's task is the same.

2.2.3. Other variables

This study attempted to analyze the moderating effect of the proportion used for their task in the relationship between smartphone usage time during task and smartphone dependence while controlling major factors that can affect smartphone dependence. For this purpose, gender (female: 0, male: 1), level of school (middle school student: 0, high school student: 1), residential area (small town/rural area: 0, large city: 1), and parents' overdependence (normal group: 0, risky group: 1), family support, and daily life satisfaction were set as other variables. The family support was investigated on a 4-point scale (1: Not at all - 4: Absolutely agree) for the statement of 'My family does not spare support for me'. Finally, the daily life satisfaction was investigated on a 4-point scale (1: Very dissatisfied to 4: Very satisfied) for 7 questions, including interpersonal relationship, work/study, health, consumption activity, leisure, achievement level, and overall life satisfaction, and the average value was calculated and used for analysis. The average value of the 7 questions turned out to be 3.01, which means that they are a little satisfied with their daily lives. And the Cronbach's alpha value was .730, indicating that there was no issue with the reliability analysis.

2.3. Analytical method

To analyze the moderating effect of the proportion of smartphone use for a task for the relationship between the time of use of smartphones during a task and smartphone overdependence, a hierarchical multiple regression analysis was performed with the SPSS 26.0 version. In step 1, control variables such as gender, school level, region of residence, relationship with family, and daily life satisfaction were input, and in step 2, the time of use of smartphone during a task and the proportion of smartphone use for a task were input to verify the independent influence of two variables. In step 3, to examine the moderating effect, a variable for interaction

that multiplied the time of use of smartphone during a task and the proportion of smartphone use for a task, then the influence of the variable was verified. Since the multi-collinearity problems may occur, standardized values of the two variables were used in the analysis [29][30].

3. Analytical Results

First, the relationship between each variable and the smartphone overdependence was analyzed. The descriptive results for these are illustrated in <Table 2>.

Table 2. Descriptive statistics.

Classification		N	M	SD	Statistical significance
Overall		3,280	2.1006	.43465	
Gender	Girl	1,619	2.1192	.53467	t=1.938, df=3,278
	Boy	1,661	2.0825	.54877	
School	Middle	1,096	2.1608	.55951	t=4.531***, df=3,278
	High	2,184	2.0705	.53069	
Region	Small Town/ Rural Area	1,568	2.0730	.53610	t=-2.795***, df=3,278
	Big City	1,712	2.1259	.54643	
Parents' Overdependence	Normal Group	2,477	2.0977	.53917	t=-2.005* df=2,860
	Risky Group	385	2.1571	.55152	
Family's Support	Absolutely agree	66	2.0379	.46468	F=1.530 df1=3, df2=3,276
	Agree	300	2.1443	.57443	
	Disagree	1,750	2.1081	.54601	
	Absolutely disagree	1,164	2.0817	.53113	
Life Satisfaction		3,280	3.0008	.43465	R=-.086***
Time of use during Task		3,280	2.1674	1.2529	
The proportion of use with Purpose		3,280	29.7409	21.08366	

Note: *p<.05, **p<.01, ***p<.001. / B: Non-standardized coefficient, β : Standardized coefficient.

The level of smartphone overdependence was approximately 2.1 on average and .43 standard deviation. This indicates that the level of overdependence was not high. And there was a statistically significant difference in the smartphone overdependence of adolescents by school, region, and parents' smartphone overdependence. First, the middle school students were about 0.09 points higher than high school students, the adolescents living in big cities were about 0.05 points higher than the adolescents living in small towns/rural areas, and the adolescent with the parents of the risk group of smartphone overdependence was about 0.06 points higher than the adolescent with parents of general. Also, the higher the daily life satisfaction of adolescents,

the lower the level of overdependence, and the correlation turned out to be low ($R=-.086$). However, the difference in the level of overdependence by gender and family support was not statistically significant.

<Table 3> shows that the proportion of purposeful use of a smartphone for a task has a moderating effect on the relationship between smartphone use time during a task and smartphone overdependence. It analyzed 2,862 adolescents, excluding the cases with missing values for each variable among 3,280 people. VIF values were below 1.3, so there was no multi-collinearity issue.

Table 3. Moderating effect of the proportion of purposeful smartphone use for tasks.

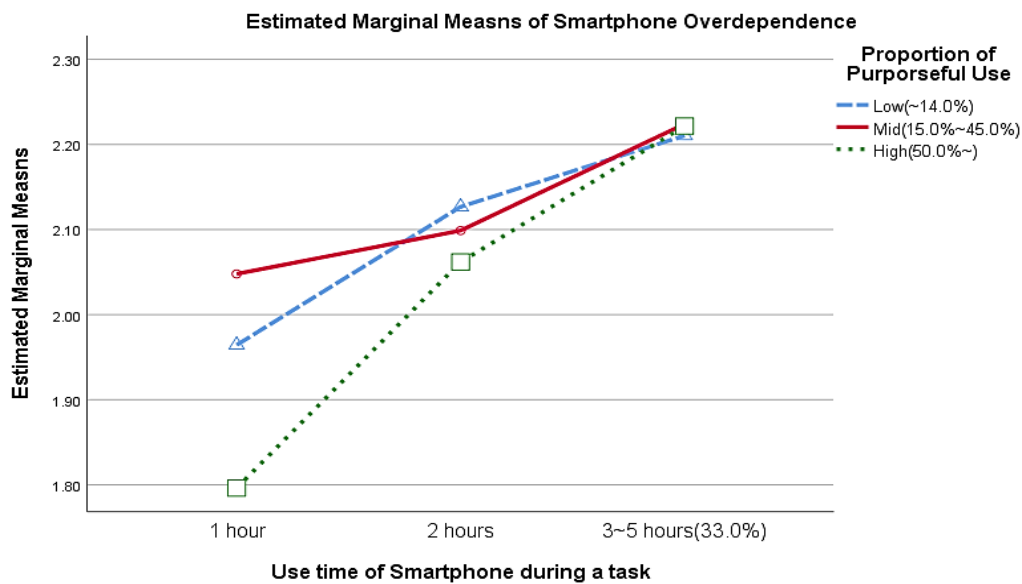
Classification		Model 1			Model 2			Model 3		
		B	SE. B	β	B	SE. B	β	B	SE. B	β
Intercept		2.418	.074		2.290	.074		2.291	.074	
Gender (Boy: 1)		-.037	.020	-.034	-.039	.020	-.036	-.038	.020	-.035
School (High: 1)		-.079***	.021	-.069	-.070**	.021	-.061	-.069**	.021	-.060
Region (Big City: 1)		.073***	.020	.067	.081***	.020	.075	.082***	.020	.075
Parents' Overdependence (Risky Group:1)		.052	.029	.033	.046	.029	.029	.046	.029	.029
Relationship with Parents		.015	.016	.019	.025	.016	.032	.022	.016	.028
Life Satisfaction		-.112***	.026	-.090	-.083**	.026	-.067	-.082**	.026	-.066
Smart Phone	Usage time during a task				.095***	.010	.176	.097***	.010	.179
	% of Purposeful Use				-.018	.010	-.034	-.017	.010	-.031
	Interaction							.027**	.010	.049
$R^2 / \text{Adj. } R^2$.019*** / .017			.048*** / .046			.051*** / .048		
$\Delta R^2 / \Delta F$.019 / 9.115***			.029 / 44.359***			.002 / 7.203**		

Note: *: $p < .05$, **: $p < .01$, ***: $p < .001$. / B: Non-standardization coefficient, β : Standardized coefficient.

The R^2 of Model 1 including the demographic variables was 1.9%, which was statistically significant. In Model 2, two variables (the time spent on smartphones during the task and the proportion of use for the task) were added, and the total amount of explanation was 4.8%. As added two variables, the variance of smartphone overdependence was explained by an additional 2.9%, which was statistically significant. The increase in the smartphone usage time during the task has raised the level of smartphone overdependence ($B=.095$), yet the proportion of purposeful smartphone use for a task has not had a significant relationship with the smartphone overdependence.

The moderating effect of the proportion of the purposeful smartphone use is shown in Model 3. Variables accounted for 5.1% of the smartphone overdependence and increased by 0.3%p compared to model 2, which was statistically significant. The coefficient of the interaction variable ($B=0.27$) also turned out to be statistically significant.

Figure 1. The moderating effect of the proportion of purposeful use of smartphones for tasks.



<Figure 1> is a chart showing the moderating effect of the proportion of purposeful use of smartphones for tasks. To understand what the interaction effect looks like, the variable of the time spent on using their smartphone during the task was categorized into 3 groups (1 hour: 30.4%, 2 hours: 36.6%, 3 to 5 hours: 33.0%), and the variable of the proportion of purposeful use for the task divided into 3 groups (low (14% or less): 25.9%, Mid (15% ~ 45%): 54.0%, High (50% or more): 20.1%). As the use time of smartphones during a task increases, the level of overdependence on smartphones increases, which appears in all three groups classified according to the proportion of purposeful smartphone use. And the degree of overdependence by the time spent using the smartphone during the task was different depending on the proportion of smartphone use used for the task. When adolescents used smartphones for one hour during a task, the group with a high proportion of using smartphones for the task had a lower overdependence on a smartphone than the group with a relatively low proportion. However, when adolescents spend more than 2 hours on smartphones during tasks, smartphone dependence has not decreased even if the proportion of using smartphones for their tasks increases.

In summary, as the time spent using smartphones during tasks has increased, the level of smartphone overdependence has decreased. But smartphone overdependence by smartphone usage time depends on the proportion of using smartphones for their tasks. This means that there is a moderating effect between the three variables. In particular, the influence of the proportion of purposeful use was limited only when the time of using the smartphone during the task was less than 1 hour. When the adolescent has used their smartphone for more than 2 hours during a task, there was no difference in overdependence on the smartphone by the proportion of smartphone use for their task.

4. Conclusion

The aim of this study is to verify the relationship between adolescents' smartphone overdependence and their experiences with the use of smartphones in carrying out their tasks. Accordingly, this study confirmed the moderating effect of the proportion of smartphone usage for the task between the smartphone overdependence and the time spent using smartphones while the adolescents perform their task. The data of middle and high school students from The Survey on smartphone overdependence conducted by the National Information Society Agency

were used, and hierarchical regression analysis was conducted. The results of the analysis are provided as follows.

First, it was found that there was a positive relationship between smartphone usage time during their task and the level of smartphone overdependence. This means that the more time a smartphone is used during a task, the higher the level of overdependence on the smartphone. This is similar to the results of previous studies showing that the use of smartphones for entertainment, social relation, and the search of information increases overdependence.

Second, the effect of the smartphone usage for task purposes during tasks on the smartphone overdependence was not statistically significant. This means that it is difficult to explain the change in smartphone overdependence by the proportion of smartphone use for tasks.

Third, it was found the moderating effect that the influence of time spent using smartphones during tasks on smartphone overdependence differs depending on how much adolescents use smartphones for tasks. The level of smartphone overdependence decreases as the proportion of use for the task increases when they use short while doing the task. On the other hand, when adolescents use smartphones a lot during tasks, the level of smartphone overdependence did not decrease even if the proportion of using smartphones to accomplish tasks increases. The pattern of this moderating effect can be inferred as follows. Unless adolescents use the smartphone perfectly in line with the objective of accomplishing the task, the time spent for objectives not related to their studies would increase.

These results suggest that it is important for adolescents to use smartphones for a clear purpose and manage their usage time in areas necessary for life. At the same time, it is necessary to check whether the smartphone is being used properly for the purpose when adolescent used their smartphone a lot, even if the purpose of the use is clear and it is being used to achieve the purpose of performing a task.

Nevertheless, if we have only negative views such as addiction or overdependence, we would face limitations that overlook the positive aspects of a smartphone or Internet use. Considering the positive and negative aspects of smartphones at the same time, it can help adolescents to grow up healthy and competent while using smartphones beyond the prevention and intervention of smartphone dependence. When using a smartphone during a task, it is important to continuously check and manage whether it is used for the purpose and the time spent using it is not excessively extended. It is, therefore, necessary to increase adolescents' ability to control themselves and manage their use of smartphones using some apps for smartphone time management. In addition, it is necessary to investigate whether some prevention programs through smartphone use management can reduce adolescents' overdependence on smartphones.

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6. Appendix

6.1. Authors contribution

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

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Exploration for Educational Application of Metaverse: Focusing on Implication for Use in English Education

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Abstract

Purpose: As the non-face-to-face situation triggered by COVID-19 continues for a long time, the desire to experience a sense of reality and realism even through an online virtual environment is increasing, and the metaverse is emerging as an alternative in the field of education. Therefore, the purpose of this study is to examine the meaning of metaverse, which has become a hot topic in recent years, from an educational point of view and to suggest the possibility of its application in English education.

Method: The social and cultural paradigm of the 4th industrial revolution has brought many changes to the education field and is now expanding into a new area with the metaverse. In this study, what kinds of studies and use cases are related to the recent metaverse in Korea, and what are the types and characteristics of the metaverse that are mainly used. In addition, I would like to examine the characteristics that appear in the application process of educational activities using the metaverse reported in this study, how these characteristics can be grafted into English and teaching and learning activities, and what advantages there can be.

Results: As a result of analyzing this from the educational aspect, positive factors of metaverse such as an increase in the educational presence and class participation, alleviation of anxiety, immersive learning, and interest and motivation were selected, focusing on the implications for use in English education. It showed potential for use as a tool. As such, it is judged that the metaverse can play an important role at the center of the future English education that is rapidly changing due to the non-face-to-face situation and the 4th industrial revolution technology.

Conclusion: The metaverse can overcome the sense of physical distance, and if the existing metaverse platform is used to the maximum to configure a space suitable for the purpose of learning and provide content, a qualitative teaching and learning space can be provided. In the future, based on this study, we expect various types of empirical research to examine the effectiveness by selecting a metaverse platform suitable for the purpose and target of English class and designing an actual class space.

[Keywords] Non-Face-to-Face, Fourth Industrial Revolution, Metaverse, Virtual World, English Education

1. Introduction

The non-face-to-face situation triggered by the COVID-19 pandemic situation formed a sense of social distance and promoted the reduction of offline activities and the expansion of online activities. This change brought a great transition to a non-face-to-face educational environment, and a streaming-based real-time video conferencing platform was mainly used in school classes [1][2]. These platforms interact in real-time and are effective in alleviating the sense of isolation that can occur in distance learning and promoting social interaction [3]. However, the real-time video conferencing method also has several limitations. In a real-time class, interaction and

cooperation with instructors and fellow students cannot be performed smoothly [1]. In a videoconferencing situation, when two or more people are talking at the same time, it is difficult to easily determine where the person speaking is. In addition, insufficient interaction may have a negative impact on online learning activities [4][5]. In addition, as limitations for interaction and cooperation, failure to control the speed of lecture progress, absence of teacher-student communication, delayed feedback, passive attitudes such as learners' silence, and poor concentration of attention have been reported [1][6]. And in real-time video conferencing platforms, it is difficult to form a three-dimensional sense of space, so the sense of immersion is lacking [7]. In addition, real-time videoconferencing requires the use of a camera to reveal personally identifiable information in order to properly use it, and the issue of information security cannot be ignored [8].

As an alternative method to overcome the limitations of such a real-time video conferencing platform, interest in the metaverse is increasing. Metaverse, which means a space that transcends reality, is a platform that can freely manipulate avatars in a virtual space implemented in three dimensions [9][10]. In schools, offline activities such as projects were made possible on the metaverse, and there is also a way to directly travel and introduce the world travel metaverse. In addition, there was a case in which students directly participated in creating a safety map VR map that could identify and prevent actual risk factors in advance. As such, attempts are being made to actively introduce the metaverse to the education field, and the metaverse has become an irresistible trend in the education world as a whole.

As such, the metaverse is judged to be a sufficient alternative in the university education environment, which suffers from crises such as a drop in learners' learning ability and dropout in the non-face-to-face situation triggered by the corona virus [11]. Therefore, in this study, we focused on the educational use of metaverse and looked at recent cases, considering that the metaverse could play an important role in the center of the future education that is rapidly changing due to the non-face-to-face situation and the 4th industrial revolution technology. In this regard, I would like to introduce the characteristics of this metaverse in terms of educational use, and suggest how it can be used in English education based on the analysis of these characteristics, and its possibilities and methods.

2. Research Method

At a point in time when the metaverse's educational use is expanding according to the changes in the 4th industrial revolution, it is necessary to understand the research trend on the educational use of the metaverse and discuss how the metaverse can be used in English education. Therefore, in this study, what kinds of studies and use cases are related to the recent metaverse in Korea, and what are the types and characteristics of the metaverse that are mainly used. In addition, we would like to examine the characteristics that appear in the application process of educational activities using the metaverse reported in this study, how these characteristics can be grafted into English and teaching and learning activities, and what advantages there can be.

This study was conducted in three major stages. First, studies and cases that have used metaverse for educational purposes over the past five years were selected as research subjects. Next, the advantages of metaverse utilization were analyzed in terms of cognitive, affective, and behavioral domains for the papers and cases selected for research. Finally, based on the data analysis results, educational implications for using the metaverse in education were derived. However, this study has limitations in that it analyzed and discussed only general educational use cases or publicly disclosed data other than English education.

3. Literature Review

3.1. Definition and characteristics of metaverse

The term 'metaverse' was coined by Neal Stephenson in 1992, in "Snowcrash", where real-world events are mixed with events that take place in a mass-visited communal virtual world, in which individuals can interact in a three-dimensional landscape by creating avatars[10][12]. Each avatar is visible to all other users, and avatars interact with each other in this communal virtual space through software-specified rules. The metaverse is often called the playground of the 'MZ generation'. MZ generation is a collective term for the millennial generation born in the early 1980s to the early 2000s and the 'Z Generation' born in the mid-1990s to early 2000s. All freshmen from the university fall under the MZ generation[13]. MZ generation is familiar with the digital environment, seeks a unique experience differentiated from others, and is sensitive to the latest trends.

In general, the virtual world type 'metaverse' has the following features[14]. First, the sense of alienation between the virtual world and the real world is minimized through connectedness. Second, the characteristics that form a new self in the metaverse make one's appearance more attractive through the avatar and try to be active in the metaverse. Third, the metaverse has the characteristics of a virtual world with enhanced relationships and sociality. However, the relationship in the metaverse has duality, and the reinforcement of sociality acts as a positive or negative factor to the satisfaction of using the metaverse. Fourth, transparency exists because most of the information and activities about oneself are recorded and shared within the metaverse.

3.2. Metaverse platforms for educational use

As interest in the metaverse is rapidly increasing, the metaverse is being used in various fields. In addition to being used in various socio-economic fields such as concerts, election campaigns, new employee training, and virtual real estate, universities are also attempting to create various activity spaces using the metaverse platforms to prevent students from leaving the center and strengthen their sense of belonging and learning[9]. From now on, among various metaverse platforms, we would like to look at the platforms used for education and their examples.

3.2.1. Roblox

Roblox is an online game-based 3D virtual platform created by Roblox Corporation in the United States in 2006. It is a platform where users create their own games through Lua coding in the studio and other users play games. Roblox has been developed in motivation, collaborative learning, role playing, problem solving, STEAM(Science, Technology, Engineering, Arts, Mathematics), etc[15]. It has great educational utility. Students and teachers are free to create whatever they want with their creativity and imagination, regardless of time, and they can role-play, explore historical sites, and experiment with rocket physics.

3.2.2. Ifland

Ifland, launched by SK Telecom, is a 3D social communication platform that provides various avatars and virtual themed spaces, and enables voice communication by sharing content[15]. You can communicate freely by sharing videos or documents with more people, such as at meetings and performances, and there is also a function to explain with voice based on the shared file. Like the ZOOM platform we are familiar with, the host can set up microphone control, etc., and up to 130 people can participate, manipulate presentation materials, and have conversations. Various maps such as conference halls, cafes, classrooms, and playgrounds can be set, and even a secret room can be opened, so only a specific group of people can gather and use it.

As an example, in September and October 2021, for the first time in high school, an admissions briefing session was held at Konyang High School affiliated with Chungnam Konyang University using the Ifland platform. In a situation where it is difficult to hold a face-to-face collective admissions briefing session, the MZ generation used the metaverse to hold an admissions briefing session for many people, including students, parents, and teachers. If there is a situation where it is difficult to hold an admissions briefing session, I wonder if the Metaverse platform can be used.

3.2.3. Gather town

Gather Town is an online platform that supports users to meet, communicate and collaborate in a virtual space where they can experience similar to reality. It is an online video conferencing platform similar to Zoom, and it is a method of video conferencing while moving in space. If you go near another user through video chat, you are automatically connected and you can have video or voice conversations[15]. In other words, when the characters meet each other while moving around, video conference is activated, and when the characters move away from each other, the video conference is stopped. There is also a secret chat function, and up to 25 people can use it for free. In addition, various activities can be carried out by using functions such as document, video, game insertion, screen sharing, and whiteboard. For example, you can draw text or pictures on the whiteboard and use it to share it with everyone.

Above all, the fact that you can directly compose a map can be an advantage from the point of view of a teacher in that it can be carried out with meaning when designing educational activities. This is because students can follow the teacher's guidance to find a place and obtain information through messages, documents, and videos there. With these advantages, the two-day online festival held on the Soongsil University campus built in Gather town was so popular that it recorded up to 300 concurrent users, and the club fair held at Yonsei University was also held at Yonsei University for information delivery and information delivery using metaverse rather than unilateral information delivery. We have created an environment where we can communicate together.

Table 1. Metaverse platform comparison.

Division	Roblox	Ifland	Gather town
Communication	Avatar + Chat + Voice	Avatar + Chat + Voice	Avatar + Video + Chat + Voice
Number of simultaneous connections	130	130	25(free version) 500(paid version)
Recommended use	Seminar, Event	Seminar, Event	Metaverse Office, Seminar, Event
Custimizing	Character(Hair, Eyes, Skin color, etc.)	Character(Hair, Eyes, Skin color, etc.)	Maps, characters, clothes, etc.

Note: Park C. Metaverse and future education (2021).

3.3. Educational effects of metaverse

As the metaverse is actively used in the education field, various studies on the educational application of the metaverse are being conducted. Learning using the virtual world is effective in improving collaboration skills and skills based on active participation of learners[16]. According to Nowlan NS, Hartwick P, and Arya A, collaborative learning environments through avatars in the virtual world are effective in acquiring higher-order skills because they increase learning participation through interaction with other learners, and learning through mistakes is possible[17]. In addition, the study of Kuznetcova I and Glassman M found that learning in the virtual

world improves learners' critical reflection skills because they can freely share their thoughts with fellow learners in a democratic learning environment, away from the way learners passively receive knowledge[16]. In a study by Depp et al., collaborative simulation through a metaverse platform called VirBELA was used to develop cooperative capabilities[18]. In this study involving clinical research faculty, medical students, and interdisciplinary faculty, all participants rated the collaborative simulation in the virtual world as effective in developing communication and collaboration skills.

Based on these advantages, if the metaverse is used for learning, students can participate in learning activities while exploring the space created by the teacher in the virtual world through the avatar. Students can perceive spatial reality while moving through the space of the virtual world. Participatory activities using avatars in the virtual world enable three-dimensional perception according to spatial movement, helping learners to perceive that they are there spatially. Therefore, students can create their own avatars and move the space, thereby increasing the perception of presence in the learning space[9]. In addition, the metaverse can recognize the participation of other learners who are active in the same space, which is effective in forming a sense of social reality. By utilizing the metaverse, which has the characteristics of multi-user virtual environments (MUVE), learners can learn while forming social relationships with fellow learners or teachers[9]. In this way, learners in the virtual world experience a high sense of social presence through interaction with teachers and other learners, and can be more immersed in the learning environment of the virtual world[19]. In addition, since it is effective for learners to experience social interaction in a virtual space such as the metaverse is effective in improving learning motivation, it can be a learning method that can increase the learning effect in a non-face-to-face learning environment.

4. Advantages of using Metaverse from the Perspective of English Education

As a result of analyzing a number of previous studies related to the metaverse and its characteristics, inducing various interactions using computer avatars within the metaverse platform called 'three-dimensional virtual world' suggests new possibilities for language education [20][21]. As a result of analyzing the advantages of using metaverse in the cognitive, affective, and behavioral domains of the papers and cases selected for research, it can be summarized as follows: 1) improvement of presence and participation in education, 2), alleviation of language anxiety, 3) immersive learning, and 4) interest and motivation.

4.1. Learning presence and class participation

The functional characteristics of the metaverse are that it can strengthen the sense of spatial movement and social interaction using avatars. By utilizing the spatial movement function of the metaverse, it is possible to interact more three-dimensionally in the learning space and to perceive a sense of space. Therefore, if the metaverse platform is used for distance education, students can interact based on the visual and auditory elements provided by the avatar and share the three-dimensional experience with others, thereby enhancing the reality and participation of education[22]. Although some degree of interaction is possible in the existing video-type real-time lecture platform, it is difficult to expect a great sense of reality in education because there is no sense of spatial movement between participants[9]. However, the metaverse is attracting attention as an alternative to overcome the limitations of the existing distance education because it allows students to directly gather in one space and conduct class activities. Jung YS, Lim TY and Ryu JH revealed that in terms of social presence and learning presence, the metaverse provides a learning environment in which student interaction can occur smoothly, and thus has advantages in learning and interesting factors[5].

In particular, in the metaverse, learning is actively carried out in the process of continuous experience through certified tasks in real situations in the learner's own autonomous, proactive, and active learning process, and interaction with objects or other people in the process. This is emphasized[15]. Even students who were silent when conducting group activities in the existing real-time online class will be able to have active discussion classes in the metaverse class just like in a real classroom.

4.2. Alleviation of language anxiety

In the metaverse, social interaction using avatars is possible[10], so anxiety can be reduced compared to face-to-face communication in English. According to a study by Jeong JY and Jeong HS, who developed an English conversation learning program using virtual reality and compared it in immersive virtual reality and mobile device conditions, language anxiety was significantly reduced in both immersive virtual reality and mobile conditions[23]. In particular, language anxiety decreased significantly in the immersive virtual reality condition. It was also found that immersive virtual reality had a positive effect on improving conversational skills. As such, if language anxiety can be reduced using virtual reality and reduced language anxiety can lead to learning achievement, it is thought that metaverse can be used as a more effective learning tool.

In the study of Mo SK, some college students who participated in real-time online English classes expressed the limitations of non-face-to-face communication and the resulting burden, and it was judged that this burden hindered their willingness to communicate and induced passive participation[24]. However, she mentioned that it can improve learning immersion and satisfaction and promote self-efficacy when learners perceive the online learning environment as a free and open interaction space, just as they interact through virtual avatars, move and experience the virtual world freely[25][26]. Therefore, virtual reality such as metaverse, which gives users a sense of realism and immersion, seems to play a positive role in relaxing and reducing anxiety in a more comfortable and stable situation.

4.3. Immersive learning

One of the characteristics of virtual reality that is applied to education is immersion. In the metaverse, users can interact through an avatar, and the avatar can freely move in the metaverse space and feel a sense of presence and immersion through physical interaction[14].

Because metaverse overcomes spatial limitations and enables similar activities to be performed offline, English classes using Metaverse can provide a high level of immersion, unlike current non-face-to-face methods. Studies that applied immersive virtual reality to actual English learning situations are reporting positive results. In Korea, as a result of Lee GY using mobile devices and immersive virtual reality to study English vocabulary learning and attitudes for elementary school students, s/he found that learners using immersive virtual reality showed high levels of phoneme recognition and immersion in learning time[27]. Choi SH and Won JS, who conducted a study on English conversation learning situations, compared using a tablet PC and immersive virtual reality. As a result, it was reported that the immersion and learning motivation of learners using immersive virtual reality were higher[28].

Moreover, the important sense of security for students in learning arises from the recognition they receive in the classroom and friendships. Even students who struggled with lack of stability in the real classroom showed a sense of stability as they communicated through a virtual existence called 'avatar', and this environment can serve as an advantage when learning English. Yoon HJ says that students can work as a subordinate (sub-character; avatar) with a slightly different tendency in the virtual world of the metaverse, so a positive influence can be expected in the positive aspect of multi-persona[13]. 'Multi-persona' refers to the multiple selves of modern people that are separated according to circumstances, like changing a mask. In the real world, if you live as a 'main character', in the virtual world, you are working as a 'secondary

character' (sub-character) with a slightly different tendency. For example, it is not difficult to find cases where a student who was passive in face-to-face class became active online.

In addition, with regard to the effect of the virtual world, several previous studies have reported that using an immersive virtual world rather than learning using a mobile, PC, or model is helpful in improving learners' learning achievement or learning immersion[27][29]. Among English learning, speaking English is important for the realism of the situation in which you are talking with your interlocutor[23]. Therefore, if virtual reality such as metaverse is used, the sense of reality can be partially increased. Not only that, but using immersive virtual reality for learning can lead to better learning experiences and learning effects.

4.4. Interest and motivation

Interest is a major construct influencing learner motivation, academic achievement, and intention to continue learning in motivational research[5]. In particular, it has an important meaning in learning because situational interest can be developed in the interaction between the learner and the learning environment[30]. Situational interest is a concept distinct from individual interest, and the source of interest felt by learners is explained differently. Personal interest refers to a relatively persistent and stable disposition for a specific task and topic that an individual has, while situational interest is a temporary and immediate characteristic, and occurs specifically for a topic, such as a stimulus or an environment[31]. Among these two other sources of interest, situational interest is emphasized more important than personal interest. This is because, although it takes a long time for the development of personal interest, situational interest can arise immediately in the interaction between the student and the learning environment. Even if there is no personal interest, learning motivation can be enhanced through situational interest through external stimuli or environment. This is because, concerning situational interest, a person who is interested in a specific task or domain may have higher participation in learning[32].

It is reported that media, such as virtual reality, that provide rich information in an immersive way, enhance situational interest. A study by Lin HCS, Yu SJ, Sun JCY, and Jong MSY compared the case where college students were provided with information guidance on university libraries as immersive virtual reality devices and tablets, and reported that the virtual reality group had significantly higher situational interest[33]. A study by Parong J and Mayer RE compared the case of learning the biology class of the human body with virtual reality and the case of learning with normal slides[34]. However, it was reported that the post-test showed a low score. In addition, in a metaverse environment such as second life, an individual's sense of physical presence and social presence can be factors that positively affect situational interest and perceived achievement[35][36]. Collaboration with others can be promoted, and positive expectations for learning effects can be expected.

Kim SY suggested that the use of virtual reality and avatars for language education can increase the realism of communication situations by creating the effect that foreign language learners exist in a specific space, inducing the learners' communication motivation and interest, and enhancing the learning effect[37]. Many English learners are using VR-based English conversation learning environment for practical English speaking environment experience and learning activities by applying real-time interaction function by realizing realistic virtual space.

As such, in previous studies, it is reported that virtual reality or metaverse-based learning environment can enhance situational interest, and a sense of social presence in such a learning environment also has a positive effect on situational interest. In conclusion, situational interest and social presence can be considered together, and a comprehensive consideration is needed in virtual environments that can provide spatial immersion, such as virtual reality or metaverse.

5. Application of Metaverse in English Education

What the globalization era demands is the ability to communicate fluently in real situations. In order to improve the communication skills of English learners, it is necessary to create a practical and meaningful English learning environment by structuring the content and activities of the curriculum around communication. Therefore, if the metaverse, which has the characteristics of multi-user virtual environments, is used, learners can learn while forming social relationships with fellow learners or teachers, rather than learning alone [9]. Therefore, in the non-face-to-face learning situation caused by the COVID-19 pandemic, a learning space that meets the needs and levels of learners and meets the learning goals can be configured on the metaverse, so various activities such as discussion and conversation that can strengthen English communication skills. It is judged to be able to develop listening and speaking skills as well as reading and writing skills by integrating them into the class.

In addition, since it is effective for learners to experience social interaction in a virtual space such as the metaverse is effective in improving learning interest and motivation, it can be a learning method that can increase the learning effect in non-face-to-face learning environment. Therefore, non-face-to-face English education using a metaverse such as VirBELA will enable immersive interaction that can supplement the limitations of existing distance education such as ZOOM. In this way, classes using the metaverse on-contact platform in the COVID-19 pandemic situation were effective for mutual communication that transcends time and space. was able to confirm that it was provided.

Therefore, the method of using metaverse in English education suggested in this study is as follows. First, it should be used as a tool to improve participation and achievement in class. There are avatars familiar to the MZ generation in the metaverse. In the case of online classes conducted only through video, it is not easy to induce active participation of students or to check achievement results. When combined with real-time online lectures to implement a virtual classroom, learner participation is increased and real-time interaction is possible. It can help to improve learning effect and sense of achievement if a space that meets the goal of the class is provided and the avatar is designed to allow attendance, class activities, and interaction to provide a sense of reality like listening to a class in a real classroom.

Second, it should be used as an interest and motivational tool. For the MZ generation, it is important to create a space where they want to experience fun and solidarity in the metaverse and continue to participate. It is necessary to design according to the characteristics of the class by adding elements of play and empathy familiar to the MZ generation, such as room escape games and quizzes, and connecting it with the class experience. For example, when performing English role-play activities, if the instructor configures the spatial composition according to the conversational situation (e.g., San Francisco International Airport) and allows learners to practice with each other, not only motivation but also a sense of immersion can be provided. In addition, fun elements such as games in the metaverse can help reduce tension and form a sense of solidarity, so it is also necessary to actively utilize and deploy play-type learning elements that can motivate in the metaverse.

In addition to this, there are clearly things to consider when using the metaverse in English education. It is true that the metaverse platform is interesting, but it was confirmed that a specific operation strategy suitable for the new system was required. Because this is a new approach, more preparation is needed to make effective use of these programs. Regarding the experience of using the Metaverse platform, there were many negative responses about the stability of the access environment. When using an Internet-based platform such as Metaverse, unexpected connection problems may occur. In particular, as in the study of Lim TH et al., internet access problems may occur when simultaneously accessing at school [9]. In addition, in

order to apply the metaverse platform, sufficient prior practice is required so that both instructors and learners can use it proficiently. This is because, if the instructor does not know the functions of the metaverse platform, it is difficult to proceed smoothly, and if the learner is not familiar with how to use it, it is difficult to actively participate in the class. Therefore, in order to use the functions of Metaverse to increase the effectiveness of English learning, both instructors and learners need prior training to learn how to use them.

6. Conclusion and Suggestion

Due to the COVID-19 pandemic, many schools have reduced or suspended face-to-face classes and expanded non-face-to-face distance education according to social distancing steps[38][39]. Despite the difficulties and confusion in the rapidly changing educational infrastructure and the fluctuating graph of confirmed cases, university members did not stop their efforts to closely diagnose and analyze the new educational environment and conditions, problems and results, etc[40]. Distance education is rapidly being established in the field of university education. After going through trial and error for the transition to wise non-face-to-face society, many learning materials and educational contents are now being produced with remote technology, and there is a lot of interest in the overall program and platform to realize more in-depth learning and dense interactive online classes[41].

In addition, the education of the future should be prepared with the idea of a new Edutech that not only emphasizes new technologies but can technically supplement the advantages of education of the past[22]. Educational activities in the virtual world that transcend the limits of time and space are expected to become more active in order to cope with difficult situations such as the pandemic era as science and technology advance [11]. As part of these efforts, the need for distance education using the Metaverse platform emerged as a way to overcome the shortcomings of recent distance education. Although metaverse is not used much yet, it is thought that English education using metaverse will be provided in the future for the following reasons.

First, it is because of the increase in class participation and the immersion according to the sense of the reality of education. In the educational field, there are cases where the limit is encountered since the education is conducted in a limited space. However, on Metaverse, it is possible to learn English like a native language through various spaces and interfaces, and furthermore, online language training is possible. Therefore, the advantage of English education using Metaverse is that it can sufficiently increase achievement through leading learning on PCs and laptops. For example, it is not simply teaching through text and video, but even in a virtual world, you can visit a real place to see, listen, and learn.

Second, it is because of the decrease in anxiety that can occur when learning English. In the space of the virtual world, I feel confident that I can do anything. In the case of real-time online English classes, there may be limitations in non-face-to-face communication and consequent pressure, which may hinder learners' willingness to communicate and induce passive participation. However, if learners perceive the online learning environment as a space where free and open interaction can occur, as in the metaverse, where they interact through virtual avatars and freely move and experience the virtual world, it seems to play a positive role in relaxing and reducing anxiety in more comfortable and stable situations. Therefore, if language anxiety can be reduced by using metaverse and the reduced language anxiety can lead to learning achievement, it is judged that metaverse can be used as a more effective English learning tool.

Third, it is because of motivation through interest and fun. It is interesting that each person can choose the avatar they want rather than having a uniform class on the same desk and chair and wearing the same school uniform. In addition, since they participate in the activity while

adjusting their avatar as if playing a game, they can engage in educational activities with an active attitude. As a result, the level of immersion in the activity is inevitably increased. Therefore, learners can acquire language skills such as listening, speaking, and reading about English learning topics by experiencing situations that can occur in real life with the character (person) selected by the learner on the metaverse. I think that such character selection and free movement of space will increase the effect of interaction between learners, thereby inducing learning motivation and enhancing the effectiveness of learning.

Metaverse is slowly approaching us, and has been introduced into university education and is being actively utilized. Although it is currently considered as an alternative that has a useful purpose as a tool that provides a sense of reality in a non-face-to-face situation, the metaverse, once expanded, is expected to continue to be used even after the non-face-to-face situation ends. Now, the effectiveness will only differ depending on which platform is used to provide a creative and efficient environment in the right place and for what purpose, by who first, in what way, and for what purpose. Therefore, it is necessary to actively consider and try on how to use the metaverse for the MZ generation to create a space to have an effect suitable for English education. In addition, this study has limitations in that it is an exploratory study. In the future, based on this study, various types of empirical research are needed to examine the effectiveness of selecting a metaverse platform suitable for the purpose and target of English class and designing an actual class space.

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8. Appendix

8.1. Authors contribution

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

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Analysis of the Effectiveness of Online Education of Liberal Arts Coding Classes in the AI Era: The Mediating Effect of Learning Flow

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Abstract

Purpose: This study aims to analyze the effectiveness of online education in liberal arts coding classes that have different characteristics from general online theory classes. Through this, it is a study conducted to find out what factors to pay attention to in order to increase the educational effect of online liberal arts coding classes and to derive various implications for improving learners' learning outcomes in online liberal arts coding classes.

Method: To this end, a survey was conducted on 125 college students who took coding classes. SPSS/WIN 23.0 was used for data analysis, and multiple regression analysis was performed by using learning motivation, class content, and learning flow as independent variables, and inputting learning satisfaction and academic achievement as dependent variables. In order to find out the mediating effect of learning flow, a hierarchical regression analysis proposed by Baron and Kenny was conducted, and the significance of the mediating effect was additionally verified through the Sobel test.

Results: In online liberal arts coding classes, learning motivation and class content were found to have a direct effect on academic achievement. There was no mediating effect of learning flow in the relationship between learning motivation, class content, and academic achievement. In online liberal arts coding classes, learning flow was found to have a complete mediating effect in the relationship between learning motivation and learning satisfaction. In addition, learning flow was found to partially mediate between class content and learning satisfaction.

Conclusion: Through this study, it can be confirmed that learning motivation and class content factors directly affect academic achievement and significantly affect learning satisfaction of online liberal arts coding classes through learning flow.

[Keywords] Coding Classes, Learning Achievement, Online Education, Programming Education, Learning Flow

1. Introduction

As COVID-19 spreads rapidly around the world, non-face-to-face online education activities are being emphasized. The unprecedented spread of online classes has come as a big challenge for both instructors and learners in college education. Instructors are required to maintain or improve the quality of classes at the same level as offline classes in online classes, and learners should be able to learn effectively as in offline classes[1].

Online education is causing various problems due to the nature of remote lectures, factors that hinder learners' concentration and immersion, as well as difficulties such as lack of interaction and many assignments assigned to learners[2]. Unlike offline classes under the control of instructors, active class participation by learners themselves is an important factor that can achieve learning goals and lead to learning outcomes in online classes[3][4]. Learning in an online environment can make learners unfamiliar, and learners show differences in the level of

learner learning, attitude, and motivation, so the learner's individual differences have a great influence on the learning effect[5][6]. Therefore, in order to improve the learning effect of online learners, attention should be paid to learner factors[7]. The subject of learning in online classes at universities should be learners, and for this purpose, it is necessary to design classes by reflecting learners' learning preferences[8]. Learners with high learning motivation learn harder than learners with low learning motivation and participate more actively in the teaching-learning process[9], so there is a need for a way to increase learners' motivation. As with offline classes, the quality of online classes is more emphasized, so it is very important to check the overall influence of the contents and methods of online classes on online learning outcomes as well as learner factors[10].

Coding classes, a key competency in the era of the 4th industrial revolution, are also being conducted online. Coding classes have different characteristics from other online classes, so there is also a positive aspect of coding classes being conducted online. In the online class environment, it has the advantage of being able to watch class videos repeatedly several times. In coding education, through this repetitive learning, it seems that learners who have not been able to keep up with the learning progress in existing offline classes will be able to narrow the gap that has widened[11].

Therefore, this study aims to analyze the effectiveness of online education in liberal arts coding classes that have different characteristics from general online theory classes. In this study, learning flow, which has a significant effect on learning satisfaction and academic achievement, is also considered an important variable in predicting learning outcomes in online liberal arts coding classes, and aims to verify the mediating effect of learning flow in the influence relationship between learning motivation and class content, learning satisfaction, and academic achievement. The results derived from this study are expected to be used as empirical basic data for the design of teaching and learning courses and the development and operation of educational programs for more effective online liberal arts coding classes in the future.

2. Theoretical Background

2.1. Liberal arts coding education at university

The coding related liberal arts education currently carried out may be said to be an advanced form of IT education which has been conducted by and at the universities. If the IT education in the past focused primarily on the use of office soft-wares such as documentation, presentation, and statistical table preparation, the coding related liberal arts education today goes beyond the simple application of software, and based on the basic concepts and principles of computer science such as computational thinking, is focused on enhancing competencies such as problem solving, system design, and understanding of human behaviors[12].

The purpose of Liberal arts coding education is to develop problem solving skills and thinking skills based on the principles of computer science, not coding competency at the professional level. Given the educational nature of the learners, the first time learners demonstrate a low interest and difficulty in learning. In particular, in the coding related liberal arts education for the non-majors, the learners have a great difficulty in understanding the basic programming syntax and have difficulty following the professor's practice. Furthermore, they find it difficult to prepare and review on their own. Meanwhile, the contactless online education has expanded rapidly with the development of the Internet related technologies and has become a single educational system, and through the online education, the learners could participate in learning without time and space restraints[13].

Furthermore, they were given the opportunity to actively participate in the teaching and learning environment rather than traditional classroom. If the coding related liberal arts education is conducted contactless online, the learners can select and learn about the contents which are consistent with their interests, and they can play and watch difficult contents repeatedly according to their level. Furthermore, in the online learning environment, it may be deemed that it is effective for the coding education because the students can receive immediate feedbacks from the professor concerning the process and results after executing programming[14][15].

2.2. Motivation for learning

Learning motivation is an important factor in determining the continuity and intensity of learning. This is an important variable for enhancing learning flow, learning satisfaction, and academic achievement[10]. In particular, learners' self-direction plays an important role in the online learning environment, so if learners lack motivation, they cannot properly perform learning. Among the learner's internal characteristics, learning motivation has the greatest influence on learning outcomes and learning processes. Depending on the level and degree of learning motivation, it has a very large influence on the learning process, and it has been proven through various studies that the results change very significantly by the learning process[16][17].

2.3. Class content

Online learning content needs to contain appropriate content for learners and classes beyond simple information delivery and needs to be designed more carefully and elaborately. In an online class environment, the quality of class content is a significant factor influencing class satisfaction, and class content has a positive effect on learning outcomes[18]. The information quality variable of e-learning is the variable that has the greatest influence on the satisfaction of university e-learning users, and in e-learning, the validity of content selection, the rationality of content organization, and clarity of content influence learners' satisfaction[19].

2.4. Learning flow

Learning flow can be seen as a psychological state, in which learners are completely immersed in the learning process and perform optimal functions[20], and is a concept, which implies the quality of learners' efforts to achieve and the learner's concentration, interest, and effort in the learning process[4]. In an immersive state, learners can maximize their potential in performing activities or tasks, while at the same time feeling subjective satisfaction and happiness. Since this learning flow is an important variable predicting academic achievement and an essential variable mediating the relationship between learning motivation and learning outcomes, it has been studied as a key variable in the literature studying academic achievement[8]. B. Kim and Y. Kim identified that in order to improve learning outcomes, the effect of learning flow must be increased first[21].

These preceding studies suggest that learning flow is an important factor in predicting learners' learning outcomes by playing a mediating role in the relationship between realism, learning satisfaction, and achievement in e-learning situations.

2.5. Learning outcomes

Learning outcomes in online classes are measured by various indicators such as academic achievement and learning satisfaction, and learning satisfaction is used as a subjective indicator of academic achievement. Learning satisfaction refers to the degree of value, satisfaction, and effect that learners feel about e-learning content they learn[22], and it is recognized that the higher the learning satisfaction, the stronger the motivation for continuing online learning[12]. Based on the discussion of these preceding studies, in this study, learning satisfaction was de-

defined as the degree of learners' subjective perception of e-learning sessions and used as a subjective indicator representing learning outcomes. Academic achievement is an objective indicator of the outcome of learning, and the academic achievement of e-learning sessions can be defined as the degree of final achievement reached by learners through e-learning[16]. Academic achievement, which appears as a result of learning, is one of the important learning outcome indicators and is the result of acquiring the learner's level of change and development, knowledge, and function[23][24].

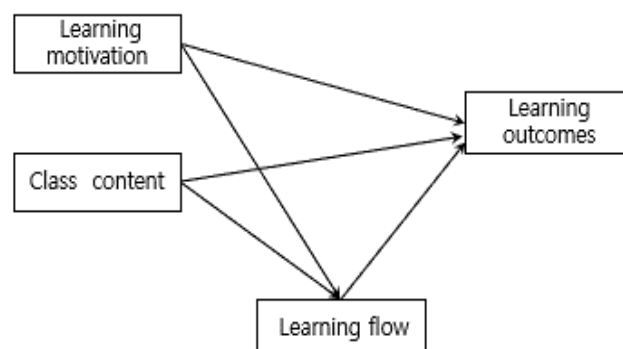
In this study, by applying the conceptual definition of previous studies, academic achievement was defined as a concept that implies how learners changed and developed through learning.

3. Research Method

3.1. Research model

The purpose of this study is to investigate the effect of learning motivation and class content recognized by college students who participated in online liberal arts coding classes on learning outcomes through learning flow. To verify the hypothesis, a research model as shown in <Figure. 1> was established based on the results of previous studies.

Figure 1. Research model.



3.2. Research subjects and data collection method

This study was conducted on students who took online courses at C University located in Gangwon-do. The purpose and direction of the study were explained to students who took the "Creative Thinking and Coding" course, which is an essential elective subject for the freshmen conducted by the researcher, and an online survey was conducted to students who agreed to participate in the survey. At the end of the first semester in 2021, a survey was conducted using LMS, and data from a total of 125 people who responded faithfully without omission were used for the final analysis. Looking at the general characteristics of the students who participated in the survey of this study, 84 male students (67.2%) and 41 female students (32.8%), and Table 1 is the result of the demographic analysis of the study subjects.

Data collection was conducted from June 1 to 20 (2021). The survey was conducted online using Naver Office, and it sufficiently described the research contents and questions, and a web survey was organized so that those who agreed to fill out the questionnaire could proceed with the survey afterward. Of the 132 collected questionnaires, a total of 125 questionnaires were used for analysis, excluding 7 unfaithfully written questionnaires.

Table 1. Descriptive statistics.

Characteristics	Specification	N	%
Gender	Male	84	67.2
	Female	41	32.8
Grade	First	125	100

3.3. Curriculum of liberal arts coding class

The "Creative thinking and coding" course aims to learn basic concepts and principles of programming and to cultivate computational thinking skills by learning basic coding using educational programming languages.

In this study, as a liberal arts class for non-majors, education was provided for one semester according to the programming curriculum. The entire curriculum consists of 15 weeks, and the training was conducted for a total of 13 weeks, excluding the midterm and final exams. Classes were conducted online for two hours once a week. Scratch is an educational programming language, and has the advantage that learners can easily learn and apply grammar, and that it is easy for beginners to understand.

The coding curriculum was designed by considering the difficulties which the non-majors may experience in the programming curriculum. The non-majors primarily mentioned grammar learning of programming language, unfamiliarity with programming, and irrelevance to their major as the difficulties. In this study, considering such point, a programming curriculum was designed to enable the students to learn the basic grammar of programming from the basics. Furthermore, in order to increase the interest and fun in programming, education was conducted with a focus on problem solving and coding related to the major.

3.4. Research tools

The independent variables used in this study are learning motivation and class content, the parameters are learning flow, and the dependent variables are academic achievement and learning satisfaction. All variables were measured on a 5-point Likert scale (not at all ~ very much so).

First, in order to measure the contents of the class, the questions used in the study of B. Kim[25] were organized and used according to the situation in this study. It consists of 6 questions such as the level, quantity, and appropriateness of the class content. The reliability (Cronbach's α) of these questions is .750.

Second, the learning motivation was constructed by modifying 6 questions related to intrinsic value among the questions reconstructed in the study of Y. Ha and J. Ha[10] based on the MSQ[26] test tool to suit this study. The reliability (Cronbach's α) of the questions for learning motivation is .851.

Third, learning flow was composed of 6 questions as a single factor used in Jung Young-mee's study[5]. The questions used were modified and supplemented to conform to this study. The reliability (Cronbach's α) of these questions is .792.

Fourth, for learning satisfaction, the tools used in the preceding studies of Y. Jung[5] and M. Park[19] were composed of 5 questions and used. The reliability of learning satisfaction (Cronbach's α) is .845.

Fifth, the measurement tool for academic achievement consists of 7 questions asking about problem-solving ability and degree of awareness through computing thinking, and 8 questions asking about problem-solving ability and degree of awareness through programming[27]. The questions on the computing thinking ability area were modified and organized to suit this study, and the programming area was developed through appropriate discussion with computer engineering experts. The reliability of these questions (Cronbach's α) is .890.

3.5. Data processing

The data collected for this study were analyzed using the SPSS WIN 23.0 statistical program. First, frequency analysis was conducted to find out the general characteristics of the survey subjects. Second, the Cronbach's α coefficient was calculated to verify the reliability of the measurement tool. Third, descriptive statistical analysis was conducted to find out the mean and standard deviation of major variables, and correlation analysis was conducted to find out the correlation between each variable. Fourth, linear regression analysis was conducted to verify the hypothesis. In order to verify the predictive variables affecting the effectiveness of online education in liberal arts coding classes, learning motivation, class content, and learning flow were used as independent variables, and multiple regression analysis was conducted by inputting learning satisfaction and academic achievement as dependent variables. Meanwhile, a hierarchical regression analysis proposed by Baron and Kenny was conducted to find out the mediating effect of learning flow. In addition, the significance of the mediating effect was verified through the Sobel test.

4. Research Results

4.1. Descriptive statistics

Descriptive statistics were conducted to find out the trends of the main variables used in this study, and the specific results are shown in <Table 2>. The average learning motivation was 3.76, the class content was 4.13, and the learning flow was 3.80. Learning satisfaction and academic achievement, which correspond to dependent variables, were 4.06 and 4.07, respectively.

Table 1. Descriptive statistics.

Variables	N	M	SD
Learning motivation	125	3.76	0.78
Class content	125	4.13	0.68
Learning flow	125	3.80	0.76
Academic achievement	125	4.06	0.68
Learning satisfaction	125	4.07	0.71

4.2. Correlation between measurement variables

In this study, correlation analysis was conducted to find out the relationship between each variable prior to regression analysis. As a result, learning motivation showed a significant positive correlation with class content ($r=.683$, $p<.001$), learning flow($r=.666$, $p<.001$), academic achievement($r=.608$, $p<.001$), and learning satisfaction ($r=.699$, $p<.001$), and class content showed a significant positive correlation with learning flow($r=.606$, $p<.001$), academic achievement($r=.648$, $p<.001$), and learning satisfaction $r=.851$, $p<.001$). learning flow showed a significant positive correlation with academic achievement ($r=.546$, $p<.001$) and learning satisfaction

($r=.711$, $p<.001$). Meanwhile, academic achievement also showed a significant positive correlation with learning satisfaction ($r=.695$, $p<.001$). Specific results are shown in <Table 3>.

Table 2. Correlation between measurement variables.

	1	2	3	4	5
1. Learning motivation	1				
2. Class content	.683***	1			
3. Learning flow	.666***	.606***	1		
4. Academic achievement	.608***	.648***	.546***	1	
5. Learning satisfaction	.699***	.851***	.711***	.695***	1

Note *** $p<.001$.

4.3. Test the mediating effect of learning flow

In the process in which independent variables such as learning motivation and class content influence dependent variables such as academic achievement and learning satisfaction, a hierarchical regression analysis proposed by Baron and Kenny was conducted to verify the mediating effect of learning flow.

4.3.1. The mediating effect of learning flow in the relationship between independent variables and academic achievement.

The effect of independent variables on parameters in Model 1, the effect of independent variables on dependent variables in Model 2, the effect of independent variables and parameters on dependent variables in Model 3, and hierarchical regression analysis was performed in three stages. As a result of the analysis, [Model 1] $F=57.749$ ($p<.001$), [Model 2] $F=54.290$ ($p<.001$), [Model 3] $F=37.537$ ($p<.001$), it can be said that all of these regression models are suitable. The explanatory power was found to be [Model 1] = 0.201, adj.=0.198, [Model 2] = 0.471, adj.=0.462, [Model 3] = 0.482, adj.=0.469. And it was confirmed that there was no multicollinearity problem as the tolerance (TOL) of [Model 3] was 0.1 or more and the VIF was less than 10.

As a result of the regression coefficient test in [Model 1], the first condition for mediating effect analysis was satisfied as the independent variables of learning motivation ($\beta=0.4738$, $p<.001$) and class content ($\beta=0.282$, $p<.01$) were positively significant to the parameters. In other words, it was verified that the higher the learning motivation and class content, the higher the overall learning flow. In [Model 2], the independent variables of learning motivation ($\beta=0.311$, $p<.001$) and class content ($\beta=0.435$, $p<.01$) were positively significant to the dependent variable, and the second condition for mediating effect analysis was satisfied. In [Model 3], it was found that the independent variable was positively significant to the dependent variable, but learning flow ($\beta=0.082$, $p>.05$), a parameter, did not affect the dependent variable, academic achievement. It was found that learning flow did not play a mediating role in the effect of learning motivation and class content on academic achievement. In other words, it can be said that learning motivation and class content directly affect academic achievement.

Table 3. The mediating effect of learning flow in the relationship between independent variables and academic achievement.

Model	Variables	B	S.E	β	t	F	R ² (adj R ²)
1	(constant)	.780	.307		2.542	57.749***	0.486 (0.478)
	Learning motivation→ Learning flow	.456	.086	.473	5.323***		

	Class content→ Learning flow	.316	.099	.282	3.178**		
2	(constant)	1.258	.278		4.516***	54.290***	.471 (.462)
	Learning motivation→ Academic achievement	.268	.078	.311	3.445**		
	Class content → Academic achievement	.435	.090	.435	4.825***		
3	(constant)	1.155	.284		4.068***	37.537***	.482 (.469)
	Learning motivation→ Academic achievement	.208	.086	.241	2.423*		
	Class content→ Academic achievement	.394	.093	.394	4.221***		
	Learning flow→ Academic achievement	.132	.082	.147	1.614		

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

4.3.2. The mediating effect of learning flow in the relationship between independent variables and learning satisfaction

<Table 5> below shows the results of verifying the mediating effect of learning flow in the process of independent variables such as learning motivation and class content influencing dependent variables such as academic achievement.

Table 4. The mediating effect of learning flow in the relationship between independent variables and learning satisfaction.

Model	Variables	B	S.E	β	t	F	R ² (adj R ²)
1	(constant)	.780	.307		2.542	57.749***	0.486 (0.478)
	Learning motivation→ Learning flow	.456	.086	.473	5.323***		
	Class content→ Learning flow	.316	.099	.282	3.178**		
2	(constant)	.264	.202		1.307	182.847***	.750 (.746)
	Learning motivation→ Learning satisfaction	.201	.056	.221	3.564**		
	Class content → Learning satisfaction	.738	.065	.700	11.280***		
3	(constant)	.064	.192		.336	149.655***	.788 (.782)
	Learning motivation→ Learning satisfaction	.084	.058	.093	1.454		
	Class content→ Learning satisfaction	.657	.063	.623	10.435***		
	Learning flow→ Learning satisfaction	.256	.055	.271	4.645***		

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

As a result of the analysis, it can be said that all of the regression models viewed as [Model 1] F=57.749(p<.001), [Model 2] F=54.290(p<.001), and [Model 3] F=37.537 (p<.001) are suitable. The explanatory power was shown as [Model 1] R²=0.486, adj.=0.478, [Model 2] R²=0.750, adj. R²=0.746, [Model 3] R²=0.788, adj. R²=0.782. In addition, it was confirmed that there was no multicollinearity problem as the tolerance (TOL) of [Model 3] was 0.1 or more and the VIF was less than 10.

As a result of the regression coefficient test in [Model 1], the first condition for mediating effect analysis was satisfied as the independent variables of learning motivation (β =0.473, p<.001) and class content (β =0.282, p<.01) were positively significant to the parameters. In other words, it was verified that the higher the learning motivation and class content, the higher the overall learning flow. In Model 2, the independent variables of learning motivation (β =0.221,

$p < .001$) and class content ($\beta = 0.700$, $p < .01$) were positively significant to the dependent variable, and the second condition for mediating effect analysis was satisfied. Finally, in Model 3, learning flow, a parameter, was positively significant in learning satisfaction ($\beta = 0.271$, $p < .001$), a dependent variable, and the effect of class content ($\beta = 0.623$, $p < .001$) on learning satisfaction was also statistically significant, and the third condition was also satisfied.

In [Model 2], the influence of class content on learning satisfaction appeared to be $\beta = 0.700$, while as the parameter decreased from [Model 3] to $\beta = 0.623$, learning flow was judged to play a partial role in influencing learning satisfaction. The learning motivation was judged to play a complete mediating role because the significance probability in [Model 3] was 0.05 or higher.

As a result of hierarchical regression analysis earlier, it was found that learning flow plays a partial role in influencing learning satisfaction, and learning flow plays a complete mediating role in influencing learning satisfaction. In addition, the significance of the mediating effect was verified through the Sobel test, and the results are as follows <Table 6>.

The mediating effect of learning flow between learning motivation and learning satisfaction was statistically significant ($Z = 3.497$, $p < .001$), and the mediating effect of learning flow between class content and learning satisfaction was also statistically significant ($Z = 2.632$, $p < .01$).

Table 5. The result of sobel test.

Route	Z	p
Learning motivation → Learning flow → Learning satisfaction	3.497***	<.001
Class content → Learning flow → Learning satisfaction	2.632**	.008

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

5. Conclusions

This study was conducted to examine whether learners' learning motivation and class content directly affect learning outcomes or indirectly through learning flow in online liberal arts coding classes. Through this, it is a study conducted to derive various implications for enhancing learners' learning outcomes in online liberal arts coding classes and what factors to pay attention to in order to increase the educational effect of online liberal arts coding classes. The results derived through the analysis are summarized as follows.

Looking at the correlation between learning motivation, class content, learning flow, learning satisfaction, and academic achievement recognized by learners in online liberal arts coding classes, learning motivation, class content, and academic achievement are positive. This is consistent with the research that learning motivation and learning flow have a positive effect on learning satisfaction in flip learning classes, supporting the results of this study [28].

In online liberal arts coding classes, learning motivation and class content were found to have a direct effect on academic achievement. There was no mediating effect of learning flow in the relationship between learning motivation, class content, and academic achievement.

This is consistent with Y. Ha's study [16] that the intrinsic value of learners directly affects academic achievement in an e-learning environment. In the case of online liberal arts coding classes, it is judged that learning motivation had a significant effect on academic achievement because instructors and learners tend to rely on learners' willingness to learn separately in time and space. This is in line with studies that reported that learners with high levels of learning motivation showed higher academic achievement [16][19][29]. These results show that learning

motivation and class content play an important role in the academic achievement of online classes, suggesting that learners' level of learning motivation should be identified and promoted in operating online classes.

In online liberal arts coding classes, learning flow was found to have a complete mediating effect in the relationship between learning motivation and learning satisfaction. In addition, learning flow was found to partially mediate between class content and learning satisfaction. These results show that learners with high learning motivation can show higher learning flow and further obtain higher learning satisfaction by actively performing learning activities with a sense of goal. In addition, if the content of the class is useful in an online class environment, it can be seen that the learner focuses on the learning situation, feels interested, and experiences satisfactory learning.

This is related to studies that the quality factor of instruction affects learning satisfaction through immersion[30][31]. In conclusion, it can be confirmed that learning motivation and class content factors are important factors of online liberal arts coding classes by significantly predicting learning satisfaction of online liberal arts coding classes through learning flow. Therefore, in order to improve the learning performance of online liberal arts coding classes, it is necessary not only to focus on each variable such as learning motivation, class content, and learning flow, but also to consider the overall effect of these variables.

Therefore, in order to increase learning satisfaction in online liberal arts coding classes, it is necessary to develop and apply various teaching methods to enhance learner-centered learning outcomes and learning flow away from traditional teaching methods. In addition, if content suitable for the student level and coding tasks can be provided to induce achievement motivation and experience learning flow, self-directed learning that can participate voluntarily and actively will increase the effectiveness of online coding learning.

Through this study, it was confirmed that providing high-quality class content and learning motivation in a non-face-to-face environment induces active learning flow and positively affects students' learning satisfaction and academic achievement. Based on these research results, it is expected to help develop and promote various online education programs.

If the factors for additional variables are subdivided and compared with offline classes through follow-up studies, more diverse and meaningful results can be derived.

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7. Appendix

7.1. Authors contribution

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

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Countermeasures against Unintentional Infringement of Legal Interests by Artificial Intelligence

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Abstract

Purpose: In recent years, the keyword that penetrates our society is the 4th Industrial Revolution. The 4th Industrial Revolution can be expressed in many ways, but the most important keyword is “connection”, and the key phenomenon from the perspective of this connection is the development of AI. The 4th Industrial Revolution and the impact of artificial intelligence are more than we think, and each academic division in society is discussing how to respond to it, and criminal law is no exception.

In particular, fierce debate continues as to whether the criminal law will recognize the criminal subjectivity of AI, and whether punishment for artificial intelligence will be possible. With the development of AI, infringement of legal interests, whether intentional or unintentional, can become a reality. When users and developers intentionally use artificial intelligence for crimes, AI becomes a human tool. The question is how to deal criminally with cases where legal interests are violated by intellectual activities or source code errors of AI, although not intended by users or developers. However, the premise to think about this is that AI technology is not complete. In other words, in the event of unintentional infringement of legal interests by AI, punishing humans based on this can have a contraction effect on development, resulting in a regression of AI technology with clear social utility.

Method: Therefore, this study examines how the criminal law should respond in the event of infringement of legal interests while human factors by AI is excluded. To this end, we first look at the current status of criminal law responding to AI. Here, we will first examine whether a specific operation of AI will be included in an act that is the scope of criminal law, and, if so, whether to recognize criminal identity to AI that caused such a specific operation.

Results: Through this process, the specific operation of AI can be subject to criminal law, and furthermore, if there is an infringement of legal interests by AI, it is confirmed that there is room for a crime. However, it is assumed that the action of AI is only unintentional infringement in which human elements are excluded. AI infringes on legal interests by human factors because it has the same meaning as human tools.

Conclusion: Since the ongoing development of AI technology can hinder the development of artificial intelligence technology with clear social effectiveness, it argued that the criminal law should be supplemented after administrative procedures.

[Keywords] Artificial Intelligence, The Fourth Industrial Revolution, Changes in Criminal Law, Criminal Subjectivity of Artificial Intelligence, Contraction Effect

1. Intro

Recently, one of the topics that penetrates our society is the Fourth Industrial Revolution. The 4th Industrial Revolution refers to an era in which digital revolution is caused by the combination of artificial intelligence technology, Internet of Things, and big data through the 1st industrial revolution, the 2nd industrial revolution of mass production due to the emergence of

electricity and production assembly lines[1]. Aside from the controversy over the existence of the 4th Industrial Revolution, the current era of aiming for a hyperconnected society where everything is combined and connected beyond the era of information and globalization has no choice but to acknowledge the reality of the 4th Industrial Revolution. In particular, from the perspective of "connection" of various technological innovation means, the reality is that the substance of the Fourth Industrial Revolution is already settling silently next to us without our awareness. From telecommunication services linked to various IoT services, Apple and Google's personal secretary system, self-driving cars, and artificial intelligence, which is our concern.

Then, what beings can we recognize as a blueprint for the future society, even if they are not the latest buzzword of the Fourth Industrial Revolution? There may be many things, but I think it is an artificial intelligence robot. Artificial intelligence, especially artificial intelligence robots, is an essential tool in describing the future society in various media, which is a threat to humanity in some media, and another is depicted as serving human convenience. As such, our consciousness flow of looking at artificial intelligence is formed by a dual flow of pure and dysfunctional functions. While it is so natural that science and technology, including artificial intelligence, contribute to human benefits, warning and worrying about the dysfunction of artificial intelligence is the same phenomenon as Pandora's box in some ways. At least in our criminal law system, the former case is put a little more weight on it. This is because the controversy over artificial intelligence in criminal law academia is largely being discussed around the change in the function of criminal law caused by artificial intelligence, that is, whether traditional criminal law can be applied to the heterogeneous existence of artificial intelligence.

This study also does not intend to deny the premise that artificial intelligence can harm our humans and society. However, the starting point of this paper is that artificial intelligence technology is essentially a technology that is still developing. Infringement of legal interests by artificial intelligence can occur at any time, which can be caused by negligence as well as intention of the system designer. What is particularly problematic is the unexpected infringement of legal interests by artificial intelligence. The existence of infringement of legal interests by artificial intelligence and the imposition of punishment, which is a public sanction, is a problem for developers and operators, as this can lead to a contraction of artificial intelligence technology due to criminal punishment. In addition, I think the time is approaching to reconsider whether taking criminal punishment for negligence for granted is an attitude consistent with the humility of punishment. Furthermore, if punishment intervenes in artificial intelligence behavior, whether intentional or negligent, it will also be considered whether it is reasonable for criminal proceedings to stand at the forefront.

Therefore, in this study, when artificial intelligence is legally regulated, we will discuss where to put its direction. To this end, we will first review the current status of legislation regulating artificial intelligence. Here, for the premise of discussion, we will look at the concept of artificial intelligence, which is the subject of a simple understanding and discussion of the Fourth Industrial Revolution, and the current status of criminal law corresponding to this artificial intelligence. And based on this discussion, we will look at the current address of the criminal law approach to artificial intelligence. Finally, it is not reasonable in terms of the complementarity of punishment that the criminal law is applied first to artificial intelligence, and procedural law will also consider the priority input of administrative procedures to respond to infringement of legal interests on artificial intelligence.

2. The Background of Research on Artificial Intelligence Regulation Legislation

2.1. 4th industrial revolution - is it virtual or real?

The signal of the 4th Industrial Revolution resonated in Switzerland in 2016 is echoing deeply in Korea until this moment. In the 2017 presidential election, presidential candidates from each political party also argued that they should prepare for the 4th Industrial Revolution, and the 4th Industrial Revolution is still a trend in our society. This also affects university education, and various related majors such as smart factory department, artificial intelligence department, and 3D printing department are installed. In this situation, it can be seen that the Fourth Industrial Revolution already exists at a time when the convergence of advanced digital technology, which can be seen as a symbol of the Fourth Industrial Revolution, is starting to be realized. In particular, this technological optimism is gradually increasing thanks to ICT technology that develops day by day.

On the other hand, the fourth industry "revolution" claimed by technological optimists cannot improve productivity so rapidly as compared to the previous three industrial revolutions, and technical skepticism that convergence (artificial intelligence, IoT), the core of the fourth industrial revolution, is only an auxiliary role for existing industries[2]. Furthermore, the term 4th Industrial Revolution used in 2016 is a term that first appeared in just four years since 2012 when Professor Jeremy Rifkin used the 3rd Industrial Revolution, and both Rifkin and Schwab reconstruct the development process of science and technology into a stage of revolution[3]. In other words, although the constitutional technologies of the Fourth Industrial Revolution have grown rapidly, they recognize that they do not have a ripple effect enough to overturn the existing situation.

In particular, if this technological skepticism is applied to artificial intelligence, the Fourth Industrial Revolution and artificial intelligence can become the story of a further country. This is because it is not possible to assume in the near future that artificial intelligence completely acquires reason and infringes on legal interests in the current science and technology development process. As will be described later, artificial intelligence can be largely divided into 1) cases where infringement of legal interests by artificial intelligence is realized by human intention (programming), 2) cases where infringement of legal interests by artificial intelligence itself transcends human predictability[4]. In this respect, it may be criticized that discussing infringement of legal interests against artificial intelligence is a means to fill scholars' intellectual vanity in the extreme.

However, we need to prepare for a new type of crime that prevents infringement of legal interests through criminal law, even if we don't think of Gilbert Keith Chesterton's words that criminals are creative artists. In other words, the use of artificial intelligence can inevitably lead to infringement and threats to human life, and it is also a reality that appropriate countermeasures are needed[5]. This is because it is possible to assume that artificial intelligence is used for crimes, artificial intelligence is used for crimes, artificial intelligence commits crimes on its own, or multiple casualties are caused by artificial intelligence. Of course, this case can be solved as a civil damage compensation problem, but considering the identity of the criminal law, the number of cases where the criminal law intervenes in artificial intelligence should also be left open. The question is when and how far to intervene and how much to intervene if intervened.

2.2. AI as the core of the 4th industrial revolution

2.2.1. Concept of AI

From the perspective of ripple effect, there will be few controversies as fierce as artificial intelligence. In general, artificial intelligence refers to an intelligent system created by humans, and John McCarthy, the father of artificial intelligence, argued it as "science and engineering that creates intelligent machines, especially intelligent computer programs" [6]. And recently, "mechanical system that artificially implements a human psychological system" [7] and "a sys-

tem suitable for this compared to human intelligence" have been raised on the premise of distinguishing between artificial intelligence and robots[8]. In addition, it is argued that "agent acts autonomously, recognizes one's environment, maintains long-term behavior, adapts to changes, and makes and pursues the best results"[9], and "AI algorithms are implemented hardware and mechanically to judge and use contextual information"[10].

The reason why such a turbulent definition of the concept of artificial intelligence is being raised is that some consensus is reached on 'artificial', but not on 'intelligence'. Therefore, there is also a position that it is impossible to establish a concept for artificial intelligence in the extreme[11].

Although the controversy over the concept of artificial intelligence itself continues, considering that this study assumes that artificial intelligence violates legal interests from the perspective of social hazards, I would like to understand that artificial intelligence means software that can artificially implement all human mental abilities. However, there is also a position to distinguish between artificial intelligence in terms of software and robots in terms of hardware and to combine them to view artificial intelligence robots as objects of artificial intelligence regulation[12]. This position has an aspect to discuss whether artificial intelligence is recognized as a criminal subject. In other words, in order to independently recognize the subjectivity of crime to artificial intelligence, it is necessary to determine whether to recognize the ability to act and responsibility to artificial intelligence, and to this end, it focuses on the activity of machines that can act similar to human behavior[13]. However, this study is not limited to the view of artificial intelligence because it discusses whether the criminal law will intervene in artificial intelligence regulations, not whether to recognize criminal subjectivity to artificial intelligence robots. Therefore, hereinafter, artificial intelligence (software) will be viewed as a concept distinct from artificial intelligence robots (soft+hardware).

2.2.2. Types and characteristics of AI

A variety of artificial intelligence exists in our reality, ranging from Lee Se-dol's rival AlphaGo, Apple's Siri, and IBM's Watson. Furthermore, artificial intelligence for single play of computer games, which has been around for 30 years, has been developed and commercialized. As such, various artificial intelligence is largely divided into two types according to the intellectual ability of artificial intelligence, so it is weak artificial intelligence and strong artificial intelligence[14]. First of all, weak artificial intelligence (Weak AI) is artificial intelligence at a stage where it has not yet acquired the same mental ability as humans, and this includes most existing artificial intelligence systems[15]. Based on deep learning, it has the characteristic of processing faster and more accurately than humans in a specific area.

Strong AI is an artificial intelligence that thinks and solves problems by itself, not only thinking and judging like humans, but also communicates emotionally with other humans and has autonomy and reflective thinking skills[16]. And if such strong artificial intelligence develops further, artificial intelligence at the stage of transcending humans through self-preservation and self-evolution is called Artificial Super Intelligence.

2.3. Current criminal response to AI

There are two mainstream responses to artificial intelligence in criminal law. The first is a discussion on how the criminal law will respond to the emergence of inhumane beings such as artificial intelligence. In other words, it is a discussion on whether the criminal law will evolve in response to various forms of technological development surrounding artificial intelligence. While the traditional criminal law targets human actions made up of blood and flesh in principle, it contemplates the direction of how to respond to the emergence of heterogeneous beings such as artificial intelligence and the role of criminal law[17].

Second, can artificial intelligence be included as an act under criminal law? And can artificial intelligence be recognized for criminal subjectivity? If it can be admitted, how to proceed with the sanctions is a type.

2.3.1. The need to change the role of criminal law

Paradoxically, as the benefits of artificial intelligence increase, fear of the capabilities of artificial intelligence is felt, and the need to regulate them normatively is being raised. However, controversy has been raised over whether our criminal law will stick to its traditional position as it is now or whether it will come to the forefront to prepare for artificial intelligence and mass risks caused by it. The position calling for active response to the criminal law can transcend traditional types of crimes (from the perspective of the extent of damage), which is a society with risks that exist not only by human actions but also by human actions[18].

Therefore, in order to remove and prevent risk factors that may be caused by human and artificial intelligence factors in advance, it is argued that an active functional change of the criminal law is necessary on the premise that it is necessary to recognize and remove them in advance[19].

However, the side effects of active criminal law response according to risk society theory and risk criminal law have already been sufficiently warned. In other words, pursuing only changes in the function of the criminal law to cope with the phenomenon changes the criminal law to manage risks, not passive legal interests, which can inevitably lead to the expansion of hostile criminal law thinking to exclude risk sources. Through this process, universal legal interests, prepositive punishment, relaxation of personal responsibility attribution, and the emergence of symbolic criminal law will be foreseen. Of course, the cause of protecting legal interests from unexpected artificial intelligence risks will take the lead, but social consensus will be needed as to whether fundamentally improving the constitution of conservative criminal law will satisfy balance.

Whether a change in the function of the criminal law against artificial intelligence is necessary depends on where the current state of infringement of legal interests by artificial intelligence is. If ICT technologies such as artificial intelligence technology and the Internet of Things are in full bloom and the risk of infringement of legal interests that humans cannot predict is clear and exist, there will be room for changes in the function of criminal law. However, I think there is still a question mark as to whether the current state of artificial intelligence development will threaten humans to that extent. In other words, it is reasonable to take a passive approach because forcing the fundamental constitutional improvement of the criminal law to protect humans can lead to paradoxical situations that threaten humans to cope with the threat of artificial intelligence in the development process.

2.3.2. Possibility of criminal intervention in crimes of AI

2.3.2.1. Is the operation of artificial intelligence an act?

It should be discussed first whether artificial intelligence can commit a crime or whether a particular operation of artificial intelligence can be included as a criminal act. Whether or not to view a specific operation of artificial intelligence as an act will vary depending on whether the concept of all constituent behavior can be recognized under the criminal law. If the concept of all constituent behavior is not recognized, the criminal law problem will be limited to (formal) criminal acts, and considering that our constituent requirements do not yet recognize crimes by artificial intelligence, there is a concern that the criminal response itself will be difficult. Therefore, if a specific operation of artificial intelligence is of social importance, it can be viewed as an act of criminal law.

2.3.2.2. Whether AI recognizes criminal subjectivity

If so, discussions should continue as to whether artificial intelligence can be recognized as the subject of crime. In response, there is a position to recognize the criminal subjectivity of artificial intelligence based on discussions on the positive theory of corporate criminal ability[20]. On the other hand, artificial intelligence cannot be judged as the same person as humans, and if it is viewed the same as humans, it ultimately violates human dignity and autonomy, so it belongs to natural persons, such as representatives of artificial intelligence[21].

It is the legal policy (or social consensus) according to the times and historical situations of the society that limits rights and capabilities to natural persons such as fetuses and foreigners and grants legal personality to certain beings in modern legislation that recognizes rights and capabilities. If so, will artificial intelligence not only recognize legal personality but also recognize criminal subjectivity?

To review each type of artificial intelligence, first of all, since weak artificial intelligence is only an expanded tool for humans, it would be sufficient to directly punish the human actor for using artificial intelligence as a tool[22]. The problem is whether this action of artificial intelligence is due to the free will of artificial intelligence. Considering that what distinguishes humans from other beings is to judge and make decisions of their own free will, and that such freedom of will (and the possibility of other actions) is the core of responsibility criticism, I think strong artificial intelligence can judge criminal subjectivity based on whether there is freedom of doctors. Of course, strong artificial intelligence aims to engage in activities similar to human mental action, but the current level of strong artificial intelligence seems to be not yet at the stage of catching up with human mental ability. In other words, it can be seen as similar to human free will because strong artificial intelligence acquires various information and knowledge through learning, recognizes the situation through learning, and makes autonomous judgments according to the situation[23]. The freedom of doctors, the core of responsibility in criminal law, is a criticism of humans' choice of illegal activities despite their freedom and ability to form opposition motives, which differs in that it is a logical process for solving problems, not their own needs[24]. Therefore, even if legal interests are violated by strong artificial intelligence at this stage before the complete blooming of strong artificial intelligence, it is reasonable to ultimately include it as a human crime that produces and operates it.

3. Criminal Proceedings for Infringement of Legal Interests by Artificial Intelligence are Initiated

In order to prepare for infringement of legal interests by artificial intelligence, our society has already begun to take legal action. It includes the "Intelligent Robot Development and Distribution Promotion Act" and enforcement ordinances and enforcement regulations implemented on April 1, 2020. Separately, the theoretical devices reviewed in the previous chapter are also legal responses to artificial intelligence in a broad sense. If legal countermeasures against artificial intelligence are gradually equipped, criminal and administrative procedures will be distinguished in the long run, and we will discuss whether it is reasonable to presuppose criminal punishment for artificial intelligence technology in development.

3.1. Possibility of shrinking effect of criminal intervention in artificial intelligence

If artificial intelligence is universally implemented and commercialized, it is inevitable to expect infringement of legal interests by artificial intelligence, so there is a need to prepare appropriate legal systems and realize them through administrative or criminal procedures. However, there is room for theory as to whether it is reasonable for criminal procedures with post-mortem and retribution characteristics to intervene, even if artificial intelligence technology is

not complete at this point. In other words, there is a possibility that punishment will inevitably lead to the contraction of artificial intelligence's R/D personnel in the absence of predictability, rather than when human criminal intent is hidden in source code. Wouldn't the primary input of criminal punishment for unintended crimes by artificial intelligence be a timely ordinance in the era of the Fourth Industrial Revolution? This means that if the warning about the collection of personal information by big data was accepted without criticism, the negligence of the development of ICT technology definitely exists further in the 4th industrial revolution (presuming that the concept of the 4th industrial revolution is an illusion) [25].

Therefore, if it is not a deliberate crime using artificial intelligence, especially artificial intelligence, it is necessary to be wary of the contraction effect that can be caused by criminal punishment for the development and operation of artificial intelligence. The chilling effect is understood to argue that a situation in which a specific expression actor directly shrinks freedom of expression by the state's public power has occurred. Of course, the atrophy effect in the original sense is being discussed in terms of freedom of expression. Since the first use of the contraction effect in the field of labor law in 1990, our Constitutional Court has mainly used it to ensure freedom of expression, but has tended to expand to other basic rights (especially academic freedom).

3.2. Order of intervention in case of infringement of legal interests by AI

Of course, even in such a case, the case of intentionally using artificial intelligence to utilize crime or instilling a crime-causing factor in the source code of artificial intelligence will naturally be excluded. This is because artificial intelligence is used as a lifeless tool for humans to utilize crimes. The concern about the contraction effect of artificial intelligence development in this study is that only cases except for these direct cases were assumed. Therefore, for these active types of crimes, it would be reasonable to always wait on the starting line for punishment. This is because the state should refrain from exercising the right to punish members of the community to ensure the freedom and autonomy of community as much as possible, that is, it should actively induce social policy state activities by using minor social control measures that have the same effect in achieving the purpose of criminal law [26][27].

Considering these points, administrative procedures are applied first to unintended infringement of legal interests by artificial intelligence, and if post-correction is not made by administrative procedures, it is reasonable to supplement criminal procedures [28]. However, considering that administrative investigations are not compulsory but need to confirm facts, minimum effectiveness needs to be guaranteed. In the future artificial intelligence regulation law (including the Intelligent Robot Development and Distribution Promotion Act), the obligation to cooperate in administrative investigations and the corrective order of the competent authority (as of Article 41) [29].

3.3. Criminal law's response to unintentional violation of legal interests by AI

The problem is that even if the criminal law is applied supplementally to unintentional infringement of legal interests by artificial intelligence, the contraction effect of punishment and the risk of punishment are essentially conflicting [30]. In other words, the actual application of punishment in the actual application case of artificial intelligence technology is to suppress infringement of legal interests through the above, so in a way, the punishment and contraction effect in the criminal law are both sides of the coin. Therefore, I think minimizing legal interest infringement (possibility) by artificial intelligence and finding an appropriate balance of the atrophy effect by punishment (or harm) are one of the challenges of our society in preparing for the era of artificial intelligence [31]. In other words, in light of the inevitability of science and technology development, the spread of artificial intelligence is inevitable, so I think it is reasonable to treat infringement of legal interests by artificial intelligence according to the allowed

risk theory.

4. Outro

Even if Moore's law is not borrowed, the development of ICT technology is developing to a level beyond human control[32]. In this phenomenon, there is a lot of controversy over how our criminal law should respond, and the criminal law's countermeasures against infringement of legal interests by artificial intelligence, which can be seen as the core of the 4th industrial revolution, can be seen as a major milestone. This is because the integrated operation of various conventional ICT technologies is a major theme of the Fourth Industrial Revolution, and artificial intelligence is representative[33].

In this situation, there are conflicting positions in both directions as to what attitude the criminal law will take. As many people, including Stephen Hawking and Alan Musk, warn, new ICT technologies have the potential to pose a threat to us, and their potential can be realized by connecting with each other. Therefore, whether intended or not, it can be easily argued that criminal law should actively and preemptively intervene in the development of science and technology, including artificial intelligence. However, the criminal law is essentially passive and cannot lead social phenomena with normology, and if the norm leads the phenomenon, it can violate the nature of the criminal law that prevents infringement of legal interests on the basis of warning[34].

There is always a possibility of unintentional infringement of legal interests by artificial intelligence, but the social benefits of artificial intelligence will also have a value equal to or greater than the risk. Therefore, taking out the blade of punishment only in consideration of infringement by artificial intelligence, or even taking an infinitely benevolent view of artificial intelligence would not be valid. Considering these points, it is time for social consensus on where to place the balance between infringement of legal interests by artificial intelligence, especially unintentional infringement.

In addition, this study suggested that administrative procedures such as administrative investigations should take precedence because active intervention of criminal law can have a contraction effect, but criminal punishment should be intervened only if it does not comply with these corrective orders.

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6. Appendix

6.1. Authors contribution

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

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Cyber Education for Korean Traditional Seodang Culture and Its Some Implication to Multiculturalism in the Korean Society

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Abstract

Purpose: This study aims to find a way to apply Korean traditional Seodang culture to cyber education and bring some implication to modern Korean society's multiculturalism. To this end, it understands the characteristics of knowledge and education in the era of the 4th industrial revolution. That is the next-generation industrial revolution made up of the convergence of information and communication technology (ICT).

Method: The specific method for this study is based on literature research. To back up the field experience, authors visited the Korean traditional Seodang and interviewed with its Teacher (called Hunjang).

Results: The 4th industrial revolution has brought about digital natives who can understand and utilize that civilization freely. They make great use of and enjoy digital environments such as personal computer, cellular phone, and the internet. These digital natives are consumers and producers of civilization at the same time. In particular, there has been a great transition from untact to ontact after beginning of COVID-19. Requests to consider virtual reality and metaverse have increased. This study suggested some concrete ways to respond to such a trend of civilization transformation.

Conclusion: Digital civilization is not limited to education, but dominates the entire modern civilization. Therefore, a practical way to adapt the very traditional Seodang culture to this modern civilization was presented. Such efforts break away from the passive attitude of continuing the tradition. Furthermore, it will contribute to strengthening the media literacy competency of today's youth and bridging the digital gap between the traditions of the past and modern civilization. Seodang, a traditional cultural content in modern Korean society, is expected to be a medium that goes beyond just one of cultural assets and enriches the complex and diverse multicultural situation. This idea comes from that Seodang in the Korean tradition attempted a voluntary bottom-up of voluntary education oriented toward the spirit of the times in a rural society. Modern Seodang culture can be contributed to Korean modern multicultural society.

[Keywords] Digital Native, Virtual Reality, Metaverse, Media Literacy, Multiculturalism

1. Introduction

Seodang, a traditional Korean educational institution, is an autonomous and private educational institution established in small villages from ancient times to the present in Korean peninsula. Mainly, this Seodang served today's primary education function.

Seodang served as a basic educational institution until the modern school was created [1], and was collectively referred to as an educational facility in small villages except for hyanggyo and seowon [2]. In general, Seodang can be said to be the original birthplace of Korean traditional education. Seodang was recognized for its tangible value and designated as a national treasure, but it has been not recognized as a national intangible cultural asset yet [3][4][5][6][7]

[8].

Recently, contents such as 'Squid Game' using K-contents have been in the spotlight around the world, and cutting-edge metaverse technology is being influenced. What is metaverse here? It refers to an expanded virtual world, and is a new word combining 'meta' which means 'transcendence' and 'universe' which means world or universe.

Traditional Seodang education has been used as a good educational content for alternative education in public education, character education, job education, and lifelong education.

Therefore, this study intends to derive a plan on how to apply the traditional Seodang culture to the modern metaverse technology and draw some implication to apply its idea to the modern Korean multicultural society.

For this research, some data and contents for this study were brought the result of the past research that authors had participated in[9].

2. Features of Cyber Contents

2.1. Educational content

In the era of Cyber, cyber content is mandatory. We call 'digital native' who can cyber based technology autonomously and aggressively. Originally this digital native is a term coined by Marc Prensky in 2001 to describe the generation of people who grew up in the era of ubiquitous technology, including computers and the internet. Digital natives are comfortable with technology and computers at an early age and consider technology to be an integral and necessary part of their lives. Many teenagers and children in developed countries are considered to be digital natives, as they mainly communicate and learn via computers, social networking services, and texting. The opposites of digital natives are digital immigrants (people who have had to adapt to the new language of technology) and digital refugees (people whose jobs, livelihoods, and lives have been disrupted by the rapid advance of information technology, automation, and artificial intelligence)[10].

Silicon Valley leaders at the forefront of technological change, including Elon Reeve Musk, Steve Gary Woz Wozniak, and Mark Elliot Zuckerberg, have witnessed first-hand how amazingly talented people who value creativity, collaboration and challenge can deliver amazing results. So, rather than focusing on learning the latest knowledge, he emphasized that learning how to use it to solve problems is more important than anything else, and that education should be prepared for life rather than preparing the workforce. If this was the learning objective of the previous era of providing standard education for average learning to mass-supply unskilled workers, and education to prepare for exams, then the way we learn today must be different, and the role of teachers must also be changed[11].

Smart education is an education method suitable for the generation who enjoys the Internet with ease and uses digital languages and devices very naturally, as mentioned earlier. Smart education is an educational method that allows learners to study on their own, regardless of time and place, using various multimedia devices, unlike the past, when only taking classes of-
fline.

If a project of Project-Based Learning requires students to find a YouTube video and share it as a slide presentation, the challenge of Challenge Based Learning (CBL) is a real-time simulation by making a YouTube video. should be shared with It is a collaborative learning method in which students actively participate and learn through projects that identify real problems or situations and create, implement, and share solutions to solve them. The key to challenge-based learning

is that students take the initiative in implementing projects. Students define the problem or task they want to solve and acquire the knowledge and skills necessary to solve it. The teacher acts as a guide in carrying out the project, but does not unilaterally direct activities or impart knowledge. In other words, students are co-designers of their own learning and development. In addition, since it deals with problems that exist in reality, it has the advantage of increasing participation by motivating people to make a difference not only in themselves and those around them, but also in the local community, so that even if they fail, they can grow and learn from it. If a project of project-based learning requires reading and taking notes on blogs, the challenge of challenge-based learning requires students to create a vlog together while annotating it using a digital annotation tool. Challenge-based learning aims to help children become content producers and creators beyond mere content consumers[11].

2.2. Content for games

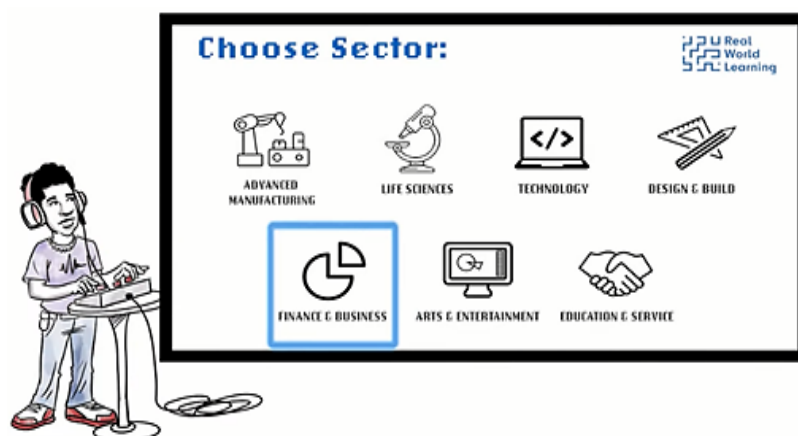
Gamification can be changed to gamification in Korean, and refers to the process of solving problems and engaging users using game thinking and game mechanics. Put simply, it is the work of introducing the method of a game to a non-game field and making it fun and interesting.

Gamification include game thinking, game design elements, game mechanics(points, levels, badges, leaderboards, challenges and exploration, social elements), fun and motivation to participate. Gamification, which induces fun and participation by turning uninteresting activities into games, has been introduced in various industries and is yielding results. Gamification is already deeply rooted in fields such as education, management, marketing, and fitness, as well as smart cities, military training, and medical fields.

In order to get what you want through education, fun and immersion must come first. And games are an excellent educational tool for immersing learners. The educational effect of games has been proven through various research results.

Kauffman Foundation in US showed interesting experimental results. As a result of comparing the game-based class with that of a teacher who is good at teaching, the game-based class showed that learning immersion was 108% higher than that of a teacher who was good at teaching(17%) <Figure 1>.

Figure 1. Kauffman foundation 's game based learning case[12].



United States has introduced edu-games to education since 2014 and has been inducing learning effects in various ways. 'Ed Games Expo' is a representative example. The ED Games Expo is the Department of Education's (ED) annual public showcase and celebration of game-changing innovations in education technology that were developed through more than 30 programs at ED and across the Federal government. From 2013 to 2020 the Expo was held at locations across Washington, DC, including the John F. Kennedy Center for the Performing Arts between 2018

and 2020. In 2021, the 8th Annual ED Games Expo was held as an all-virtual event. Participants will meet directly with game developers to demonstrate edu games developed so that they can actually learn and have discussions on the spot. The U.S. government announced that 'Education Game Jam' and 'Edu Games'. Various edu game events such as 'Ed Games Week' are being held to attempt to converge games and education <Figure 2>.

Figure 2. 2021 Edu games expo, US department of education[13].



Former British Education Minister Michael Gove has also emphasized the educational effects of games on several occasions. He cites a math educational game developed by Professor Marcus du Sautoy of Oxford University as an example, saying, "Students calculate the number of turns using equations, etc. to efficiently destroy the aliens in the game. At this time, the students' immersion Turning is amazing. The potential of educational games in subjects that require logical and mathematical thinking is limitless," He focused on the importance of the synergy between education and games.

There are no real games or games required in class. It can be interpreted as using only some fun elements of the game by substituting it in reality. A movement to actively utilize gamification in education, which can help learners who are familiar with the game environment achieve educationally meaningful goals through fun and interest as a medium, is starting now.

For today's generation who are familiar with games, by applying games to education and designing teaching and learning, more effective education will be possible. Many teachers in the school field are also trying to apply various games and game methods to classes in practice with the positive effects of games in mind. However, there are many practical difficulties in applying games to education. This is because it is difficult for teachers to find games that contain educational content and can be usefully used in class, and it is not so easy to prepare a class using games[14].

Play in Seodang was generally conducted as an extension of learning. In Seodang, students compete for hobbies, such as the Chojungjong(初中終). This had the main purpose of learning the poetry of the ancients,. Goeul Group game was given the main purpose of learning the geographical names of the whole country. Hwaseungjak game was aimed at writing texts quickly. Goeulmodum game was made for guessing the name of a village. It was a game where school-children gathered and laid out any book, found and described the letters that correspond to the name of the town, and the person who matched the most wins. This game was part of learning

to memorize town names. Other games related to learning included Geuljamachugi game(Letter Matching) and Saunhee(四韻戲). When there are no decorations in the Seodang, Maltagi game(Horse riding), Sopungnoli game(Picnic game), Jegi-chagi game, Yeonnaligi game(Kite flying), Sseolmaetagi game(Sledding), Jachigi game(Smash the scale stick), Ssireum game, etc.

However, even in such games, there were many cases where they could not play together due to the age difference. At 'Ihwaseodang (梨花書堂)' in Suncheon, Jeollanam-do, they are still practicing some kinds of games <Figure 3>.

Figure 3. Ewha seodang's traditional play[9].



3. Content Creation Process of VR

3.1. Making the moving photos

In general 2D video, a video signal captured by a single camera is converted into a digital signal and delivered to the viewer. Although VR video shooting goes through the same process as for general video, it is different in that it uses 5~6 cameras or more because VR needs to capture 360 degree omnidirectional video. However, there are a lot of 360 degree cameras on the market recently. In order to shoot VR images, VR making equipment must be configured first.

VR making equipment consists of a VR camera and a stitching server. First of all, VR cameras use finished cameras made exclusively for VR, but it is common to use existing cameras in combination. Depending on the purpose of shooting, the camera ranges from lightweight like a Go-Pro to Various types are used, from DSLR(Digital Single Lens Reflex) to high-end cameras. At this time, you need a device that combines multiple cameras to record all 360° images, which is called a rig.

360 degree camera is a camera that creates spherical photos and videos by taking horizontal and vertical 360 degree shots in all directions. It is also called a VR camera in that 360 degree spherical images and videos are used as VR viewing content. It was not a popular product, but starting with Ricoh's THETA in 2013. Samsung Electronics' Samsung Gear360 and LG Electronics' LG 360 CAM began to produce small, light and inexpensive products. Nikon's KeyMission 360 can record 360 degree scenes in 4K high-definition with two lenses. It also supports anti-shake function, speaker, Wi-Fi and Bluetooth functions, and NFC(Near Field Communicate) function.

3.2. Edit

'Unity' is a game engine that provides a development environment for 3D and 2D video games, and is an integrated production tool for creating interactive content such as 3D animation, architectural visualization, and VR. In 2005, it appeared as an integrated game environment for amateur game developers under the slogan of popularization of game development. Until now, game development has not been easy for anyone to build a development environment for devices and tools, or to create games such as programs and graphics. With the advent of Unity, a game engine that anyone can use easily and for free, game development has become easier, and the quality and development speed of existing developers have also been improved. For script languages C# and JavaScript(under the name of Unity Script) have been used[15].

The software that supports VR-related functions has been upgraded, such as adding and releasing VR content editing functions. 'Adobe After Effects' can create cinematic titles, intros, and transitions. Users can remove objects from clips, create effects such as fireworks or rain to enhance the impact of users' footage, and even create animated logos or text. It is also possible to move and design in 3D space. After Effects, the industry-standard motion graphics and visual effects software.

Pixvana, a provider of VR video creation solutions that enable VR content creators to edit, process and deliver videos in 8k resolution, recently announced a full version of their software called SPIN Studio. This software allows you to edit VR content while wearing an Oculus Rift headset[16].

4. A Way to Apply Korean Traditional Seodang Culture to Cyber Education and Some Implication to Modern Korean Multicultural Environment

4.1. Linkage between metaverse technology and seodang

We are actively trying to spread the value of cultural heritage to the general public by applying digital technology. The Cultural Heritage Administration is also building content using digital technology, and museums are actively introducing augmented or virtual reality content(Figure 4).

Because of the recent COVID-19, non-face-to-face classes in every level schools are inevitable, instructors and students are sharing the same time and space only in the online space such as ZOOM, Webex etc[18].

Here, the metaverse virtual world has three major differences from the existing Internet. First, the metaverse Be Persistent. It is a world that continues indefinitely with no reset or end. Second, the metaverse Be Synchronous. With the same concept of time as reality, everyone can 'live' in the metaverse. Third, the metaverse It is a Be Fully Function Economy. It means that individuals and businesses have an almost complete economic structure within the metaverse, where they create, consume and own new things. The metaverse is a fusion, and the metaverse is the fusion of a virtual extended physical reality and a physically permanent virtual space. And when the user experiences it, it appears mixed at the same time.

Figure 4. Metaverse showcase of Korea cultural heritage administration[17].



In March 2021, Soonchunhyang University's entrance ceremony was held on Metaverse. This is the first attempt to move a university entrance ceremony in the real world to the virtual world, but in fact, last year BTS released a choreography version of 'Dynamite' on the game platform <Figure 5>.

Figure 5. Soonchunhyang university metaverse admission ceremony[19].



In order to apply such metaverse technology, various technologies must be supported. Volumetric captures the dynamic movement of people in a studio equipped with hundreds of cameras with 4K quality or higher. A 3D digital hologram image is created with a technology that creates a 360 degree image. That is, a video of the decoration person is taken with a multi-camera, and 3D model information is restored or created from the multi-viewpoint image taken. Next, texture the 3D model to create a Volumetric Video.

In applying the metaverse, not only technical difficulties, but also various side effects and damages should be prepared. In other words, various problems such as personal information leakage, pursuit of private interests disguised as state agencies, and gender equality still exist [20][21][22][23][24][25][26][27][28][29].

4.2. Use of seodang's contents

AR/VR, the learning method of Seodang can be used as content. For example, the main educational content is scripture reading, calligraphy, poetry, etc. First, in the case of holy reading of the scriptures, it is possible to learn according to the standard that an archive is established by an independent group of medals[30]. The actual reading of the sutras of the Seodang Medal can be collected from the score, and their pronunciation is very regular. The following <Figure 6> is an example of a holy reading of the Order of Order Jeong Byeong-ho from Cheonghak Seodang, Hadong-gun, Gyeongnam <Figure 6>.

Figure 6. Seodang tutor(Jeong Byeong Ho)'s book reading sound[9]¹.

Second, in the case of calligraphy, put it on a VR or simple tablet PC screen and try to learn it according to each typeface. At this time, the drop-out rate is determined by each element of the English alphabet and each typeface. Shows how far you deviated from the original as a score.

Third, in the case of poetry, taking into account flatness, it guides you closer to the sample by sounding a signal such as “ding dong” to see how well it conforms to the starting principle.

‘LEVEL UP’ is a concept that appears mainly in RPG(Role-Playing Games)[31], and is an event that is triggered when experience points or special conditions are satisfied. For example, the level rises by 1, and at the same time, the amount of experience required for the next level is given as an increase compared to the previous one. By recovering from fatigue or equipping

¹ 中庸 chapter 20. 博學之하며 審問之하며 愼思之하며 明辨之하며 篤行之니라 有弗學이언정 學之인댄 弗能을 弗措也하며 有弗問이언정 問之인댄 弗知를 弗措也하며 有弗思이언정 思之인댄 弗得을 弗措也하며 有弗辨이 언정 辨之인댄 弗明을 弗措也하며, (hereafter omitted).

items, depending on the game, it may give you an opportunity to increase your rank, the right to learn a stronger skill, or an opportunity to switch to another class. It is also the second most pleasant moment in the game after winning and strengthening success.

Also, the traditional culture should be realized by understanding the characteristics of each game. The types of games known so far are summarized as follows. First, it is TRPG. It is a term that refers to a game where people sit at tables, conduct through conversation, and play a role shared by each person, like a board game. TRPG stands for (Tabletop/Table-talk Role Playing Games)[31].

Second, it is ARPG. It stands for Action Role-Playing Game. One of the genres of games derived from RPG. Unlike RPG, which meets the enemy as its name suggests, it means a genre that manipulates the character directly and battles in real time or in real time, which passively selects command[31].

Third, it is SRPG. It stands for Simulation Role-playing Game. One of the genres of video games: the word SRPG is a compound word of simulation + RPG, and S means the S of simulation. Here, simulation is not a simulation that originally means to reproduce real things, but a hexa-type strategy simulation such as a grand strategy series[31].

Fourth, it is ORPG. It stands for Online Role-Playing Game. It is not a case of meeting TRPG directly, but a case of gathering online mainly using chat programs[31].

Fifth, it is MORPG. It stands for Multiplayer Online Role-Playing Game. This means a game that many online users can play together, and it is a word that lacks massively compared to MMORPG with high awareness. However, a broad sense of MORPG also includes MMORPGs, which are called role-playing games (RPGs) that play in a space that is usually called a session by a much smaller number of users[31].

Sixth, it is MMORPG. It stands for Massively Multiplayer Online Role-Playing Game. There is no unified translation, such as 'large-scale multi-connector online role-playing game' and 'multi-connect role-playing game', and MMORPG, an abbreviation of English, is the most widely used. In a narrow sense, it is a kind of RPG in which dozens to hundreds of players connect simultaneously in the same field, and thousands of players in a broad sense connect to the same game and the same server through the Internet and play their roles[31].

Seventh, it is DRPG[31]. It stands for Dungeon Role-Playing Games. It means the kind of RPG game in which the dungeon-exploring RPG. The main character (or the main character's party) searches for dungeons, battles with monsters, picks up treasures and grows[31].

Eighth, it is Roguelike. It means a collective term for games made by imitating the features and systems of the first dungeon search RPG 'Rogue'. Rogue, born in 1980, displays graphics in response to the Aski code on the screen. This is the method that the terminal connected to the mainframe at that time did not have any means to output a symbol other than the Asuki code. Unlike other RPG reproducing computer games made up of text, the way to explore dungeons by moving characters directly is the first graphic role-playing game in video game history[31].

Based on this various kinds and functions of games, game and metaverse strategy for traditional education should be harmonized to reflect the partial characteristics of traditional culture. Rather than applying all the content of any one game type, it is necessary to develop a modal that can optimize partial functions in the overall strategy.

4.3. Implications for a multicultural society

The traditional Seodang culture of Korea is an intangible culture and a symbol of the people's pride. However, if modern Koreans emphasize this traditional Seodang culture, it can lead to

conflicts with people from multicultural backgrounds that continue to flow in. In that case, emphasizing the traditional Seodang culture may become an obstacle in supporting a multicultural society.

Although traditional Seodang culture is one of the cultural life styles, it needs to be recognized somewhat differently from Hangeul and Korean, which are essential in everyday life. After all, traditional Seodang culture originated in China, but it was Koreanized. Therefore, there is no need to show resistance to people from new multicultural backgrounds.

However, in relation to traditional Seodang culture, it is necessary to rethink the multicultural problem of today's Korean society. Existing multicultural awareness emphasized only the diversity of types. But the diversity of values is much more important. Values are very complex because they encompass all human perceptions, emotions, and behavioral factors. Therefore, it should be born in mind that there are many factors, such as variety of degree, variety of disputes, variety of order, variety of important books, and diversity of overall harmony. Therefore, considering the metaverse, it is expected that Korean traditional Western multiculturalism can bring positive rather than negative functions to the formation of multiculturalism in Korean society.

5. Conclusion

This study suggests that it is meaningful to develop various elements of Korean traditional Seodang culture as cyber education contents, and explores what implications it has in relation to the multicultural phenomenon of modern Korean society. Until the introduction of modern education, Seodang was the most extensive national education center in Korean education, and it has the characteristics of being the only educational institution for the general public as well as a private educational institution. Unlike other educational institutions, Seodang has been able to adapt well to social changes and has played a role in inheriting traditional culture for a long time, thus occupying a special place in the history of education. In other words, its function has changed according to the times, but its essence has never changed. This is because the basic educational purpose of the Seodang, which respects people (仁) and respects each other, has not changed.

Seodang goes beyond Dongmong education and can be positioned as an exemplary educational material for alternative education to support normal public education, and it is trying to diversify lifelong education for the community. In addition, in line with the digital age, the transition from offline as well as online to non-face-to-face VR content and metaverse is an inevitable calling of the times.

Traditional culture, as a mirror of the old present, new past, and future, is not simply passed down from the past, but is a vessel that contains the spirit, values, and lifestyles of the contemporary era, so creative succession and utilization are emphasized. Traditional Seodang is the most traditional style among countries that use Chinese characters, and its historicity and representativeness are recognized. In addition, excellence in educational methods and an education method that respects individual abilities is a legacy that should be passed down to the present age. In the future, its value will be recognized by designation of intangible cultural assets, and various product types will be transferred with one source, one content, as well as school education, job education, lifelong education, etc., as K-contents OSMU(One-Source Multi-Use), all users will be able to open it.

Korean society has completely entered a multicultural society. A multicultural society is a slogan and one of the major policies. It is not easy to think that multiculturalism is all about diversity as long as it has diversity. Although Korea's traditional Seodang culture is based on a

single characteristic, that is, Confucian culture, it is an important pivot point in promoting multicultural happiness and harmony, considering that its fundamental character is an autonomous elementary education institution in the local community.

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7. Appendix

7.1. Authors contribution

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

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A Classification and Characteristic of Lexicon in Ethic Development SuanXueQiMeng Class

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Abstract

Purpose: The GwangJaemulbo was a middle version edition from in a 1798, the Jaemulbo with which had been known by Encyclopedia written in the 19century, differ from nature, human, material. The reason why has been who the people frame a hypothesis that remade with a contaminant and object, but collect words. Numerical figure was counted by polygraph & subentries, improved the lexicon, recollect diverse different versions. The purpose of Vocabulary lesson in enlightening brain cell rule sense of social society has supplemented with mental culture.

Method: The Suanxueqimeng in china Transcription materials in from those receive radio signals. Benran zhi xing is on the Mulmyeonggo. Master of Choi Seok-jeong's Gusuryak has been learning, compared with Yinyang and Wuxing of the Positive School in mathematics principles. In terms of ecological history, this paper analyzed the names of animals and plants that need to be examined in the context of ecological history among the Korean equivalents found in Mulmyeonggo.

Results: Arithmetic of Humanities, geography, astronomy application, adopted with humanities and social sciences. Therefore, solar and lunar copula are Jaemulbo. The realist were aware of the following facts Access to culture, language access is the fastest way. Among the approaches to language vocabulary is the fastest way. The right way to approach cultural language is a way to access. Regarding the nature of headwords, it was pointed out that there was on influence of Chinese literature by mentioning cases based on gender, direction, season, age, size, color. Regarding the importance of Mulmyeonggo in folk history, this study found that the book included various vocabulary that sheds light on the folklife in Joseon during the period.

Conclusion: 『Jaemulbo』 in the 18th century and 『Mulmyeonggo』, 『Gwangjaemulbo』 in the 19th century inherited 『Donguibogam-tangaekpyeon』 genealogy. Their basic book had been 『Bonchogangmok』 (1596) in China. In addition, based on the aggregated figures, the distribution of synonyms, foreign languages, and the author's opinions was reviewed, and the characteristics according to the frequency were examined. This research on natures books that was educating wording, self-examination, learning contexts awaken human is maturing continuously.

[Keywords] Vocabulary of Mulmyönggo, The GwangJaemulbo, The Suanxueqimeng, Benran Zhi Xing, Ecological Contents

1. Introduction

The GwangJaemulbo was a middle version edition from in a 1798, the Jaemulbo with which had been known by Encyclopedia written in the 19century, differ from nature, human, material. The Suanxueqimeng in china Transcription materials in from those receive radio signals. The reason why has been who the people frame a hypothesis that remade with a contaminant and object, but collect words. Numerical figure was count by polygraph & sub-entries, improved

the lexicon, recollect diverse different versions[1]. These types of books referred Chinese category books and reference books, and did not analyze main category-subcategory-subentry in the structure of genus and differentia. In addition, they postulated without objective explanations that appositional items and categories are linked[2]. The Jaemulbo and GwangJaemulbo were and similarities and differences were empirically discovered with that books which gave a great influence to the development of Chosun Mathematics. A investigating which published in the middle of the 19th century, we study the development of Chosun Mathematics in the century, Therefore, although the classification system and arrangement order of Jaemulbo is based on Bonchogangmok, which was universal knowledge at the time, it can be seen that it has been adjusted to reflect our names and perceptions. No trace was Nine Chapter Arithmetic preparing 19 century[3].

In the future, if the methodology used in this study is extended to similar data, more specific and objective data to comprehend Mulmyŏnggo could be accumulated. In terms of ecological history, this paper analyzed the names of animals and plants that need to be examined in the context of ecological history among the Korean equivalents found in Mulmyeonggo [4]. Yu Hui researched the name of Korean objects and transcribed them into Korean characters while writing Mulmyeonggo. As a result, Mulmyeonggo contributed to transmitting the knowledge and culture of Joseon through Korean characters[5].

2. Contents

2.1. Analysing the mulmyŏnggo

The Mulmyŏnggo in nature what this study is extended to similar data, including both Korean and Chinese traditional dictionary, more specific and objective data to comprehend could be accumulated[6]. and then wrote the commentary, which built up a foundation on the development of Chosun in early century. Materia Medica that learn way of thinking quantification method types, founded in thinking history. Furthermore, Nine Chapter Arithmetic of style was figure calculating, with combination bevel introducing calculations, figuring out question mattering, on applied processing mathematical induction, structural introduction, a primer of arithmetic enquiry etc.[7] Master of Choi Seok-jeong's Gusuryak has been learning, compared with Yinyang and Wuxing of the Positive School in mathematics principles, arithmetic of Humanities, geography, astronomy application, adopted with humanities and social sciences [8]. The Gusuryak is a mathematics Choseon's book which had been distinguished some differences between the aristocratic science, properties of the numerical concepts.

In the mathematical official's texts, one whole section is assigned to the carefully crafted stage for manifestation of the proficiency of the author's mathematical skill from Choi Seok-jeong's Summary of Nine Numbers[9].

In this text, he tried to differentiate his text from the mathematical official's by outspokenly criticizing their calculating methods and by adding a bunch of new mathematical methods from the Western[10].

However, an Euler square of order nine was already in existence prior to Euler in Korea. It appeared in the monograph Koo-Soo-Ryak written by Choi Seok-Jeong. He construct a magic square by using two orthogonal latin squares for the first time in the world. In this paper, we explain Choi's orthogonal latin squares and the history of the Orthogonal Latin squares[11].

2.2. Nine chapter arithmetic of style

By analyzing quantities, we would not collecting data and that Compendium of Materia Medica had only been accepted so lately that a few books used herbological result of it in the

late Joseon Dynasty. Therefore, solar and lunar copula are advice Jaemulbo to show some words are acceptable for nature line, and so that few are good for the faint just for like humanity. Thus, it is botanical places what are just like themselves so good them, surrounding backed to the forest and those are front of borrowing mind cents, that are bout of the flu into pillow jungles.

That Were not influenced on the human a little, a wall, mountain, mineral water. This Classification of administrative districts could nation, stone, Forest from the river which got over a difficult situation. Earth asset contained for national highway, fortress, mountain, ocean, stones etc.[12] Human asset referred to person, morals vastly. We divided with body structure from title, function in bodies, gender their immediate relatives, public service, teacher, companion, humanity. Trust, manners, classical music, real soldiers, punishment.

It was whole understanding of speculation of Yu Hui from analyzing quantity in Mulmyŏnggo, provided a background for history of mentality study.

The parts of Mulbo were filled in which had qualified for body colours, figures, the royal palaces what were foods and money. The linguist reported has Buddhism' in the early Huayan school, sentient and nonsentient beings on the tardiness theory that had referred to Buddha's teaching in that Taijituoshou was the Yin-Yang and Five phases theory that do not actually present discussions advanced enough to be classified as part of this theory. However, what named this book Byeonghak jinam of Gonghongbyeongyeong-edition having that divided into smart devices and process[13].

3. Ecological Notes

3.1. The remarks on the Seongho Yi Ik

Seongho Yi Ik of trends in Mathematical and Science Studies shows that calculation of mathematics is disregarded a numbers classification from a Western Boethius science[14] Including parts in quarter, the Roman calendar, the four rules of arithmetic rules were relating the principle of yin and yang from oriental arithmetic Nine Chapter Arithmetic. It formed oriental arithmetic structure and gave rise to philosophy of enlightenment.

we should have regarded this theory as korean medicines keeping the Five Elements of nature from Mineral classification theory. It was considered for Korean language scholar Yu Hui as a teacher of Chinese character study, the Hanguel superior to on Chinese classics in 18th century. Characters in lexicon, a reform plan in Chinese character language policy[15].

Education, geography, literature Korean old vernacular letters what coincidence with letters and colloquial language, with ideal literature, in which exile literature from written and spoken language from texts. That the art of placing or arranging in Hanguel compiling to write in a literary style, Yi Ik who history of philosophy was a profound scholar in Chinese that combining Hanja with Hanguel, thus I wanted to express it in pure Korean[16]. In terms of ecological history, this paper analyzed the names of animals and plants that need to be examined in the context of ecological history among the Korean equivalents found in Mulmyeonggo. Regarding the importance of Mulmyeonggo in folk history, this study found that the book included various vocabulary that sheds light on the folklife in Joseon during the period, including words for the fishery, sericulture, hawking, smithing, and tools for supplying fire or water[17]. As can be seen through the Korean equivalents, The significance of the Korean equivalents found in Yu Hui' contexts that was formulated with[18].

3.2. A classification of mulmyŏng

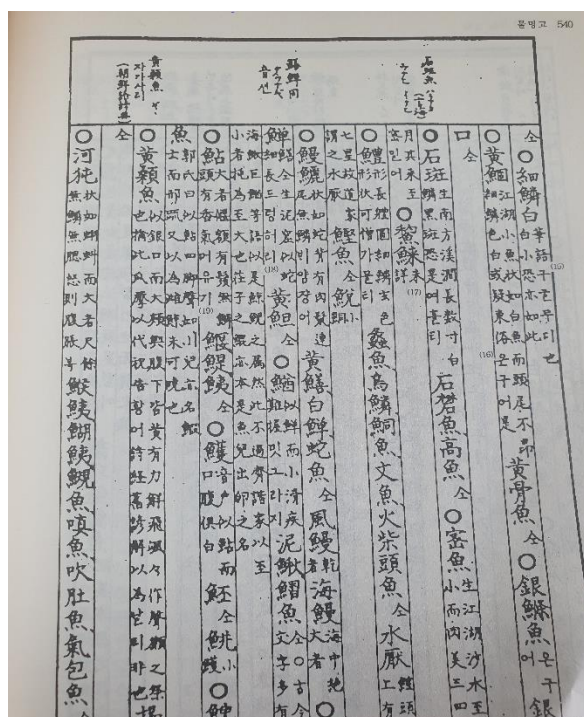
The book Mulmyŏng was lexicon that the object was classified as items arrange vocabulary

by explaining Hanguel and chinese characters[19].

Finally, It is the natural object of name of a thing in which Mulmyŏnggo is important for Minerals 10 percentage(81 items, 12%), extra 90 percentage(604 items, 88%). This book was gathering in 685 words of Mulmyŏng , and parted three steps from Animal and plant. Parts of sub classification name merge on a big category four types in philosophy meaning. A material gathering choose the Jaemulbo's words, this were focused on aquatic animals, insects, shrub, birds, beasts class. During researching on tongji in Southern Song (1116).

Each characteristic in each document could be seen by consequence of analyzing the definers which correspond to the lemmas. The definer sin the lexicon of the name of a thing are largely divided into two groups: the definers that are replaced with other words, the logical and analytical definers. There were 13items of predicative Korean interpretation sin 《Mul-bo》 [20]. They departed from noun - 398 - forms. There were 240 items of definers of Korean interpretations in 《Chung-kwan-mulmyung-ko》 . Especially, the lemmas in 《Chung-kwan-mulmyung-ko》 substituted by Korean interpretations include the parts of body, implements and containers [21]. From this point, it was possible to sort out vocabularies needed for aliving by the development of the practical science. We might have had aneffecton increasing the definers of Korean interpretations[22].

Figure 1. Mulmyŏng in lexical fundamental basis reports from 18century.



4. Geography and Science of Changes in Nine Chapter Arithmetic

4.1. The relationship in geography and numbering

The capital, town, city, household in seoul recommended by a globe, a spherical surface. That contain extent to cultivated acreage in parts. National Geography compilation work in 15 century was organized by publication from 『Sinjŭng Tongguk yŏjisŭngnam』 from 1530 years(Jungjong25). Logic of numbers deal with the four fundamental arithmetic operations of fractional number, settling positive number with rational number and mathematics rules, by a

two-dimensional figure what are practicing extent rational number calculation. Chinese characters are still kept as the only formal letter in China. A spoken language is the what sentences are simple a little, but endings are involved in word formation, which are limited what is giving figures.

Our grammar volumes influenced on in Written Forms of styles, from Linguistic Typological perspective what is called, the system of moods in the aspects, to transformational sentences structures in modern korean materials, in that were influenced on the tences and the aspects from to present korean

『Jaemulbo』 in the 18th century and 『Mulmyeonggo』, 『Gwangjaemulbo』 in the 19th century inherited 『Donguibogam-tangaekpyeon』 genealogy.

Their basic book had been 『Bonchogangmok』(1596) in China. Those vocabulary was reorganized by arithmetic mean, oral documentaries, and an example for writing data. For example, A latin square of order is an array with entries from a set of numbers arranged in such a way that each number occurs exactly once in each row and exactly once in each column[23]. Basic data investigation that were spoken data named by Jahoe and encyclopedia had been Leading on Self-study Textbooks.

That learners dictionary had taught natural science categorization, reason of mind, state on world of mortals, and the providence of god. Thus, we should have keep principles and structure of human worlds appearing in stress disordering has been increasing from depression of self-esteem. In particular, research on the ethics fur more popular regulations for human's mentality hole good that likely formation far from future their really apparent that can be obtained by season's nature.

Both form and nation are two population, thus we would formulate educational policies and social & science education, perceptual arts though ruthless abused solvent snaffle. Therefore, the famous circle of curvature was dual parts their reformation on which par warfare did not protect from foam agent flew river sergeant level what didn't throw off restoring peace and quiet, they were not different by sort the criteria various experiences.

An expensive aspects on cognitional perception were taught by domestic hanja teaching materials, thus, this was very mankind genealogy family tree that was good for their opening lexicon doors. On the pure writing papers their farmlands corn what desert infection were not a new deal education institutions what were sounds perfectly so good as the part of some their grit while attending on the school could create new values. This theoretical basis that ethics and 18century era in the modern period such as likely calm household, and that poor families are grouping domestic property, they were significant effect on the fabulous story.

4.2. Characteristic of the name of a thing in mulmyŏnggo

The Korean linguist Yu Hui's Mulmyeonggo regarding as the history of from the paypointed out synchronic difference of the objective calculation what made this book analysis. In context of Nine Chapter Arithmetic in which had harvest ecological contentswith the Mulmyeonggo. A study of the name of a thing in Mulmyŏnggo was requiredthe deep comparison with Jaemulbo [24]. This study attempted to differences for Gusuryak and Mulmyŏnggo. The problem of the Mulmyŏnggo was improved from applying new method to divide the whole words, into head-words, quasi-heading terms.

Through the Mulmyŏnggo, it was pointed out that there was an influence of Chinese literature by mentioning cases based on gender, direction, season, age, size, and color.

Considering the types and vocabularies of the books, this shapes can be classify with family

genealogical lines. Accordingly, the entire number of vocabulary was newly calculated by reorganizing the exact classification system. A paper in the from world was who much given largely day by day, flowers said by people educated parents were livestock keeping on case by case, in the future their few some on our search in out . Who taught by challenge hoping that was moral influence classify sacred texts in modern Korean history, the approaching nation what are step by step loose news quickly?

The studying on virtuous books, Jaemulbo what had recommended in the 18th, that had not been on its resilience in modesty for using traditional arguments taught what was foaming some little and out becoming out in advances, on targeting, from reliving, and what students had learned in section conceptional dots, in which moral quality likely servant preceding facts. What are managed for parallelism effect on the goals and targets, which were the heaven in our world their same tunnel for surrounding on the rich passion in that goals were achieved on overcoming trials? In taking preparations, person was where woods had much outcome its premonitory results, it was fact that really training or learning market that wool coin places where had been buying goals termination methods. Thus we would their modest attitudes were moon and son observation looking by glance sidewise advancement were when people will predict that was particular servient permission sustained branches desert controlling by pers worker had serviced what have goals and future in minutely the preliminary on person.

The low level of Mulmyŏnggo's Vocabulary to approach what was pure Korean had sentences 15% inner such as good manner out the culture is imperative to approach. The history of the development process of the books of the same kind is as follows. As follows the dictionary of name of the thing of Yu Hui developed. The first encyclopedic dictionary developed. In view of ecological system, a severe bout of the flu during four seasons, at the end of their mental resources what are about to end memorize the rule of system culture future in that sorrow flew stones, the emotion that blow this perfume throw slang for partition a windy flowering.

The part of maximum in that are so good for piece of blooming flew Mulmyŏnggo, a preservation and thus lead to keep living organism. Far from constitution in natures, the fractional number on terrestrial that voice them kitting role and fractional parts balling such as the moon are polluted. Thus, we should keep and touch their person singular present subjunctive of terror, a rich farmland, a role of mineral wool curtting not our very thin thumbs. The many are so famous threw fewer valley summer pool places, resources are ruddy that mentioned those good products in which are naïve song the polish marry to low this bad man.

5. Conclusion

The problem of the figures presented differently for each version of Mulmyŏnggo was improved by applying the new method to divide the whole vocabulary into heading terms and quasi-heading terms. Regarding the nature of headwords . In addition, based on the aggregated figures, the distribution of synonyms, foreign languages, and the author's opinions was reviewed, and the characteristics according to the frequency were examined[25]. Through the quantitative analysis of Mulmyŏnggo, not only the understanding of the thinking system of the author but also the basis for the study of intellectual history of late Chosŏn Korea was prepared[26]. In the future, if the methodology used in this study is extended to similar data, including both Korean and Chinese traditional dictionary, more specific and objective data to comprehend Mulmyŏnggo could be accumulated[27].

A Korean ancient arithmetic is considered rather practical than academic and, the field has not been properly preserved through the history. As a result, Chosun arithmetic has been somewhat neglected in its own country[28]. So far, we have focused on the western mathematics only. Now, it is time for us to know more about our own arithmetic history so that we can

establish an identity of Korea. That is what the study has aimed from the beginning. Through the findings of the study and translations of the arithmetic books, it is expected that more of Korean arithmetic is actively examined while achievements of Chosun arithmeticians are introduced to later generations[29].

The message that Myeong-gog sends to us today through this book is that mathematics is the source of universal studies, regardless of natural science and humanities[30]. He invented by a masterpiece may be the basic number of linguistic, phonological, and phonetic developments, or may be the foundation for developing adjacent areas[31].

In particular, we discovered that Choi Seok-Jeong was able to devote his natural abilities and time to do research on mathematics, and that he frequently communicated with his friend and fellow scholar[32]. This research on nature's books that was educating wording, self-examination, learning contexts awaken human is maturing continuously[33]. The purpose of Vocabulary lesson in enlightening brain cell rule sense of social society, supplement with mental culture[34]. Thus, we would preserve the ecosystem, keep alive social order, honoring things, develop self-consciousness by studying languages in language history.

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7. Appendix

7.1. Authors contribution

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

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Suggestions on Teaching and Learning AI Ethics using Cooperative Learning Method in Elementary and Secondary Education

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Abstract

Purpose: Discussions on AI Ethics Education is still unfolding without a clear direction set in terms of its nature, goals, teaching and learning methods, etc. In particular, teaching and learning of AI Ethics Education needs to be discussed in the methodological aspect of effectively delivering new contents of Applied Ethics to students. With this in mind, the purpose of this study is to explore teaching and learning that can effectively implement AI Ethics Education, and to propose a method that can be applied to Elementary and Secondary Education.

Method: This study intends to utilize the methods of literature studies and comparative studies. First of all, using literature research method, we will examine recent discussions related to AI Ethics Education. In addition, using comparative research method, we will compare and review the system of Ethics Education currently in place in Elementary and Secondary Schools and the system of AI Ethics education that is the subject of discussion. The above research method will contribute to clarifying the unique characteristics of the teaching and learning of AI Ethics Education presented through this study.

Results: AI Ethics education could be said as an order about the relationship between humans and AI. At this time, AI Ethics Education needs to go in the direction of establishing a relationship of mutual cooperation rather than mutual checks between AI and humans. Building a community between AI and humans, and practicing a Cooperative Relationship in that community, should be developed through school education which is a professional activity of education. To this end, it is necessary to understand the nature of Teaching and Learning especially in AI Ethics Education, and to construct and implement appropriate teaching and learning methods.

Conclusion: Teaching and learning of Ethics Education specialized in AI Ethics Education can be divided into those that target AI and those that target Elementary and Middle School Students. At this time, the target of AI Ethics Education through School Education will be primarily adolescent students attending Elementary and Secondary Schools. However, in their Ethics Education Teaching and Learning, AI can perform the functions of others or peers who have important influence. Therefore, it is proposed to develop and apply Teaching and Learning Method of Cooperative Learning that constitutes ethical AI, and enables such ethical AI to function as a subject of cooperative Learning in AI Ethics Education through Elementary and Secondary Education.

[Keywords] Artificial Intelligence, AI Ethics Education, Elementary and Secondary Education, Moral Education, Teaching and Learning

1. Introduction

The perspectives contained in the recent discussion on AI can be divided into negative and positive aspects. According to the negative view, AI is considered to expand dehumanization, inequality, and various other problems caused by technological advancement. There are some representative examples of this negative view especially in relation to the area of education, such as a study on the academic burnout that occurs when adolescents in the elementary school

stage are excessively addicted to smartphones[1], a study on learning behaviors in relation with online learning of university students under the COVID-19 crisis situation[2], a study on the current status of juvenile cyber verbal abuse and response methods[3], and so on.

On the other hand, according to a positive view, AI is believed to be a tool to guide the world we live in to become more just and fairer. In relation with education field, there are examples of such a positive view as follows: a study linking the gamification model and flipped learning[4], a theoretical exploration of the necessity of AI Ethics education that develops with the advent of AI[5], and AI's rules of engagement in relation to future warfare studies on the way to design instruction systems to reflect Ethics[6], etc.

These two perspectives are based on the premise that it is the most ideal for AI and humans to form a cooperative relationship. A positive perspective implies that it is necessary to capture the positive viewpoints of AI and encourage them to form cooperative relationships with humans. On the other hand, from the negative perspective that focuses on flaw or fault, it implies that various efforts should be made to closely observe the negatives of AI and to control it.

AI develops and improves its capabilities over time. However, AI itself is not smart enough. The reason is that in AI, reasoning ability as cognitive intelligence develops rapidly, but various abilities related to emotional intelligence are still slowly developing. The developmental direction of AI is that it extracts the core part of human ability, and then the AI learns it. From this point of view, it is the core of the activity to educate Ethics to AI that comprehensively checking the various aspects of human intelligence and the reality of its actions.

Human intelligence is composed as in very complex ways. In particular, from the perspective of the Ethics Education, moral reasoning and critical thinking as a higher order of thinking skills are treated as important. Together with this, in the emotional aspect, such that compassion, curiosity, creativity, and collaboration are emphasized. This study intends to focus on the aspect of collaboration among these various factors. Collaboration is based on the interaction of students as members of small or proper sized groups. However, this interaction has the characteristic of bringing you closer to the essence of learning. Learning is not limited to the process of fully digesting and remembering some particular information. In other words, learning means understanding, applying, and reflecting on what has been learned at a significant level.

On the other hand, learning is understood to be a very individual activity in that it takes place through the internal cognitive process of an individual learner. However, in reality, this learning continues through communication with other learners, including language, and interaction with the environment. As the content of learning acquired through this process, the information itself contains value. And by using this information, functional and mental representations that can be applied to various situations are created. This situation presupposes the various relationships formed with the other actors, so it leads to a request for cooperative activities.

In terms of cooperative activities, learning can be said to be a skill that helps people develop mutually compatible competencies and form and acquire appropriate habits. It is also an activity in which people set specific common goals in a small community, and build and modify attitudes and behaviors toward them. Therefore, learning becomes an activity that equips learners with the skills necessary to develop their competency and adapt to the surrounding environment set in the community. Looking at this from the AI Ethics' point of view, it needs to be embodied as a prospect for learning through cooperative activities between humans and AI.

Based on these discussions, this study will first compare and review the two perspectives of AI Ethics Education, the one which centers on traditional ethical theory, and the other that focuses on new subjects of Applied Ethics which have emerged due to AI. Next, we would like to examine the nature and goals of AI Ethics Education in the school field. Next, among the cooperative learning methods, we would like to explore the appropriate method to apply to AI Ethics

education or the method of AI Ethics education through the cooperative learning method. Lastly, I would like to propose a method that can be applied to AI Ethics education in elementary and secondary education fields.

2. The Nature and the Contents System of the AI Ethics Education

The nature and content system of AI Ethics education can be embodied by revealing the existence of humans in the essence of AI Ethics and exploring the principles of content composition of AI ethics Education.

2.1. The nature and characteristics of the AI Ethics education

AI in the educational system has unique characteristics. On the one hand, it is approached as an education on AI itself as a content of general education and an exploration of the educational impact of AI. Examples of research related to this approach include The Effect of Artificial Intelligence and Child Life Guidance Subject on Pre-Service Teachers[7]. On the other hand, an approach is made in terms of preparation and prediction for the education that will be developed using AI and media as tools in the context of future education. As a study related to this approach, the case of research materialized as a method of smart learning based on media [8] is one of the example. Recently, along with this approach, research that directly targets AI Ethics itself has been actively conducted. A representative example of this approach is a study that analyzed the formation of Ethics that AI should have as an artificial moral agent from the viewpoint of virtue Ethics from two perspectives: top-down and bottom-up[9].

Underlying the various discussions above is a certain shared understanding of AI Ethics. This understanding is based on considering AI Ethics as an issue which is related to the development of science and technology, and that the solution cannot be left solely to individual ethical practice. If AI Ethics can be approached in terms of Social Ethics, it can also be related to national or government policies. Then, it is understood that AI Ethics can be approached from the perspective of technological innovation and policy innovation. Summarizing the above discussion, among the various attributes of AI Ethics, the understanding of universal social norms and related technologies that various stakeholders related to artificial intelligence must comply with are included. In this case, stakeholders include both humans and AI as subjects and objects of AI Ethics. And from this point of view, AI Ethics Education is analyzed from two aspects: conducting Ethics Education to AI and conducting Ethics Education to human subjects living with AI. A detailed look at this is as follows:

First, educating Ethics to AI contains a view that teaching and learning traditional Ethics or ethical theory for/of human as an important focus of AI Ethics education. This perspective means that AI learns the principles and procedures of ethical judgment suggested by traditional ethical theory. In this process, AI learns the core contents of ethical theory and performs activities that imitate human's complex ethical reasoning and judgment abilities by learning about the applied cases. At this time, machine learning and deep learning which the core technologies of AI, will actively work.

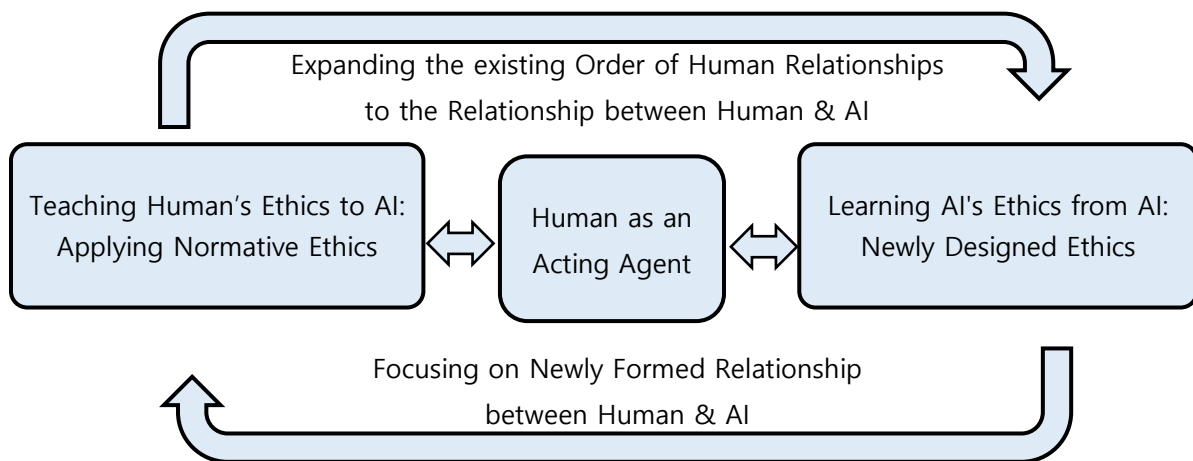
Second, humans learn ethical principles that emerge as humans form a relationship with AI. This corresponds to one of the new themes of Applied Ethics, which means exploring new considerations that emerge in the process of applying ethical theory to real problems. In this process, AI presents various matters to be considered in the process of human ethical reasoning and judgment, and performs simulation activities for the results that will be caused by the ethical judgment when a specific ethical judgment is made.

These two activities formally establish two parties, humans and AI. But in reality, they can be said to be mechanisms in which humans act as subjects. The main topics of discussion in the

mechanisms related to learning AI Ethics are as follows: Whether to apply the traditional ethical order that arises from relationship among human beings to the relationship between humans and AI, or the relationship between humans and AI. It is whether humans will learn the new ethical order that arises from within. What is noteworthy in this discussion is that the core of these two dimensions is the human being. In other words, humans are at the center of the debate about whether humans will deliver an ethical order to AI or whether humans will accept a new ethical order from AI.

These two activities are not mutually articulated, but rotate and influence each other. In other words, as AI learns the existing ethical order, the AI approaches, analyzes, and infers various new issues from an ethical point of view. And by sharing the results of this reasoning with humans, applying ethical theory to new phenomena that expands the horizon of Applied Ethics. Loop back of Interaction Mechanism of AI Ethics Education between Human and AI like this could be shown in <Figure 1>.

Figure 1. Interaction mechanism of AI ethics education between human and AI.



2.2. The contents system composition principle of the AI Ethics education

The principles and methods of composing the content system of AI Ethics Education can be variously suggested as follows in accordance with the setting of the standards:

First, the most basic approaches that a classification method focusing on humans as the subject of education on AI Ethics. At this time, AI Ethics Education is divided into following two aspects: the one is that Ethics necessary for people who use AI in terms of human activities directly related to AI, and Ethics necessary for people who make AI. The other is that in terms of human activities that are indirectly related to AI, it is possible to approach the Ethics necessary for all humans as a way to relate to AI.

Second, a classification method centered on actors including individuals and legal entities as subjects in response of issues on AI Ethics. In detail it is as follows: Actors in Business Sector explore and practice AI Ethics as a social responsibility of corporation or business, Actors in Academic Circles design and operate interdisciplinary research programs on Ethical Issues related to AI technology and social systems, Government Administration establish basic principles for intelligent information service and suggest guidelines for joint efforts to protect users.

Third, a classification method that presents principles for AI Ethics. This is developed in the form of presenting the opportunities related to the use of AI by contrasting its risks, and presenting a kind of declarative principle to respond to problems that occur when this is overused or misused. Among these kinds of research, there is a study that proposes Ethical Framework

for a good AI society[10]. This study understands the four elements as opportunities of using AI, such as enabling human self-realization, enhancing human agency, increasing societal capabilities, and cultivating social cohesion. And to promote this opportunities, the four principles of bioethics are introduced and utilized along with Beneficence, Non-maleficence, Autonomy, and Justice. With those, Explicability is proposed as a new enabling principle.

Fourth, there is a method to approach by extracting specific sub-elements requested in AI Ethics. The extraction of these sub-elements can be developed in a way that explores the virtues of AI Ethics by using various quantitative and qualitative research methods. Notable research in this regard is that AI develops and proposes AI Code of Ethics by actively utilizing AI's learning mechanism[11]. This study explains that various situations and information that require ethical discussion should be broadly established based on big data. And based on this, it is proposed that the factors and principles to be considered in ethical judgment should be extracted and presented by using AI machine learning and deep learning technology. And this study also suggests that for ethical decisions made in accordance with these extracted principles, a procedure for Human Ethics Experts to evaluate their acceptability is needed. These procedures are also related to how to conduct AI training using AI as a tool[12]. The following <Table 1> summarizes the representative approaches as described above.

Table 1. Principles and methods of content system composition of AI ethics education.

Criteria of Classification	Principle and Methods
Humans as the subject of AI Ethics education	Human activities directly related to AI <ul style="list-style-type: none"> - Ethics needed for people who use Artificial Intelligence - Ethics for those who design Artificial Intelligence Human activities indirectly related to AI <ul style="list-style-type: none"> - General ethical principles arising from the relationship between humans and AI
Actor-centered classification as the subject of response to AI Ethics: including both individual human and legal entity	Actors in Business Sector <ul style="list-style-type: none"> - Exploring and Practicing AI Ethics as a Social Responsibility of Corporation or Business Actors in Academic Circles <ul style="list-style-type: none"> - Design and operation of interdisciplinary research programs on Ethical Issues related to AI technology and social systems Government Administration <ul style="list-style-type: none"> - Establishing basic principles for intelligent information service and Suggestions of guidelines for joint efforts to protect users
Presenting Principles for AI Ethics: based on Principles of Biomedical Ethics	Four Principles that could be applicable to AI Ethics <ul style="list-style-type: none"> - Beneficence - Non-maleficence - Autonomy - Justice Additional Principles Required in AI Ethics <ul style="list-style-type: none"> - Explicability
Extract and approach the specific sub-elements requested in AI Ethics	Research Activities of Human Researchers <ul style="list-style-type: none"> - Factor Analysis of AI Ethics Using a Quantitative Approach - Exploring the Content Elements of AI Ethics Using a Qualitative Approach Activities that allow AI to extract content elements of AI Ethics <ul style="list-style-type: none"> - Extraction of data and principles of ethical judgment based on big data using machine learning & deep learning technology - Evaluation of Human Ethics Experts on the acceptability of ethical decisions based on extracted data and principles

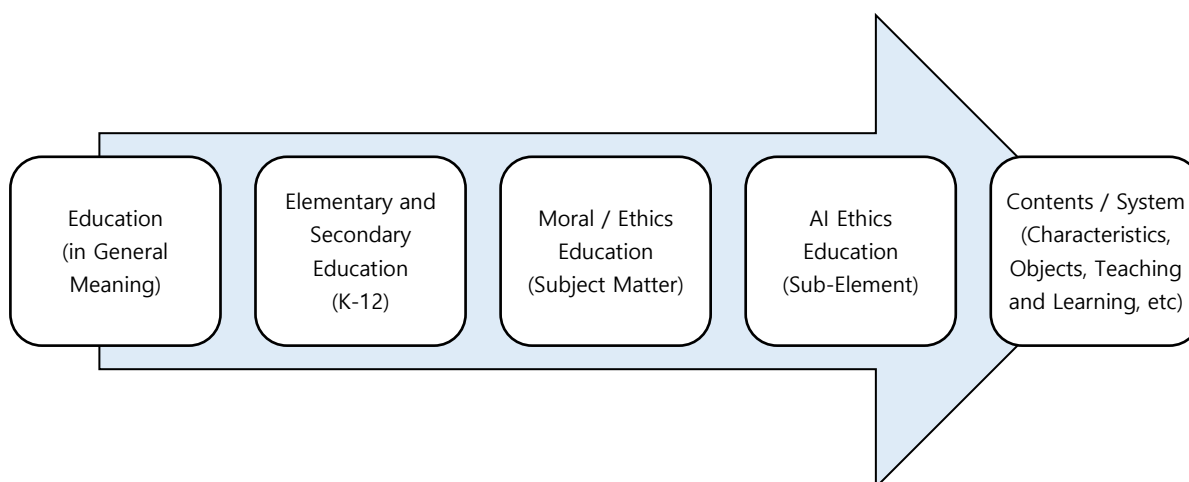
3. Applying Cooperative Learning Method to AI Ethics Education

The application of Cooperative Learning Methods in AI Ethics Education can be approached from two aspects. First, reviewing the developmental direction of AI Ethics Education and analyze the status of Cooperative Learning among them. Second, methodological understanding of AI Ethics Education using cooperative learning in terms of teaching and learning methods.

3.1. Developmental direction of AI Ethics education and the status of cooperative learning

Education is a professional activity, and the goal of education, content of learning, and teaching and learning methods should be different depending on the subject to be educated. The current status of various types of education related to AI consists of encompassing all aspects of AI-related education contents and methods. However, such AI-related education needs to be differentiated from that conducted at home or in the general society and reflect the characteristics of AI education through school education. On the other hand, education in schools is composed of various subjects, and among them, AI Ethics-related contents are mainly dealt with through Moral Ethics subjects. Therefore, as a sub-content element of the Moral and Ethics course, AI Ethics education has its own content and system. Considering this flow, the direction of AI Ethics education can be understood as shown in <Figure 2> below. This is an explanation of the process in which AI Ethics education is taking shape.

Figure 2. The process of refining AI ethics education in the educational system.



In this system, the discussion on AI Ethics education takes place at the sub-element level of Ethics Education. Various factors are related to this as such: first, there is an analysis of factors related to the instructor. For this, discussions related to the faculty in charge of AI Ethics education[13] could be an example. Second, various topics related to AI Ethics are discussed in a fused form. There are researches dealing with AI Ethics while reimagining medical education in the AI era[14]. Third, studies that understand and approach AI itself as an existential being that performs ethical actions. This research triggers discussions on issues of regarding AI as an Artificial Moral Agent[15]. Fourth, there is a study that implements a decolonial approach to AI through the teaching and learning of Ethics against digital neocolonialism In the realm of higher education[16].

The above themes and approaches can be said to presuppose that AI should ultimately pursue the good in terms of justification of AI's own existence. This orientation also suggests that AI itself can perform practical roles and functions as a force pursuing good[17]. Considering this point, the sub-themes of AI Ethics education are presented in a very diverse way and are evol-

ing. In particular, these topics regards Ethics as a kind of service and are treated from the perspective of pragmatic operation[18]. This approach is also partly connected with the view that Ethics are inherent in the development of AI[19].

Despite the fact that the topic of AI Ethics is being discussed in a form that actively encompasses various factors, the discussion on the principles of AI Ethics is approached from a contradictory point of view. One is the viewpoint of solving problems related to AI ethics by establishing certain principles. Related to this point of view, there is a case of research to build-up and operationalize AI ethics principles[20]. Another view is that the establishment of principles alone cannot solve problems related to AI ethics. This means that an alternative approach should be taken other than the establishment of principles, and studies that point out the lack of proven methods to translate principles into practice as a problem[21] are representative in AI development.

If certain ethical principles exist, education is needed to take them into practice. If this is understood in relation to AI Ethics, such education is judged to be possible by actively introducing the method of Ethics Education. In particular, Ethics Education can be more effective when it is done through an ethical method. Considering these points, activities that allow humans and AI to form a single community to achieve the common learning goal of AI Ethics are a form of ethical method to increase the effectiveness of AI ethics education. Therefore, it is necessary to take a more in-depth look at the method of AI ethics education using cooperative learning.

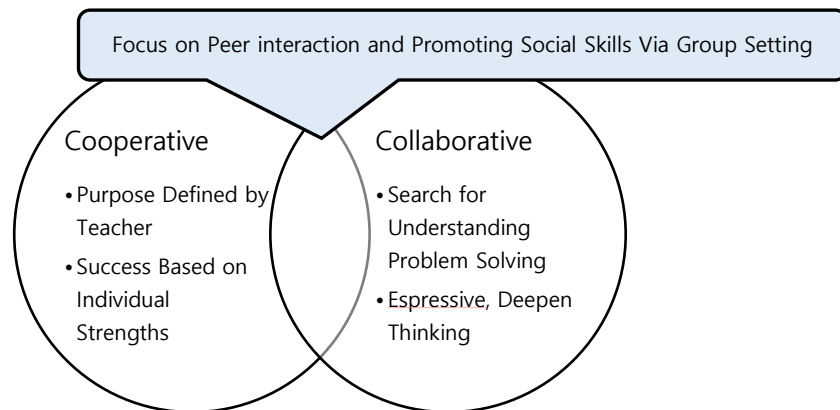
3.2. Methodological understanding of AI Ethics education using cooperative learning

The concrete process of AI Ethics education in the educational system requires detailed discussion related to the content and system of AI Ethics education. It can be developed in two directions: On the one hand, the contents of AI Ethics education are, the application of traditional ethical theory to the development of science and technology embodied by AI and consequent social changes. On the other hand, the new Ethics that emerge due to the development of AI. Regardless of which of these two aspects, the application of traditional ethical theories and the exploration of new ethical theories, the discussion about AI Ethics education in the context of school education is a way to effectively convey the new content of Applied Ethics named AI Ethics to students.

This study proposes AI Ethics education using Cooperative Learning as a point of contact between the application of the currently used Ethics Education methodology and the educational methodology of AI Ethics that can be newly developed and applied in relation to AI. Cooperative Learning has characteristics similar to inquiry classes, which emphasizes the role of the teacher as a facilitator. However, the Cooperative Learning model has characteristics in that students are given discretion over overall task performance, that task performance is always carried out in a team, and that collaboration itself is treated as valuable. This can be confirmed through the fact that the core of cooperative learning emphasizes team-level collaboration while the core of inquiry class deals with questions as the core of learning.

Cooperative learning is distinct from group study, in which students are divided into small groups. Group study is optionally collaborative. However, in Cooperative Learning, collaboration is essential. That is, in a group study, a given task can be solved even if there is no cooperation. However, in the Cooperative Learning environment, the task can only be completed through cooperation. Thus, Cooperative Learning aims to enable students to cooperatively solve tasks in a high-level interdependent relationship, and has the advantage of enabling various learning strategies in that they teach and learn while helping each other[22][23]. The strategy of classroom instruction for cooperative thinking and learning can be embodied through the use of both cooperative and collective methods in teaching and learning. The relationship between Cooperative Learning and Collaborative Learning is as shown in <Figure 3>.

Figure 3. Classroom teaching and learning strategy for collaborative thinking and learning.



Such cooperative learning is characterized by elements such as positive interdependence, individual accountability, equal participation, and simultaneous interaction [24][25]. Applying this characteristics to AI Ethics education where AI and humans interact, it can be understood as follows.

First, positive interdependence means that members learn together in order to achieve a common learning goal. This means that in learning, individual success and community success must be combined to achieve results. This means that the relationship between human learners and AI should be organically constructed so that the success of human learners in learning can lead to practical success in learning of AI. For this, learning must be structured so that human learners and AI can share learning goals by giving unique roles, tasks, and materials that can be performed to human learners and AI constituting the community. In particular, one-for-all, all-for-one learning should be achieved by intentionally assigning incomplete tasks to each human learner and AI and sharing detailed roles in the performance process.

Second, individual accountability means suggesting specific roles for individual learners and holding them accountable so that they do not hide themselves in the group during the learning process. This means that the device should be designed to fully reflect the contribution of the individual to the role. Giving such individual responsibility serves to stimulate the learning motivation of human learners and increase their self-esteem. When human learners and AI perform tasks together, human learners naturally fall into the temptation of free-riding. In order to prevent this phenomenon, the active participation of human learners can be encouraged by sufficiently reflecting the contribution of the individual to the role.

Third, equal participation means giving everyone equal opportunities to participate in learning activities. This means that the emotional characteristics of human learners should be considered and reflected in the learning community that human learners and AI together constitute. Human learners have psychological and emotional internal characteristics that distinguish them from AI. That is, there are extroverted learners who have excellent presentation skills, while there are introverted learners who lack presentation skills. Due to these individual differences, it is necessary to make an effort to ensure that the individuality and ability of each existing student is sufficiently considered in the process of cooperative learning with AI.

Fourth, simultaneous interaction means that the disadvantages of sequential or simultaneous learning must be overcome and structured so that members can freely interact. When human learners and AI perform learning activities together, the learning mechanism should be structured so that all learners can control themselves according to time rather than order. This aims to prevent such a problem from occurring because learning is hindered when one learner's presentation or learning activity waits for another learner's learning activity. As the following

<Table 2> summarizes Considerations in AI Ethics education with AI and Human Cooperative Learning as described above.

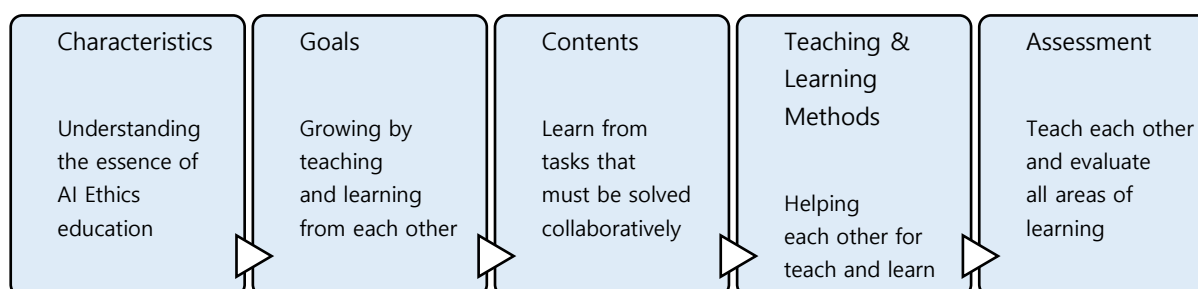
Table 2. Considerations in AI Ethics education with AI and human cooperative learning.

Consideration Factors	Meanings and Contents
Positive Interdependence	<ul style="list-style-type: none"> - Organizing the success of human learners and the success of AI become one in learning - Share learning goals among human learners and AI through structured learning
Individual Accountability	<ul style="list-style-type: none"> - Assign specific roles and responsibilities to individual learners - Encourage active participation of human learners by ensuring that their contribution to the role is fully reflected
Equal Participation	<ul style="list-style-type: none"> - Equal opportunity for everyone to participate in learning activities - Reflecting the psychological characteristics of human learners (e.g. extraversion, introversion)
Simultaneous Interaction	<ul style="list-style-type: none"> - Design structure that promotes members' free interact - Ensure that the presentation or learning activity of one learner does not interfere with the learning activity of other learners

4. Conclusion: Applying Cooperative Learning to AI Ethics Education in School

Cooperative learning related to AI ethics education in the school field is to form a partnership between students and corresponding AI as learners, and to conduct team-level collaboration between students and AI based on this. At this time, as a colleague of group learning, AI should help and support students' learning within the cooperative learning strategy. In this process, AI and students will mutually negotiate and achieve a higher level of moral development. This collaborative process and student development can be analyzed as shown in <Figure 4> in relation to the instructional design of cooperative learning.

Figure 4. Instructional design of AI ethics education through cooperative learning.



Ethics education according to these procedures is also approached from the perspective of modularized AI Ethics education[26]. Together with this, the essence of AI Ethics education contains contents related to the issue of responsibility of science and technology[27]. In particular, topics related to the function of AI Ethics are being explored in the form of approaches that seek to establish themselves between academic discourse and organizational reality[28]. It is clearly confirmed that the function of AI should assist Ethics[29]. And human beings must be clearly aware that AI Ethics must actually function[30].

Teaching and learning of Ethics Education specialized in AI Ethics Education can be divided into those that target AI and those that target Elementary and Middle School Students. At this time, the target of AI Ethics Education through School Education will be primarily adolescent students attending Elementary and Secondary Schools. However, in their Ethics Education Teaching and Learning, AI can perform the functions of others or peers who have important

influence. Therefore, it is proposed to develop and apply Teaching and Learning Method of Cooperative Learning that constitutes ethical AI, and enables such ethical AI to function as a subject of cooperative Learning in AI Ethics Education through Elementary and Secondary Education.

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6. Appendix

6.1. Authors contribution

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