

Original Article

Development of an SW-Utilized Curriculum Linked to Villages and Online Class Exchange for the Lower Grades of Elementary School

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Abstract — As the need for autonomous operation of curriculums by city and province increases, and the effectiveness of curriculums linked with local communities is proven, the need for the development and operation of the village-linked curriculum is continuously increasing. In this study, an SW-based village-linked curriculum suitable for small classes was developed for the lower grades of elementary school, and a plan for interacting with schools and students in other regions was carried out. By introducing an online class result exchange plan into the curriculum, the results of this study can be used not only to expand the lack of sociality of small school students but also to solve the spatial and temporal limitations of class exchange. For small classes in the 2nd grade of elementary school, the 14th integrated curriculum using SW was developed and operated in 2021. By conducting online class exchange activities through virtual exhibition environments, the class output contributed to the expansion of students' sociality through the class exchange in a non-contact environment.

Keywords - Curriculum for the integrated subject, Effectiveness of SW education tools, Elementary school SW education, Online class exchange, Village-linked curriculum.

I. INTRODUCTION

In recent years, the need for autonomous operation in the curriculum for each city and province has been increasing, and the need for village curriculum linked to the local community is increasing[1, 2]. As the operation of small classes becomes inevitable due to the decrease in the school-age population in a specific area, various studies have been conducted for small class students[3, 4]. In addition, as the need for universal AI education is emphasized, various-

Learning tools and environments that help anyone easily experience and use AI are actively developed and distributed and are encouraged to actively use AI education at the K-12 level[5-7].

In this study, the achievement standards of Korean, math, and integrated subjects in the 1st and 2nd grades of the 2015 revised curriculum[8] were considered, and a curriculum suitable for small schools was developed, focusing on the village-linked curriculum. In addition, class teaching aids, including SW, were actively used in class to increase the participation of students and the effectiveness of education and to produce outputs for online class exchange. By introducing an online class result exchange plan, the results of the curriculum that students have been active and experienced have expanded the lack of sociality of small school students through exchanges with schools and students in other regions. In addition, by introducing an online class result exchange plan, a plan was prepared to solve the spatial and temporal limitations of class exchange. From the perspective of a teacher who selects a class tool in the process of conducting a lower grade class, the selection of the tools used in the curriculum, the reasons for selection, the advantages and disadvantages of the tool, and the possibility of expanding other tools were presented as the results of the curriculum operation. This not only reduces the trial and error of teachers who want to introduce the curriculum but can also contribute to enhancing the effectiveness of classes using various tools.

In this paper, Chapter 2 examines previous studies related to curriculum development and online class exchange, Chapter 3 describes designs and operates curriculum for integrated subjects in lower grades of elementary school, Chapter 4 describes online class exchange plans and results suitable for small classes, and Chapter 5 describes conclusions and future studies.

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II. RELATED STUDIES

As the need for universal AI education is emphasized, education on the concept, operation principle, and utilization method of AI is actively progressed using various online learning tools and environments[9-12]. Artificial intelligence and convergence areas with data science, artificial intelligence, and robotics as sub-areas were newly included in the next-generation software(SW) education standard model development study[13]. In the exploratory study of the artificial intelligence education content system[8], five areas of "understanding artificial intelligence, artificial intelligence and data, artificial intelligence algorithm, application of artificial intelligence, artificial intelligence and social impact" are organized equally in elementary and middle schools, and a continuous artificial intelligence education content system is presented as an AI education content system.

The regional curriculum is organized and operated by reorganizing the national curriculum according to the situation of the region, school, and student. Reflecting the specificity of the region, the actual condition of education, the needs and needs of students, teachers, and residents. A plan will be established to focus on education at the education office level. For the development of the school curriculum, it is possible to operate guidelines for organizing curriculum at the city and provincial offices of education.

The effect of education on environmental sensitivity and respect for the life of elementary school students was analyzed in the development study[16] of the ecological experience education program of the village education community. The program developed in a total of 14 sessions was designed to allow students to experience the knowledge and activities for solving problems related to rivers and forests around the village. It was suggested that the ecological experience education program of the village community using human and material resources is effective in improving the environmental sensitivity of elementary school students.

As COVID-19 continues for a long time, class exchange offline becomes very difficult, and the need for online class exchange for students in small classes is increasing. Therefore, meta-bus-based online exhibitions and classes, meaning the virtual world as well as class exchanges through open chatting or virtual exhibition halls, are being activated. Metabus is a compound word of "meta," which means virtual and transcendental, and "universe," which means the world and the universe, and is widely used to mean a living and game-type virtual world where reality and non-realism coexist[18, 19].

A study on the educational effectiveness of realistic media[20] and an educational utilization study of meta bus platforms[21-25] utilize various technologies such as sharing functions, whiteboards, rest areas, and additional game functions beyond existing real-time education platforms. It is suggested that educational effectiveness can be increased compared to existing online education by increasing immersion and interaction.

III. VILLAGE-LINKED CURRICULUM FOR THE LOWER GRADES OF ELEMENTARY SCHOOL

One teacher with experience in running classes using various SW tools and four second-year students participated in developing a village-linked curriculum. The curriculum follows the achievement standards of the integrated curriculum and focuses on systematizing the experience of the educational content and precautions for the operation of the village-linked curriculum.

A. Design of a Village-Linked Curriculum

The achievement standards[24] related to Korean, mathematics, and integrated subjects in the 1st and 2nd grades of the 2015 revised curriculum are as follows. For first and second graders, Korean includes basic activities 3R's (reading, writing, counting), mathematics includes classification, table, and graph, and the integrated curriculum includes seasonal activities and activities to know our village and to love and introduce our village. Accordingly, the criteria for achieving related topics in the village-linked curriculum for use in the integrated curriculum of the first and second graders are as follows.

- Participating in performances and exhibitions that express my interests and talents
- Expressing your thoughts or experiences through poems, songs, and stories.
- Learning the importance of work by finding and practising what I can do for the neighbourhood.
- Understanding various characteristics of friends and learning how to get along with friends
- Observing, drawing, and explaining the appearance of the neighbourhood.
- Examining animals and plants that can be seen in summer and exploring their characteristics.
- Expressing and appreciating various animals and plants that can be seen in summer.
- Looking at what can be seen in autumn and grouping them according to their characteristics.

As shown in Table 1, the development process of the village-linked curriculum proceeds as a curriculum goal setting and environmental analysis, curriculum and instructional guidance development, curriculum operation, and instructional output writing process.

Table 1. Curriculum development process

Divisions	Contents
Goal setting	Establishing curriculum goals and analyzing the educational environment <ul style="list-style-type: none"> • Competency analysis of participating teachers and participating students • Analysis of class and educational environment • Related literature, research analysis
Curriculum development	Development of a village-linked curriculum <ul style="list-style-type: none"> • Selection of educational content and achievement standards • Development of a village-linked curriculum • Development of instruction plans
Curriculum operation	Operation of a village-linked curriculum <ul style="list-style-type: none"> • Curriculum operation • SW, selection and application of tool candidates • Completion of class output • Effectiveness analysis according to SW tool application

B. Development and operation of a village-linked curriculum

The considerations in the development and operation of the village-linked curriculum and the contents according to each classification are presented in Table 2. Here, a plan was proposed to increase the convenience of introducing the curriculum and the effectiveness of students' participation in the curriculum.

Table 2. Considerations for the development and operation of village-linked curriculums

Division	Contents
Topic	• Selection of topics to be educated through classes
Achievement standards.	• Educational effect of classes on students and setting criteria for evaluation according to achievement
The time required	• The session requires 40 minutes in the first class, and the class consists of 1 to 3 sessions considering the topic and activities
Pre-contents	• Teacher: role in class, presentation of the preparation • Student: presenting pre-prepared activities for learning
Contents of class	• Content of the class consists of activity units, consisting of 1-3 activities for each class
Evaluation method	• Presenting evaluation methods to evaluate achievement standards
Post-contents	• Presenting follow-up activities according to class results
Teaching aids	• Presenting teaching tools that can be used to increase the effectiveness of classes • Selection considering the level of students and the method of writing class products for online class exchange
Notice	• Presenting the subject and activities of the class, the operation method of the class tool, and precautions
Pros and cons of using teaching aids	• Use of teaching aids, pros and cons according to actual use
Possibility of expanding teaching aids	• Based on the actual tools used, a more useful tool is suggested by analyzing the strengths and weaknesses of students' responses and tool use.
Class activities and outputs	• Results of class activities and suggesting a plan to organize products
Improvement plan	• Topics and suggesting plans to improve the curriculum according to class activities

As shown in Tables 3 to 7, the village-linked education course consists of 12 sessions, including getting to know me, getting to know the village, experiencing local specialties, and categorizing the animals and plants of the village. The output of each subject class is produced as a program using images, videos, and entries and is used in online class exchanges.

Table 3. Village-linked curriculum(1st and 2nd sessions)

Division		Contents
1st and 2nd session	Topic	<ul style="list-style-type: none"> • Getting to know me before getting to know the village
	Achievement standards	<ul style="list-style-type: none"> • Participating in performances and exhibitions that express my interests and talents
	Time required	<ul style="list-style-type: none"> • 40 minutes for each session • Session 1: expression for me • Session 2: Expression in PPT or entry templates
	Pre-contents	<ul style="list-style-type: none"> • Teacher: online PPT templates, entry templates • Student: preparing introduction material
	Contents of class	<ul style="list-style-type: none"> • Presenting self-introduction materials • Knowing me by other people's evaluations • Expressing self-introduction using templates
	Evaluation method	<ul style="list-style-type: none"> • Words and expressions presented in the introductory material about myself
	Post-contents	<ul style="list-style-type: none"> • Sharing student portfolios with bands and group chats
	Teaching aids	<ul style="list-style-type: none"> • Online PPT program • Entry
	Operation method	<ul style="list-style-type: none"> • Specific questions for students to explore about themselves, the attribute must be presented
	Outputs	<ul style="list-style-type: none"> • Self-introduction material (utilizing PPT Templates)

Table 4. Village-linked curriculum(3rd and 4th session)

Division		Contents
3rd and 4th session	Topic	<ul style="list-style-type: none"> • Project to know village–making a campaign
	Achievement standards	<ul style="list-style-type: none"> • Knowing the importance of work by finding and practising what we can do for our community
	Time required	<ul style="list-style-type: none"> • 40 minutes for each session • Session 1: finding out the hazards in the village • Session 2: making campaign poster
	Pre-contents	<ul style="list-style-type: none"> • Teacher: village hazards, information on investigation activities • Student: village survey, observation of various campaign posters
	Contents of class	<ul style="list-style-type: none"> • Learning about village hazards • Making a campaign poster
	Evaluation method	<ul style="list-style-type: none"> • Words and expressions to introduce the village, confirmation of expression method using poster
	Post-contents	<ul style="list-style-type: none"> • Sharing student portfolios with bands and group chats
	Teaching aids	<ul style="list-style-type: none"> • Colouring tool • Autodraw, Dall-e, entry
	Operation method	<ul style="list-style-type: none"> • Resources for discovering and introducing village, making a poster using the colouring tool
	Outputs	<ul style="list-style-type: none"> • Village campaign poster(a picture drawn by hand or a digital image using a colouring tool)

Table 5. Village-linked curriculum(5th ~ 7th session)

Division		Contents
5th ~ 7th session	Topic	<ul style="list-style-type: none"> • Project to know village –Village introduction material
	Achievement standards	<ul style="list-style-type: none"> • Observing the appearance of the neighbourhood, drawing, and explaining
	Time required	<ul style="list-style-type: none"> • 40 minutes for each session • Session 1: getting to know the village • Session 2: making village introduction materials • Session 3: Utilizing lego blocks
	Pre-contents	<ul style="list-style-type: none"> • Teacher: preparing the village introduction materials, information on investigation activities

		<ul style="list-style-type: none"> • Student: investigating village, expressing village
	Contents of class	<ul style="list-style-type: none"> • Getting to know the village • Making the village introduction materials with pictures and videos • Representing village buildings with Lego blocks
	Evaluation method	<ul style="list-style-type: none"> • Words and expressions for introducing the village, checking out how to express using templates and Lego blocks
	Post-contents	<ul style="list-style-type: none"> • Sharing student portfolios with bands and group chats
	Teaching aids	<ul style="list-style-type: none"> • Online PPT program, smartphone video shooting • Lego blocks
	Operation method	<ul style="list-style-type: none"> • Getting to know the village, material to introduce, representing village with Lego blocks • Shooting a village introduction video with a smartphone
	Outputs	<ul style="list-style-type: none"> • Village introduction material (online PPT program or video) • Villages and buildings made of Lego blocks

Table 6. Village-linked curriculum(8th ~ 10th session)

Division		Contents
8th ~ 10th session	Topic	<ul style="list-style-type: none"> • Experiencing local specialties
	Achievement standards	<ul style="list-style-type: none"> • Examining animals and plants that can be seen in summer and exploring their characteristics • Expressing and appreciating various animals and plants that can be seen in summer
	Time required	<ul style="list-style-type: none"> • 40 minutes for each session • Session 1: making a mushroom cultivation • Session 2: experiencing grapes harvest and expressing grapes • Session 3:experiencing apples harvest and making apple jam
	Pre-contents	<ul style="list-style-type: none"> • Teacher: preparing for the experience program, preparing for the entry program • Student: preliminary research on mushrooms, grapes and apples
	Contents of class	<ul style="list-style-type: none"> • Mushroom characteristics, cultivation environment, cultivation kit • Finding out how to harvest grapes and their characteristics • How to harvest apples and make apple jam
	Evaluation method	<ul style="list-style-type: none"> • Experiencing the village's specialties and checking the harvest methods and characteristics of mushrooms, grapes, and apples.
	Post-contents	<ul style="list-style-type: none"> • Sharing student portfolios with bands and group chats
	Teaching aids	<ul style="list-style-type: none"> • Online PPT program • Expressing specialties using entry
	Operation method	<ul style="list-style-type: none"> • Presenting data to facilitate the expression of harvest methods and characteristics of specialties using the designated template
Outputs	<ul style="list-style-type: none"> • Speciality product introduction materials (online PPT program) • Special product introduction program using the entry 	

Table 7. Village-linked curriculum(11th ~ 12th session)


Division		Contents
11th ~ 12th session	Topic	<ul style="list-style-type: none"> • Classifying animals and plants in the village
	Achievement standards	<ul style="list-style-type: none"> • Examining animals and plants that can be seen in summer and exploring their characteristics • Expressing and appreciating various animals and plants that can be seen in summer • Looking at what you can see in autumn and grouping them according to their characteristics
	Time required	<ul style="list-style-type: none"> • 40 minutes for each session • Session 1: Examing the pictures of features of plants and animals • Session 2: image classification using entry
	Pre-contents	<ul style="list-style-type: none"> • Teacher: Preparation of AI image classification program using entry • Student: Researching pictures of animals and plants
	Contents of class	<ul style="list-style-type: none"> • Collecting pictures of animals and plants that you can see in the village

		<ul style="list-style-type: none"> • Making a group using the AI classification program
	Evaluation method	<ul style="list-style-type: none"> • Checking the accuracy of image classification based on the characteristics of animals and plants in the village
	Post-contents	<ul style="list-style-type: none"> • Sharing student portfolios with bands and group chats
	Teaching aids	<ul style="list-style-type: none"> • Entry
	Operation method	<ul style="list-style-type: none"> • Collecting photos of animals and plants in the village and checking the grouping through a classification program
	Outputs	<ul style="list-style-type: none"> • A program to classify animals and plants using the entry

IV. EXCHANGE ACTIVITIES IN ONLINE CLASSES

As shown in Table 8, the Online class exchange education course consists of 2 sessions. Online class exchange activities were introduced as a way for students to communicate with students in other regions using real-time and non-real-time online services. To solve the problem of lack of social skills arising from small-scale learning, the temporal and spatial problems arising from the class exchange were solved by simultaneously utilizing the real-time output exchange method using Kakaotalk Open Chat[26] and Padlet[27] and the non-real-time output exchange method using virtual exhibition platforms. The virtual exhibition platform constructed a virtual gallery using artsteps[28] and presented village safety content and village introduction content so that the content could be accessed in non-real-time and used.

Table 8. Online class exchange activities(13th ~ 14th session)

Division	Contents
Understanding Online Services (Session 1)	Introduction and utilization of online services Real-time exchange tool: Using Kakao Open Chatting and Padlet Non-real-time exchange tool: Virtual exhibition hall using art steps Watching out for words and expressions that can be used in real-time exchanges Making an introduction video for online products Registering outputs and sharing information for class exchange with online services
Exchanging the output (Session 2)	Exchange safety contents in the village Presenting dangerous areas and campaign posters Sharing opinions on safety contents Village introduction contents exchange Introducing the village and specialities A program to classify animals and plants in the village Sharing opinions about the village
Contents of exchange	

V. CONCLUSION

This study aims to expand sociality through learning villages, expressing villages, and exchanging village contents of first and second graders in the integrated curriculum by analyzing achievement standards related to Korean, math, and integrated curriculum in 2015. In addition, in order to improve the effectiveness of classes and to produce class products that can be used for online exchange, it was intended to help students operate classes by presenting tools that can be used for each class topic, providing advantages and disadvantages, in particular, it was possible to increase

students' ICT literacy and use it as data for online exchange, through the production of outputs using SW teaching aids.

Activity plans such as knowing the village, knowing and expressing the village, experiential activities, and class exchange was presented through the design of a total of 14 curriculums. It contributed to the expansion of the sociality of small class students through real-time and non-real-time online services and online exchanges with students from other regions on the output of the curriculum. Real-time or non-real-time exchange learning focuses on receiving

feedback by continuously and regularly exchanging results and opinions of learning activities without being restricted by time and space. Therefore, students should be encouraged to actively share data and express opinions, develop an attitude to respect other people's thoughts and try to prevent restrictions on free expression and exchange through online services.

It is necessary to develop educational content and interact with students from other regions centring on the village where students live. If various attempts to minimize problems and maximize effects in the process of selecting and utilizing various tools, including SW, continue, it will help students improve ICT skills, improve the effectiveness of education, and expand the sociality of small school students.

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