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Development and Application of a Forest Education Program Using the ADDIE Model

Soyeon Kim[1], Jiwon Kim[2] and Jungkee Choi[1,*]
[1]*Department of Forest Management, Kangwon National University, Chuncheon 24345, Republic of Korea*
[2]*Department of Education, Kangwon National University, Chuncheon 24345, Republic of Korea*

Abstract

This study was conducted to develop a forest education program through middle school curriculum linkage. We used the ADDIE model, comprising the five phases of Analysis, Design, Development, Implementation and Evaluation, to secure the objectivity of the program. In the Analysis phase, middle school textbooks were analyzed while considering middle school students' needs for curriculum linkage and the developmental stages of adolescents. The Design phase focused on promoting an understanding of curriculum subjects based on what was reviewed in the Analysis phase and concretized and organized a program that can be implemented in the forest, with a focus on science and physical education, based on the results of middle school students' needs. We also established the objectives and goals of curriculum linkage forest education, established the concept of the program, and selected the educational contents, teaching-learning methods, and evaluation methods. In the Development phase, we developed a 2-night, 3-day program linkage with the middle school curriculum and created a manual for instructors and a workbook for students. In the Implementation phase, we revised and supplemented the program through the first test operation with 24 students in their second year of middle school, after which, we carried out a six-session program for the 2-night, 3-day as the second test operation with 17 students in their second year of middle school. In the Evaluation phase, the program was evaluated by the students who participated in the second test operation using questionnaires on satisfaction and curriculum linkage understanding as well as rating scales for attitudes toward forests and environmental sensitivity. The results showed that middle school students showed positive significance in satisfaction and understanding of the middle school curriculum as well as attitudes toward forests and environmental sensitivity through the forest education program.

Key Words: curriculum linkage, ADDIE model, attitudes toward forests, environmental sensitivity, forest education

Introduction

The 2015 Revised National Curriculum has paved the way toward shifting the educational paradigm to enable Korean students to grow into creative and integrative talents with humanities-based imagination, scientific techniques, and innovation to meet the needs of the times (Ministry of Education 2014). The curriculum for core competencies demanded by future society was developed such that each textbook provides core concepts and principles, rather than fragmentary knowledge, changing into a curriculum with an adequate workload to cultivate students' competencies by having them participate actively in class, such as through discussions/debates and experiments/practical exercises (Ministry of Education 2016). Moreover, the curriculum focuses on learning key competencies such as self-management competency, knowledge-information processing skills, creative thinking skills, aesthetic-emotional com-

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Corresponding author: Jungkee Choi
Department of Forest Management, Kangwon National University, Chuncheon 24345, Republic of Korea
Tel: 82-33-250-8337, Fax: 82-33-259-5617, E-mail: jungkee@kangwon.ac.kr

petency, communication skills, and civic competency, requiring students to become integrative learners in various ways. In accordance with this, the Korea Forest Service is attempting to solve the social problems of adolescents and develop their core competencies using forest education. Korea has the lowest happiness index of adolescents among the Organisation for Economic Co-operation and Development (OECD) countries. Three out of 10 adolescents have experienced severe depression, and as they grow into adults, this may lead to social problems. To resolve this issue, various educational approaches and attempts are made constantly, and forest education is receiving attention as one of the solution (Ha 2017). The vision of forest education is "to realize a green welfare nation for learning, enjoying and sharing in the forest," and the goal of forest education is to promote people's emotional cultivation and awareness of the forest's value through forest education (Korea Forest Service 2013). It is an activity that provides education so that people can understand the importance of forests by learning, experiencing, and exploring various functions of forests, acquiring knowledge about forests, and obtaining positive and righteous values. Furthermore, the effects of forest education have been proven by several studies. Song (2013) proved that forest education has mentally and psychologically positive effects and emphasizes that forest education recovers negative stress into positive emotions, enabling people to feel joy and peace (Song 2013). The Korea Forest Service (2009) published the Forest IQ 200 to provide the latest forest information that adolescents must know. Moreover, Ha and Lee (2016) surveyed satisfaction with forest education program in the Free Semester system and found that this program increased positive awareness about forests. Kim (2018) examined forest activities of elementary school students and proved that there were significant positive effects on attitudes toward forests and on personality and Lee and Choi (2004) sought directions for various forest education programs through recreational forests and Another study examined vocational high school programs for forestry education (Inoue et al. 2008). The Korea Forest Service (2014) published a book of forest education programs to supply programs that are linkaged with elementary, middle and high school curriculums and distributed it to 1,462 places. However, only the Youth Career Exploration Program, Creative Experience Activities, and Free Semester Program have been carried out which institution, whereas barely any operating agencies or forest education programs are linkaged with curriculums for adolescents in Korea.

Curriculum linkage forest education promotes an understanding of the curriculum and provides opportunities to experience various environmental resources to develop integrative thinking skills and nurture 21st-century talent. Today, as there is a need to establish a direction and find solutions for education to cultivate personality and promote the healthy growth of adolescents, as well as to provide heuristic and practical education on appreciating forests, it is necessary to socially spread curriculum linkage forest education. Currently, there are forest experience centers for young children and forest education centers outside of school, but most are experience-based or one-time events, and not enough efforts are being made to activate forest education within the regular curriculum (Korea Forest Service 2016). Recently, the US has been pursuing two key tasks of environmental education and outdoor education for preschool children to adolescents through the No Child Left Inside (NCLI) bill, and education is provided in linkage with the regular school curriculum (Shin and Chung 2015). Sweden has had forest education programs integrated into their regular curriculum for a long time, requiring all preschool children to go out into the forest for activities at least once a week on friluftsliv day. Forest education is naturally developed in elementary, middle, and high schools as well and is integrated into physical education (Lee 2016). Globally, forest education focuses on encouraging sensitivity toward nature and environmental awareness. There are growing needs to establish the direction for forest education in Korea as well to help students achieve all-around growth. Participation in current one-time programs based on forest experience has limitations in evoking the positive effects of forest education, and thus there is a need for a permanent program in association with schools, offices of education, and youth organizations. Therefore, this study develops and implements a curriculum linkage forest education program for middle school students based on a systematic instructional design model; analyzes the responses of students who participated in the process; and seeks ways to actually incorporate forest education into the school curriculum based on the need and effectiveness of the forest education program.

Materials and Methods

Procedures

This study used the five phases of the ADDIE model: Analysis, Design, Development, Implementation, and Evaluation (Molenda et al. 1996; Daryl 2006; Lee et al. 2012).

The meaning of each step of the ADDIE model is briefly described as follows: Analysis is the process of clarifying what needs to be done and identifying the needs of needs. The design specifies goals and appropriate learning materials and methods. Development is to make a specific textbook for students. Practical practice is to perform what is designed and developed directly in the classroom environment. Finally, assessments are used to modify and supplement programs using a variety of assessments (Gustafson and Branch 2002) (Fig. 1). According to Gustafson and Branch (2002), ADDIE models are systematic teaching design processes and are used in many studies. In addition, the development of the program creates specific teaching materials for students, and it is necessary to analyze their needs for the level or format of learning materials they want and reflect them in their analysis results (Oh 2018). Using the ADDIE model helps reflect the needs of learners who are consumers, rather than developing with a focus on the operator, and thus it is possible to provide a more suitable educational program (Table 1). the ADDIE model enables effective and efficient design by developing the program according to the purpose and intent of the curriculum (Park 1997; Choi 2002). Therefore, this study applied the ADDIE model to develop the program.

Research method

Analysis

Middle school textbooks were analyzed in four steps. In Step 1, we classified the subjects of each grade disclosed on the websites of 163 middle schools in Gangwon-do. In Step 2, we measured the frequency of publishers by grade and

Table 1. Forest education program development process

Phase	Program development and content
Analysis	Analyzing middle school textbooks
	Middle school students' need for curriculum linkage
	Characteristics of the developmental stages of adolescents
Design	Purpose and goal of curriculum linkage forest education
	Establishing the concept of the program
	Coming up with forms of program development
	Seeking various evaluation methods
Development	Planning a six-session program
	Creating a manual for instructors
	Creating a workbook for students
Implement	Applying the 2-night, 3-day program
	First test operation/second test operation
Evaluation	Survey on satisfaction and curriculum linkage understanding
	Feedback on results

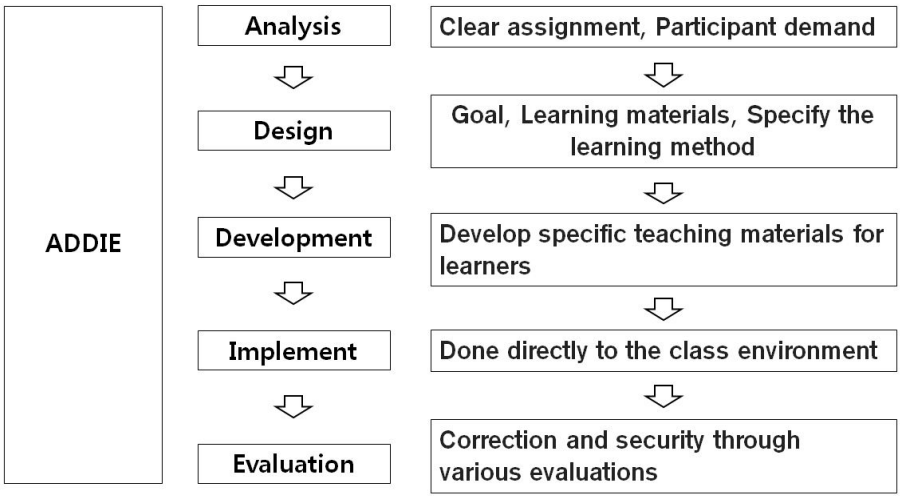

Fig. 1. ADDIE Model.

subject and selected publishers to be used in the subject analysis. In Step 3, we developed a curriculum that can be applied to forest education and included physical education integrated with physical activities according to the pre-survey on participant needs. In Step 4, we developed a program that can provide forest education using subjects with the highest applicability to the forest education curriculum developed in Step 3. To develop the program, a survey was conducted in advance to reflect the needs of middle school students in curriculum linkage, involving 127 students in their second year at C Middle School who participated in the Hoengseong SoopCheWon program on May 21, 2019. In order to reflect the demand, the same group was selected as the second grader of middle school, who decided to conduct a pilot operation. The reason for the survey was that the main character who experienced forest education was a middle school student, and it was conducted to continue the linkage of forest education by approaching it as a fun and enjoyable class through forest education related to the curriculum.

The survey comprised 14 items on gender, interest in the forest, adequate time, adequate number of participants, adequate duration, preferred season, type of learning, improvement of academic ability, programs needed, programs in which they participated, effects of forest education, need for curriculum linkage, whether it helps improve academic ability, and fields they want to learn. The questionnaire was also reconstructed by referring to the preceding study for objectivity (Korea Forest Service 2016). For effective program development, we conducted an analysis with a focus on adolescents' cognitive, psychosocial, self-initiated, and activity competencies according to age (Ma 2019). The 2015 Revised National Curriculum announced by the Ministry of Education laid the groundwork for students to grow into creative and integrative talents with humanities-based imagination, scientific techniques, and innovation to meet the needs of the times (Ministry of Education 2014). In a similar vein, in modern society, it has become important for adolescents to display social competencies based on creative thinking. Adolescents can display various competencies once they obtain positive ego identity and self-efficacy. Furthermore, adolescence is a time during which their object of identification changes, and they strongly tend to pursue the thoughts and values of homogeneous groups such as peer groups away from their parents' control and supervision. In other words, it is the time during which the new concept of ego identity and existence is expanded (Kwon and Kim 2008). Teenagers prefer dynamic experiences to static experiences, family relationships and friendships are important to achieve emotional stability and maturity, and it is effective to engage in artistic activities or appreciate them. In addition, it is a general feature that rewards them with added competition (Korea Forest Service 2016). In this study, the program was developed in consideration of these developmental stages of adolescents.

Design

The purpose of the program is to promote students' understanding about school subjects through forest education linkage with the middle school curriculum to develop the ability required to coexist with others, nature, and the community, as well as to provide opportunities for middle school students to experience and learn their curriculum. We developed the concept of the Science Tree and developed a forest education program related to this concept by reflecting the growth process of middle school students through the life history of trees. Moreover, we integrated the newly revised 2015 National Curriculum with forest activities and focused on promoting an understanding of the curriculum subjects. The growth process of trees and adolescents comprises: Seeds (Step 1), Photosynthesis (Step 2), Annual Ring (Step 3), Flowers (Step 4), Fruits (Step 5), and Coexistence (Step 6), and the program was developed with a focus on science and physical activities. The program was a six-session, Accommodation type and integrative program with a 2-night, 3-day schedule.

Development

We developed activities based on the concept of the Science Tree, such as Like the Seeds Resting, Catch the Sunlight, Growth of Trees, Hoengseong SoopCheWon Illustrated Plant Book, My Name is Larch, and Forests are the Earth Keepers, and we developed a middle school curriculum linkage program for the 2-night, 3-day schedule (Table 2). Based on the similarity between the growth process of trees and the growth process of humans, the 6th program was organized. The seed (stage 1) felt the stability and

Table 2. Six-session program plan

Step	Session	Program name	Program content	Day
Seeds	1	Like the Seeds Resting	• Inding mental stability and relieving stress with hypogastric breathing and brain breaks	Day 1
Photosynthesis	2	Catch the Sunlight	• Cientific activities of photosynthesis and transpiration • Xploring rosette plants and wildflowers	Day 1
Annual ring	3	Growth of Trees	• Ooking back on human life by observing annual rings • Ood crafts using natural objects of Hoengseong SoopCheWon	Day 2
Flowers	4	Hoengseong SoopCheWon Illustrated Plant Book	• Alancing twigs/branches • Bserving leaves, veins, and flower shapes of plants in the forest • Ake the one and only illustrated plant book in SoopCheWon	Day 2
Fruits	5	My Name is Larix kaempferi	• Rigin of Larix kaempferi and their relationship with humans • Actile play, pinecones, and natural objects	Day 2
Coexistence	6	Forests are the Earth Keepers	• Inding out about the amount of carbon at Hoengseong SoopCheWon • Xplore the herbaceous flora cluster	Day 3

tranquility of the mind as man rested in the mother's arms, and photosynthesis (stage 2) indicated that man grew up with love and care around him. The rings (stage 3) expressed human joys and sorrows, and the flowers (stage 4) meant the process of various efforts. The fruit (stage 5) symbolizes the best result of human effort, and coexistence (stage 6) expresses that humans must coexist and live together. Therefore, the program was developed according to the contents of the curriculum according to the steps. Also To increase the effects of the class, we created a manual for instructors and a workbook for students, and we selected learning and evaluation methods of middle school students.

Implementation

We improved, revised, and supplemented the program through the first test operation and applied it to the second test operation. The venue for the test operations was Hoengseong SoopCheWon. The first test operation was performed with 24 students in their second year at A Middle School on May 27 and 28 of 2019, and the second test operation was performed with 17 students in their second year at B Middle School on May 29-31 of 2019 (2-night, 3-day). The workbook for students, which was developed in advance, was used as the textbook for the class.

Evaluation

We evaluated middle school students' satisfaction with the program, curriculum linkage, attitudes toward forests, and environmental sensitivity using relevant rating scales. We rated satisfaction with the program (six items) and curriculum linkage understanding (20 items) at the end of the program. The program satisfaction and subject-linked comprehension questionnaire was produced by selecting the number of questionnaire items related to the curriculum for a program conducted for the a 3-day, 2-night. The evaluation was made on a 5-point scale, and 3 experts were verified for objectivity of the questionnaire. The present study used the attitude toward forest scale developed by Joo (2001). This scale, consisting of 12 items, was supplemented and revised to meet the situation in Korea and incorporated the elements of forest-related experience and interest reported by Wending and Wuensch (1985). In this study, the total reliability of the question was 0.921. The results showed that there was internal consistency. The environmental sensitivity of adolescents is based on the scale developed by Han (2006). Kang et al. (2011) and Park (2011) revised the scale. In this study, the total reliability of the question was 0.894. The results showed that there was internal consistency.

Data analysis

We conducted a frequency analyses on middle school textbooks and middle school students' needs using Excel. For the analysis of satisfaction with the program and curriculum linkage, we obtained the mean and standard deviation

using SPSS 23.0. For the analysis of attitudes toward forests and environmental sensitivity, we used SPSS 23.0 to compare the pretest and posttest results and performed a paired t-test, with the significance level set as $p < 0.05$.

Results and Discussion

Analysis of needs for a forest education program

The survey was administered to 127 students, and they showed a high interest in forests (78%). They responded that the adequate time for each session was 90 minutes (43%), the adequate number of participants was 2-5 persons (47%), and the adequate duration was a 2-night, 3-day

Table 3. Needs analysis results

Item	Category	No. of responses	Percentage (%)	Item	Category	No. of responses	Percentage (%)
Gender	Male	61	48	Programs they want (multiple responses)	Environment-focused	42	33
	Female	66	52		Forest-focused	29	23
Interest in forests	Yes	98	78		Ecology-focused	27	21
	No	28	22		Career linkage	18	14
Adequate time for each session	1 hr.	32	25		Curriculum linkage	9	7
	1 hr. 30 mins.	55	43		Other	3	2
	2 hrs.	30	24	Programs in which they participated (multiple responses)	Forest observation	76	31
Adequate number of participants	1 person	1	1		Forest interpretation	67	27
	2-5 persons	60	47		Forest play	34	14
	6-10 persons	30	24		Crafts using natural objects	29	12
	11-15 persons	9	7		Forest experiencing	23	9
	16-20 persons	11	9		Afforestation	14	6
	21 persons or more	15	12		None	6	1
	Non-response	1	1	Effects of forest education (multiple responses)	Instill teamwork	40	22
Adequate duration	Half a day	17	13		Relieve stress	39	22
	Full day	18	14		Promote health	38	21
	1 night, 2 days	18	14		Cultivate knowledge about nature	37	21
	2 nights, 3 days	42	33		Develop emotions	14	8
	3 nights, 4 days	22	17		Develop creativity	5	3
	1 week	9	7		Promote independence	4	2
	Non-response	1	1		Other	2	1
Preferred season	Spring	46	36	Need for curriculum linkage	Yes	95	75
	Summer	11	9		No	32	25
	Autumn	47	37	Helpful in improving academic ability	Yes	94	74
	Winter	16	13		No	33	26
	Any season	12	9	Curriculum subjects they wnat to learn	Environment	47	37
	Non-response	2	2		Physical education	38	30
Type of learning	100% indoors	13	9		Art	22	17
	100% outdoors	14	11		Science	12	9
	50% indoors+ 50% outdoors	96	76		Social studies	11	9
	Other	2	2		Mathematics	4	3
	Non-response	2	2		Other	2	2
Improvement of academic ability	Yes	94	74		Korean language arts	1	1

(33%). The season they preferred was autumn (37%), and they wanted the program to be 50% indoors+50% outdoors (76%). They also responded that forest education for middle school students helps improve academic ability (74%) and that they wanted environment-focused (33%), forest-focused (23%), and ecology-focused (21%) programs. They claimed that forest education is effective in instilling teamwork (22%), relieving stress (22%), promoting health (21%), and cultivating knowledge about nature (21%). They also responded there is a need for curriculum linkage (75%), and the linkage subject they most wanted to learn about was the environment (37%), followed by physical education (30%), art (17%), and science (9%) (Table 3). The demands of middle school students also reflected the analysis results. The program was developed for the 2nights 3days in consideration of the indoor and outdoor programs, a 90-minute class, the team's cooperation, stress relief, environment, physical education and art.

Table 4. Program satisfaction results

Activity	M	SD
Like the Seeds Resting	4.4	0.94
Catch the Sunlight	4.2	0.64
Growth of Trees and Myself	4.1	0.75
Hoengseong SoopCheWon illustrated plant book	4.1	0.83
My Name is Larix kaempferi	4.1	0.90
Forests are the Earth Keepers	4.1	0.88

Analysis of satisfaction with the forest education program and curriculum linkage understanding

After developing the program, the first trial operation was conducted for two nights and three days from May 27, 2019. The program was modified and supplemented through feedback from three experts and interviews with 24 second graders of A Middle School who participated in the pilot operation. The second trial run starts May 29, 2019 for two nights and three days, We administered a satisfaction survey to 17 students in their second year of middle school (5 males, 12 females) from the second test operation. Satisfaction with the 2-night, 3-day program was rated on a 5-point Likert scale—very dissatisfied (1 point), dissatisfied (2 points), neutral (3 points), satisfied (4 points), very satisfied (5 points)—and the results were all 4.1 or

Table 5. Curriculum linkage understanding results

Item	M	SD
I grew interested in nature and the environment.	3.76	0.75
I learned about the types of herbaceous plants.	3.65	0.79
I learned about the native wildflowers in Korea.	3.41	0.94
Forest activities relieved my stress.	4.24	0.97
The program helped me understand the process of photosynthesis.	4.12	0.99
I learned about the growth process of trees.	4.00	0.94
I learned about the origin of Larix kaempferi	3.59	1.00
I learned how to measure the height and diameter of trees.	4.12	0.78
I learned how to measure the amount of carbon.	3.88	0.99
I learned about various types of plants inhabiting Hoengseong SoopCheWon by closely observing flowers, leaves, and fruits of plants.	4.29	0.92
The program developed my scientific knowledge.	4.06	0.90
The program helped me understand the curriculum subjects.	4.06	1.20
I was satisfied with the program overall.	4.47	0.80
The program made me feel less reluctant to touch soil or trees.	3.82	1.19
Games and physical activities helped me understand the program.	4.29	0.85
The program was led by the students.	4.06	0.90
I actively participated in the program.	4.29	0.85
There was enough time to observe.	4.35	0.70
There is a need for a program linkge with curriculum subjects in the forest.	4.06	0.90
If I get the chance, I would like to participate again in a curriculum linkage program.	4.18	0.88

higher, showing satisfaction with all six activities. The students were most satisfied with Like the Seeds Resting (4.4), followed by Catch the Sunlight (4.2), and then others (Table 4). In particular, the program, like the resting of seeds, was the highest with 4.4. In the meditation place where Larix kaempferi is clustered, Danjeon breathing and brain relaxation programs were conducted. Through the program, the mind's stability and stress were relieved in the forest, and positive satisfaction with the curriculum-linked program was shown. We administered a survey to 17 students in their second year of middle school from the second test operation to determine their curriculum linkage understanding. A 5-point Likert scale was used, and most results were above average (2.5 or more). The most positive result was found in the item "I was satisfied with the program overall" (4.47), followed by "There was enough time to observe" (4.35), "I learned about various types of plants inhabiting Hoengseong SoopCheWon by closely observing

Table 6. Comparison of attitudes toward forests

Item		SD	t-test	p-value
The forest is a fun place.			-9.50	0.000
Before	3.59	0.51		
After	4.71	0.47		
The forest is filled with life.			-9.05	0.000
Before	3.88	0.49		
After	4.82	0.39		
I'm very interested in the forest.			-8.45	0.000
Before	2.94	0.75		
After	4.41	0.51		
The forest is a fun place to learn about nature.			-8.64	0.000
Before	3.71	0.77		
After	4.53	0.62		
I enjoy learning about nature in the forest more than at school.			-7.65	0.000
Before	2.88	0.99		
After	4.59	0.51		
People and other living things that live in the forest are all important.			-7.95	0.000
Before	3.47	0.78		
After	4.82	0.39		
We can't live without the forest.			-7.67	0.000
Before	3.53	0.62		
After	4.76	0.44		
People are severely destroying the forest.			-12.34	0.000
Before	3.71	0.47		
After	4.88	0.33		
We must protect the forest.			-5.19	0.000
Before	3.82	0.73		
After	4.76	0.48		
I feel comfortable and relaxed in the forest.			-4.22	0.001
Before	3.18	0.88		
After	4.47	0.62		
I love going to the forest.			-2.30	0.035
Before	3.35	1.22		
After	4.06	0.90		
I feel gratitude toward the forest.			-4.76	0.000
Before	3.65	0.79		
After	4.65	0.49		

flowers, leaves, and fruits of plants" (4.29), "Games and physical activities helped me understand the program" (4.29), "I actively participated in the program" (4.29), and "Forest activities relieved my stress" (4.24) (Table 5). On the other hand, interest in nature and the environment, the types of herbaceous plants, native Korean wildflowers, Larix kaempferi stories, carbon-measurement methods and rejection of natural contact are not solved by short-term forest education. It means there is a need for continuous curriculum linkage. As a result of the study by Song (2018), the school forest experience program showed an effect on improving the attitude toward science to students, showing similar results to this study. The students were interested in the forest experience program and found that the satisfaction was also high. Through this, it was found that it improved with a positive attitude toward the subject.

Effects of forest education activities on middle school students' attitudes toward forests

To determine the effects of the middle school curriculum linkage forest education program on middle school students' attitudes toward forests, we conducted an analysis on 17 middle school students from the second test operation (Table 6). We compared the changes in attitudes before and after the program and found that the mean of attitudes toward forests increased with statistical significance from 3.48 to 4.62 in the 12 items ($p < 0.05$).

Like the study, Kim (2018) and Kim (2019) also showed positive results in their attitudes toward the forest after experiencing the forest.

Effects of forest education activities on middle school students' environmental sensitivity

To determine the effects of forest education activities on middle school students' environmental sensitivity (Table 7), we compared the changes before and after the program and found that the mean increased with statistical significance from 3.28 to 3.45. There was no significant difference before and after the program in items such as "I don't stop in my tracks to observe small living things," "I don't look up to see a tall tree out of habit," and "If I find a TV program on the environment while flipping through the channels, I stop and watch the program," but overall, it was found that the diverse activities in the 2-night, 3-day forest education program were effective in increasing middle school students' environmental sensitivity. Similar results were found by Kang et al. (2011), who determined that activities using the school forest had positive effects on forming environmental sensitivity and environmentally friendly attitudes of elementary school students.

Conclusions and Suggestions

To develop a curriculum linkage forest education program for middle school students, we used the ADDIE model and applied the five phases of Analysis, Design, Development, Implementation, and Evaluation in developing the program, which we applied to students in their second year of middle school. The results are as follows. First, in the Analysis phase, we analyzed the middle school curriculum in four steps and examined the students' needs for forest education in detail with 14 items. Moreover, we conducted a comprehensive analysis considering the developmental stages of adolescents to develop a curriculum linkage program specialized for adolescents. Second, in the Design phase, we concretized the program with a focus on science and physical education based on the contents reviewed in the Analysis phase. We classified the growth process of trees and adolescents into Seeds (Step 1), Photosynthesis (Step 2), Annual Ring (Step 3), Flowers (Step 4), Fruits (Step 5), and Coexistence (Step 6), and we established the goal and theme of the program. Third, in the Development phase, we developed a six-session, integrative, and unit-based program fit for the 2-night, 3-day schedule, and we created a manual for instructors and a workbook for students to promote an understanding about forest education. In addition, programs suitable for forest experience education were developed through analysis of middle school textbooks and youth demand analysis. Fourth, in the Implementation stage, we revised and supplemented the program through the first test operation with 24 students in their second year of middle school, and then, applied the program to the second test operation with 17 students in their second year of middle school. Fifth, in the Evaluation phase, we rated middle school students' satisfaction with the program, curriculum linkage understanding, attitudes toward forests, and environmental sensitivity. Most items showed positive results in sat-

Table 7. Comparison of environmental sensitivity

Item		SD	t-test	p-value
It's better to watch TV than to go outside and into the fields.			-7.21	0.000
After	2.29	0.92		
Before	3.82	0.73		
There is a plant I really want to grow.			-4.64	0.000
After	3.06	0.83		
Before	4.18	0.73		
Bugs and insects are creepy and gross.			-2.64	0.018
After	3.71	1.16		
Before	4.53	0.62		
I don't stop in my tracks to observe small living things.			-2.55	0.022
After	2.71	1.05		
Before	3.53	1.18		
I'm so happy to see trees that I want to say hi whenever I see one.			-4.52	0.000
After	2.18	0.95		
Before	3.24	0.90		
I look forward to the pleasant experience of coming across a stream as I walk in the forest.			-3.51	0.003
After	2.76	1.20		
Before	4.18	1.01		
Stars in the sky make me feel happy.			-3.85	0.001
After	3.82	0.88		
Before	4.65	0.49		
I don't look up to see a tall tree out of habit.			-3.36	0.004
After	1.76	1.03		
Before	2.82	1.07		
Nature has many secrets and rules.			-1.16	0.264
After	4.12	0.70		
Before	4.41	0.87		
My favorite color is green (or other shades of green).			-3.17	0.006
After	3.00	1.41		
Before	4.12	0.60		
I want to live near a forest or where there are trees.			-1.85	0.083
After	3.41	0.87		
Before	3.94	0.90		
I have my own knowledge about certain things like trees or insects.			-1.00	0.332
After	2.71	1.26		
Before	2.76	1.25		
There are many things around us that I want to observe.			-1.66	0.116
After	2.76	1.25		
Before	3.35	1.50		
I prefer books on nature, insects, and plants than children's literature, traditional fairy tales, or biographies of great people.			-0.72	0.483
After	2.59	0.87		
Before	2.88	1.36		
I look around me, curious about the cause of environmental pollution.			-1.14	0.270
After	3.35	1.06		
Before	3.82	1.19		
I think there are fewer and fewer creatures living around my school.			-0.34	0.735
After	4.06	0.90		
Before	4.18	1.07		

Table 7. Continued

Item		SD	t-test	p-value
If I see a child or an adult acting cruel to an animal, I tell them to stop.			-2.02	0.060
After	3.59	1.00		
Before	4.24	0.75		
I want to collect insect nests to observe insects.			-1.85	0.083
After	1.94	0.83		
Before	2.47	1.28		
If I find a TV program on the environment while flipping through the channels, I stop and watch the program.			-1.62	0.125
After	2.47	1.50		
Before	3.29	1.21		
I help out to reduce behaviors that damage plants or animals.			-3.57	0.003
After	3.59	0.87		
Before	4.41	0.71		

isfaction with the program and curriculum linkage understanding, and the comparison of changes before and after the program showed significant results in attitudes toward forests and environmental sensitivity. This is consistent with the findings that participating in ecological activities improved attitudes toward forests (Choi and Ha 2015), and such improved attitudes of adolescents toward forests are expected to affect their interest and attention in similar forest activities as well. This is also similar to the findings by Kang et al. (2011), who found that forest activities have positive effects on the increase of elementary school students' environmental sensitivity, and the findings by Kang and Kim (2012), who found that forest activities significantly increased preschool children's environmental sensitivity.

This study has significance as it proved that the curriculum linkage forest education program promotes middle school students' curriculum understanding and is effective in improving attitudes toward forests and environmental sensitivity, thereby verifying the positive effects and importance of forest education. The results proved that various forest activities in the 2-night, 3-day program, which provided experiences that are difficult to encounter in everyday life, increased the students' interest and attention in the forest and the environment, while also promoting their understanding about school curriculum subjects.

The results of this study are intended to provide basic data to develop and promote curriculum linkage forest education programs for adolescents. Meanwhile, this study also has limitations in that the effects of the program are difficult to be generalized because there were only a few respondents who participated in the program satisfaction survey.

A few suggestions can be made based on the results of this study, as follows. First, this study was conducted with students in their second year of certain middle schools, but the subjects must be expanded to other regions and middle schools nationwide so that the results can be generalized. Second, the objective of this study is to use forest education in promoting students' understanding in their curriculum subjects through various programs linkage with the middle school curriculum. However, by reflecting the results on the policy beyond perceiving the importance of forest education linkage with the curriculum, it would be possible to make use of various types of forests that make up 64% of the Korean territory. Furthermore, based on this linkage, it is necessary to establish the direction to develop forest education programs.

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