Development and Operational Test of the Free Semester Program Education in Arboreta and Botanical Gardens: Focusing on ‘Gardener for a Day’ Program in Korea National Arboretum

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ABSTRACT

As part of the free semester program, the ‘Gardener for a day’ program in the Korea National Arboretum was newly developed in 2018. The program was developed as a free semester program reflecting the works of a ‘gardener’ who performs the planning, preparation, maintenance and management of exhibition gardens. This ‘Gardener for a day’ program was applied to a total of 106 middle school students in October 2018. Educational elements were extracted from Korea National Arboretum exhibition gardens and career exploration of gardeners. The program was designed to provide education on theory and practices, including watching the gardener video, visiting the gardener booth, meeting with actual gardeners at Korea National Arboretum, visiting two exhibition gardens, and participating in three types of practical training as a gardener. A survey about program satisfaction and education was conducted after the program to analyze the students’ satisfaction with the program (contents, management, instructor), free semester program (career planning, occupational attitude, independence), and education (awareness of forest biospecies, preservation will). The analysis showed that the following results: satisfaction with the program (score 4.0), free semester program (score 3.8), and education (score 4.0). Comparative analysis of the pretest-posttest questionnaires showed that there were significant educational effects in career planning, occupational attitude, and awareness of forest biospecies.

Keywords: career experience, gardening, Korea National Arboretum educational program, one-day program

Introduction

According to the ‘Middle School Free Semester Program Action Plan’ announced in 2015, the free semester program has been implemented in all middle schools in Korea since 2016 (Korea Educational Development Institute, 2015). As a result, issues have been raised about the limited term, which led to the ‘Middle School Free Semester Program Expansion and Development Plan’ in 2018, and currently the free semester program for one year (two semesters) is operated in over 1,500 schools in Korea (Kim and Kim, 2018). The ‘Free semester program activities’ in the free semester program are comprised of four types of activities (career exploration, elective activities, art and sports, club

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activities) (Lee, 2018). Career exploration in particular requires specialized programs, human resources and connection to local resources since various career-related experiences are needed. However, there is insufficient social consensus about the system, as well as stable support of the budget and human resources (Lee, 2018). Therefore, it is necessary to build a social infrastructure that can provide active support and provide a specialized free semester education program by a national institution in order to expand and develop the free semester system and secure diversity and expertise of career exploration activities (Yun et al., 2018).

People's view of the forest is constantly changing (Lee et al., 2008). As the national demand for forest services is recently growing in terms of not only leisure but various other fields such as therapy and education, there is a need for policies to provide complex forest environment services combining multiple fields such as experience, therapy and education in addition to just creating recreation forests and forest parks (Seok and Ahn, 2013). According to the '2nd Comprehensive Plan for Forest Education' announced by the Korea Forest Service in 2018, the number of participants in forest education increased by 93% from 1.71 million in 2013 to 3.3 million in 2017, which shows that the national interest in forest education is continuously increasing (Korea Forest Service, 2018). Accordingly, the Korea Forest Service attempted to expand forest education in schools by operating a related free semester program education in addition to building an educational infrastructure to promote forest education. However, it is still not enough to meet the national demand, and thus it is necessary to continuously build new infrastructures and expand the scope of forest education (Korea Forest Service, 2018).

Korea National Arboretum has been running the 'Botanist for a day' program since 2012 as a career experience program, and then the 'Entomologist for a day' program since 2016 as the free semester program began to be implemented, the purpose of which is to help students directly experience the jobs at Korea National Arboretum and have the chance to explore their career paths. In addition, they are also operating various programs for participants to explore the arboreta and feel closer to the forests by learning the importance of forest creatures, such as the forest school, exploring rare endemic plants, and one-day forest interpreter experience. With the implementation of the free semester program in 2018, the Arboretum Education Center of the Korea National Arboretum is constantly developing various free semester education program.

Arboreta and botanical gardens are facilities that collect, grow, preserve and exhibit plants, and must cultivate plants with records and manage them professionally. Korea National Arboretum has 6,344 species of plants (Korea National Arboretum, 2019), and exhibition and preservation of such plants are considered important duties. The plants are gathered by theme and taxonomic group, and cultivated in the exhibition garden, which is managed by experts and used as research materials through monitoring. To this end, those who perform duties such as collecting, growing, cultivating, exhibiting and recording plants in arboreta and botanical gardens are referred to as 'gardeners' (Korea National Arboretum, 2004; Kim, 2011). Chollipo Arboretum claimed that arboreta need management specialists, or gardeners, with knowledge and expertise about exhibition gardens and plant physiology (Chollipo Arboretum, 2009). However, there is insufficient research on gardeners that are specialized in duties required by arboreta and botanical gardens (Jeong, 2013). This study developed and test-operated a free semester program career experience program for students to directly and indirectly experience the practical affairs of gardeners at arboreta and botanical gardens for specialized career experience, and even promote their awareness in forest biospecies. The research questions are as follows.

First, with what elements will the program be organized for efficient gardener experience?

Second, what educational effects would the program have on participating students?

Research Methods

Program development

This study developed and test-operated a ‘Gardener for a day’ program at arboreta and botanical gardens in the following order: analyzing and extracting the elements of education related to gardeners, designing and developing the program, test-operating the program and analyzing the statistics. The initial proposal is drawn up under the theme of ‘gardener’ in four types such as one-day programs (2 hours, 4 hours) and multiple-day programs (three-day, five-day) (Table 1), and the one-day program (2 hours) was used in test operation. The instructional design of the ADDIE mode¹⁾ was used to develop the program for test operation (Table 2), and the specific details of each step are shown in ‘Results and Discussion.’

Selection of education contents related to Korea National Arboretum exhibition gardens

Korea National Arboretum is managing 25 exhibition gardens in the area of 1,120ha for efficient plant exhibition, and has 3,344 species of plants in the exhibition gardens and 3,000 species of plants in the Tropical plant resources research center. To provide education in the outdoor space of specialized exhibition gardens where the plants are cultivated during the ‘Gardener for a day’ program, we monitored the exhibition gardens in September 2018 to determine the plant species, plant conditions, circulation of exhibition gardens, and risk factors. The objectives of the ‘Gardener for a day’ program are as follows: 1) learn about and visit Korea National Arboretum and exhibition gardens, 2) learn about and perform the role of gardeners at Korea National Arboretum exhibition gardens to promote understanding about gardeners, and 3) obtain the opportunity for career exploration as a gardener at Korea National Arboretum (Table 3). The program is test-operated in 2018 and the contents of education are organized based on the exhibition themes of the Rare & endemic plant garden and Tropical plant resources research center (Tables 3 and 4).

Table 1. Models of educational ‘Gardener’ program in Korea National Arboretum

Category	Program 1	Program 2	Program 3	Program 4
Participants	Middle school students			
Type	One-day	One-day	Three-day	Five-day
Place	Korea National Arboretum	Korea National Arboretum	Korea National Arboretum	Korea National Arboretum (three days) and school (two days)
Total duration	2 hours	4 hours	12 hours	20 hours
Level of difficulty	General career experience		Advanced career experience	
General outline	Visiting two exhibition gardens	Visiting three exhibition gardens	Visiting six exhibition gardens	Visiting six exhibition gardens
	Participating in three experiences	Participating in five experiences	Participating in nine experiences	Participating in twelve experiences
	40 minute classroom learning	60 minute classroom learning	180 minute classroom learning	300 minute classroom learning

¹⁾ The ADDIE model is based on the theory by Sels and Richey who classified the instructional design process and elaborated by multiple instructional designers. It establishes the general procedures of developing educational programs and is thus a verified model that is generally applied (Kang, 2013).

Table 2. ADDIE model of ‘Gardener for a day’

ADDIE		Details						
Analysis	Teaching elements extraction	1) Extraction of educational elements for the searching of forest biology in free semester program from a gardener’s work 2) Analysis of a gardener’s work based on season and exhibition garden characteristics in order to extract educational elements						
		1) Education types are organized by combining theory and practice for students to experience a gardener’s work directly or indirectly						
Design	Program design to experience a gardener’s work	<table><tr><th>Type</th><th>Elements</th></tr><tr><td rowspan="3">Directly</td><td>-Collecting seeds -Sowing/planting -Monitoring plants</td></tr><tr><td rowspan="3">Indirectly</td><td>-Viewing a gardener’s work video -Viewing actual gardener work -Classroom learning using teaching materials</td></tr></table>	Type	Elements	Directly	-Collecting seeds -Sowing/planting -Monitoring plants	Indirectly	-Viewing a gardener’s work video -Viewing actual gardener work -Classroom learning using teaching materials
		Type	Elements					
		Directly	-Collecting seeds -Sowing/planting -Monitoring plants					
			Indirectly	-Viewing a gardener’s work video -Viewing actual gardener work -Classroom learning using teaching materials				
				2) Set the program as a short-term course by reflecting the characteristics of the free semester education program				
Development	Program development for free semester education program	1) Producing a ‘gardener video’ that includes the work of gardener of the Korea National Arboretum 2) Producing a ‘gardener booth’ where participants can view tools and watch the gardening works of the gardener 3) Producing ‘learning materials’ with educational elements of the Korea National Arboretum						
Implementation	Pilot application	Applied to middle school students (106 total)						
Evaluation	Statistical analysis using SPSS	Analysis of program satisfaction in terms of free semester program and education						

Extraction of educational elements and program planning in terms of gardener career experience in arboreta and botanical gardens

To come up with educational elements in terms of gardener career experience in arboreta and botanical gardens, details were discussed with field specialists and plant experts. Based on that, we set the scope of the gardener’s job at arboreta and botanical gardens to include monitoring for research in addition to forming, maintaining, fixing and managing exhibition gardens. The educational elements in terms of career experience that can be directly and indirectly experienced by students were extracted, considering the level of students as well as the program operation period within the scope of the gardener’s job. The program was designed to include watching the ‘gardener video’, visiting the ‘gardener booth’, meeting the ‘Korea National Arboretum gardener’, visiting two specialized exhibition gardens, and participating in three types of practical training as a gardener. Throughout the entire program, the students participated along with an instructor to explain necessary theories, and also used activity sheets as training aids to help them understand (Table 4).

Subjects of test operation

The participants for the ‘Gardener for a day’ program were recruited in September 2018, and the program was test-operated twice on students at two middle schools that participated in October 2018 (Table 5). Total 106 valid copies of the questionnaire were used among those from the pretest-posttest survey to analyze the satisfaction in education and educational effects.

Table 3. Characteristics of ‘Gardener for a day’ program

Category	Contents
Participants	Middle school students
Type / Duration	One-day / 2 hours
Month	October
Place	Korea National Arboretum exhibition gardens (Rare & endemic plant garden, Tropical plant resources research center)
Teaching objectives	1) Students learn about the Korea National Arboretum and the Korea National Arboretum exhibition centers and visit the places. 2) Students learn about a gardener’s role in the exhibition gardens and understand a gardener’s work through experience. 3) Give the opportunity to explore the path of becoming a gardener for the Korea National Arboretum to students

Table 4. Contents of the ‘Gardener for a day’ program

Category	Time	Program contents
Introduction	10:00 to 10:15	1) Filling out a pre-questionnaire 2) Watching the ‘gardener video’
Stage 1	10:15 to 10:35	3) Defining the gardener of the Korea National Arboretum 4) Explaining the work of gardeners of the Korea National Arboretum 5) Hands-on experience of gardener tools and watching planting steps in a gardener booth
Stage 2	10:35 to 11:05	6) Meeting the actual gardeners from the Korea National Arboretum and listening to talks about gardening 7) Learning how to irrigate plants and introduced to the greenhouse environmental measurement device ‘Dotori’ 8) Practice greenhouse environmental measurement
Stage 3	11:05 to 11:25	9) Monitoring of blossoming flowers in Rare & endemic plant garden 10) Explanation of scientific name of plants and how to label plants
Stage 4	11:25 to 11:50	11) Collecting plant seeds directly and observing seed maturity 12) Sowing the collected seeds
Finish	11:50 to 12:00	13) Finishing program 14) Filling out a post questionnaire

Method of analyzing the educational effects of the program

To investigate the satisfaction and educational effects of Korea National Arboretum’s free semester education program, this study revised and improved the relevant free semester program questionnaire (Korea Forest Service, 2016; National Institute of Ecology, 2014; Lee et al., 2017). The participants responded to the survey twice, once each before and after the program, to examine their satisfaction with the program as well as the educational effects. The pretest-posttest questionnaire included certain equivalent items regarding the free semester program and education, while items related to satisfaction in the operation of the program were included only in the posttest questionnaire. The free semester program category included three variables such as career planning, occupational attitude and independence, and the education category included two variables such as awareness of forest biospecies and conservation will, which were used to investigate and analyze the awareness of the participants before and after the program. The items were

rated on a 5-point Likert scale (1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree), and SPSS (Statistical Package for the Social Sciences) ver. 23.0 is used to conduct reliability analysis, descriptive statistics, and paired samples t-test. The survey items are as shown in Tables 6, 7 and 8. The Cronbach's α was higher than .6, and thus the items had suitable reliability.

Results and Discussion

Program development

The initial proposal was drawn up in four types such as one-day programs (2 hours, 4 hours) and multiple-day programs (three-day, five-day) (Table 1), and the one-day (2 hours) program was used in test operation considering the hours of the Korea National Arboretum free semester program and the travel time of participating students (Tables 2-4). The 'Gardener for a day' program was carried out based on the steps of the ADDIE model: analysis, design, development, implementation, and evaluation. As the tools to enhance efficiency of the program, we developed the 'gardener video' and 'gardener booth' and included them in the program for indirect gardener experience of the participants. The 'gardener video' was 5 minutes long, made based on the job as a gardener at Korea National Arboretum, including actual

Table 5. The general characteristics of the participants (N = 106)

Location of middle school	Participants			Program date
	School year	Gender	Number of participants	
Pocheon-si	1st	Male	24	October 2, 2018
		Female	26	
Namyangju-si	1st	Male	19	October 5, 2018
		Female	37	

Table 6. Questionnaire items and reliability (N = 106)

Variable	Item	M ^z	Cronbach's α
In terms of satisfaction	1) I was satisfied with the overall content of the program.	4.0	.791
	2) While participating in the program, I felt joy and excitement.		
	3) I want to participate in other programs at the Korea National Arboretum.		
	4) The running time of the program was appropriate.		
	5) The number of people per class was appropriate.		
	6) I was satisfied with the teaching material.		
In terms of free semester program	7) The teacher communicated well and formed a good rapport with us.	4.0	.866
	8) The teacher answered questions faithfully.		
	9) The teacher took full advantage of the teaching material.		
In terms of free semester program	10) I learned about diverse careers related to forest biology.	3.9	.816
	11) I want to know more about majors related to biology and forest resources.		
	12) I want to study and find a career in forest biology.		
	13) Participating in this program has helped me choose my dream and career.		
Total		4.0	.880

^z5-point Likert scale answers were used.

Table 7. An analysis of activity preferences in ‘Gardener for a day’ program (N = 106)

Variable	Item	Frequency (percent)
Preferred activity	1) Sowing seeds in a plastic seedling tray	29 (27.4%)
	2) Collecting plant seeds	25 (23.6%)
	3) Learning about irrigation methods for tropical plants	20 (18.9%)
	4) Visiting a gardener booth	12 (11.3%)
	5) Monitoring of the flowering of rare and endermic plants	11 (10.4%)
	6) Plant-growing environment survey in a greenhouse	9 (8.5%)
	Total	106 (100%)
Reason to preferred activity	7) It was good to be able to observe the soil and plants and to touch them in person.	35 (33.0%)
	8) It was good to experience a gardener’s actual work.	33 (31.1%)
	9) It was good to have a close experience of the nature.	22 (20.8%)
	10) It was good to be able to visit the Korea National Arboretum.	16 (15.1%)
	Total	106 (100%)

Table 8. Pre-post questionnaire comparison analysis (N = 106)

Variable	Item	Pre		Post		
		M ^z	Cronbach's α	M ^z	Cronbach's α	
Free semester program	Career planning	1) Choosing and planning my carer is important.	3.6	.842	3.8	.893
		2) I need to prepare now for my career.				
		3) Think specifically about what to do now to achieve your future hope.				
		4) I have my own plan for realizing my dream.				
		5) I have a plan to gain various experiences for the future.				
	p = .018*					
	Occupational attitude	6) My life could be different depending on what occupation I have.	3.7	.931	4.2	.939
		7) Any occupation has both its merits and demerits.				
		8) Any occupation is difficult but rewarding.				
	p = .000***					
	Independence	9) My career is my choice and I am responsible for the consequences.	3.9	.742	3.9	.830
		10) The career problem (selection of occupation), I try to decide for myself.				
		11) I try to work myself out as much as I can if something rather difficult happens.				
p = .975						
Forest education	Forest species awareness	12) I like the forest.	3.3	.631	3.9	.845
		13) Life in the forest is precious.				
		14) It is fun to meet and observe living things in person in the forest.				
		15) I feel alive when I'm in the woods.				
		p = .000***				
	Conservation will	16) Forest life is something that must coexist with us.	4.1	.763	4.2	.846
		17) I don't chop flowers and trees recklessly to protect and preserve plants.				
		18) The conservation and preservation of forest life (including rare plants) should be made.				
	p = .105					

^z5-point Likert scale answers were used.

* $p < .05$, *** $p < .001$.

photos of gardeners and brief descriptions. The students were to watch the video before the program to help them understand the program. The ‘gardener booth’ exhibited the plant growing task that is the most fundamental job of the gardener, as well as the tools used by gardeners to promote understanding about the gardener’s job. The students participated in the program in the following order: filling out the pretest questionnaire → watching the ‘gardener video’ → visiting the ‘gardener booth’ → meeting and training with the gardener (Tropical plant resources research center) → monitoring the blossoming of plants (Rare & endemic plant garden) → collecting plant seeds and seeding → filling out the posttest questionnaire. The program was led by the instructor’s explanations, and activity sheets were used as training aids to promote students’ understanding. At the Tropical plant resources research center, the students met with an actual gardener, listened to the explanation about how to water plants and manage the plant environment, and actually measured the environment in the greenhouse. The students were to perceive the difference in managing various plants by explaining the difference in watering tillandsia and cactus. The students also learned how to control the environment within the greenhouse by being introduced to the low-power integrated environmental measurement device ‘Dotori’, thereby realizing the importance of environmental control in plant management and promoting understanding about the gardener’s job. At the Rare & endemic plant garden, the students monitored the blossoming of *Asteraceae* plants that are flowered, through which they could experience the tasks related to the research. They were to also increase their awareness about forest biospecies by explaining about rare and endemic plants. Finally, they actually experienced the tasks of collecting seeds and seeding, thereby encountering the plants in the exhibition gardens closer and actually experiencing the growth method of plants, and could increase their interest in the gardener’s job.

The ‘Gardener for a day’ program that was test-operated was designed to include outdoor training activities such as collecting seeds and seeding, but these activities have limitations due to weather conditions. Thus, a substitute indoor program was also designed to replace the other program in order to increase flexibility of operation (data not shown).

Satisfaction and preference survey results

As a result of analyzing the satisfaction with the program through the posttest survey of the ‘Gardener for a day’ program, the mean of each variable was higher than neutral (score 3.0) in both program operation (Score 4.0) and instructor (Score 4.0) (Table 6).

As a result of the preference survey on various missions within the program, ‘Sowing seeds in a plastic seedling tray (27.4%)’ showed the highest frequency, followed by ‘Collecting plant seeds (23.6%)’, ‘Learning about irrigation methods for tropical plants (18.9%)’, ‘Visiting a gardener booth (11.3%)’, ‘Monitoring of the flowering of rare and endemic plants (10.4%)’, and ‘Plant-growing environment survey in a greenhouse (8.5%)’ (Table 7). The reason for preference was because they could ‘It was good to be able to observe the soil and plants and to touch them in person (33.0%)’, followed by ‘It was good to experience a gardener’s actual work (31.1%)’, ‘It was good to have a close experience of the nature (20.8%)’, and ‘It was good to be able to visit the Korea National Arboretum (15.1%)’ (Table 7). The students that participated in the test operation of the program showed high satisfaction because they could gratify their curiosity about the ‘gardener’ job after the program and also meet their expectations about experiencing the forest, arboreta and plants.

Free semester program and educational aspect analysis results

As a result of analyzing the educational effects in the three variables ‘career planning’, ‘occupational attitude’ and ‘independence’ in terms of the free semester program through the pretest-posttest questionnaire of the ‘Gardener for a day’ program, there were significant effects in ‘career planning’ and ‘occupational attitude’ (Table 8). This shows that there

were secondary educational effects for students to reconsider their career paths and dreams and polish up their attitudes toward jobs by giving them the chance to understand and experience the job as a gardener. This result proves that this ‘Gardener for a day’ program has educational effects in the free semester program because it is a career experience program, even for students who are not interested in forests or gardeners.

As a result of analyzing ‘awareness of forest biospecies’ and ‘preservation will’ in terms of education, there were significant educational effects in ‘awareness of forest biospecies’ (Table 8). The first item of the ‘awareness of forest biospecies’ category, ‘I like forests’, showed the greatest mean increase from 3.1 to 3.7 after the program (data not shown). The mean scores all increased in various items of the same category, which suggests that the ‘awareness of forest biospecies’ increased as students encountered various types of plants such as tropical, rare and endemic plants by participating in the program and indirectly perceived the importance of biospecies during the explanation about the gardener’s duties. ‘Preservation will’ already had a high mean of the three items at 4.1 in the pretest survey and did not show much of a gap between and after the program, thereby not having significance.

Conclusion

This study developed and test-operated the free semester program job experience program that helps understand Korea National Arboretum and exhibition gardens, learn about gardeners, and directly and indirectly experience their practical affairs. The development steps were based on the ADDIE model, and the program was comprised of watching the gardener video, visiting the booth, meeting with a gardener at Korea National Arboretum, visiting two exhibition gardens, participating in three types of the actual gardener’s practical training, and listening to the instructor’s explanations. Activity sheets were also used as training aids. After test-operating on 106 students in two middle schools in October 2018, the results and effects of the program were analyzed using the SPSS Statistics ver. 23.0 statistical program. The results are as follows.

First, this study has significance in developing and test-operating the free semester program job experience program based on the tasks and duties of gardeners at Korea National Arboretum, one of the jobs actively engaged in the field by planning, forming, maintaining and managing the exhibition gardens. As a result of the preliminary survey for research, there were two career experience programs for adolescents related to gardeners in 2017-2018 (Yun et al., 2018). Korea National Arboretum’s free semester program ‘Gardener for a day’ program provided students with an opportunity to gain career experience in the field of forestry and learn about gardeners in arboreta and botanical gardens. The Arboretum Education Center of Korea National Arboretum will continue to run programs related to gardeners by developing various related programs and carry out research and publicity about careers and jobs.

Second, the ‘Gardener for a day’ program contributes to the purpose of the free semester program that helps students find their own dreams and talent, cultivate future-oriented competencies such as creativity, character and sociality, and enjoy a happy school life by enabling students to experience and understand the new job of a gardener and promote awareness about ‘perceiving and preserving forest biospecies’. Korea National Arboretum provides education focusing on plants as the source of the ecosystem, and emphasizes education on preserving biodiversity (Yoon et al., 2013). Thus, the program is expected to produce effects that meet the purpose of the free semester program (Korea Educational Development Institute, 2015) that aims to cultivate future-oriented competencies such as creativity and character, in addition to providing career experience.

The following suggestions can be made based on the results. We intend to design and apply various versions of the ‘Gardener for a day’ program in further research. It is necessary to continuously provide career experience opportunities

regarding gardeners at arboreta and botanical gardens in order to activate the free semester program and expand the scope of career experience in forestry. To this end, there must be continuous review of the testing tools to investigate the satisfaction and educational effects of the program for analysis and development after applying various versions of the program. Furthermore, we will attempt to operate the ‘Gardener for a day’ program as a long-term program. Operating this program in the long run will not only help promote understanding about the job as a gardener through continuous experiences but also produce effective results in terms of preserving forest biospecies.

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