Components for Early Childhood Horticultural Education Program derived from Expert Delphi Research

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ABSTRACT

Background and objective: This study was conducted to identify the components of kindergartener horticultural education by deriving objective components of horticultural education using the Delphi survey method, and then to provide basic data that can be used when creating horticultural programs in the regular curriculum.

Methods: A total of 32 experts including professors of early childhood education, kindergarten directors, horticultural therapy professors, and horticultural therapists were selected as the Delphi panel. Of the 32 selected, only 29 answered all three rounds of the surveys. For the first round of the survey, an open-ended questionnaire, was used, and in the second and third rounds closed-ended questionnaires were used.

Results: Results indicated that under the category of the goals of horticultural education, there were 7 items related to the current problems of horticultural education, 16 items related to the need for horticultural education in the smart age, 18 items related to the direction of horticultural education, and 5 items related to the areas most suitable for horticulture education for young children in the Nuri Curriculum. Results in the category of the implementation of horticultural education indicated that 2 items related to horticultural education hours, 3 items related to the venue for horticultural education, 2 items related to the activity types applicable to the Nuri Curriculum, and 4 items related to the objects of horticultural activities were derived. As the current problems of horticultural education, the following items were identified: event-oriented activity (M = 4.24) and lack of kindergarten teachers' opportunities for systematic gardening education (M = 4.21). The results related to the necessity of horticultural education indicated the following items: education on respect for life through caring (M = 4.59), emotional intelligence and stability (M = 4.55), directly experience of the growth process of plants (M = 4.55), and development of the five senses (M = 4.55). Finally, within the direction of horticultural education: nurturing the desire to live with nature (M = 4.50), and learning about life (M = 4.44) was identified, which had higher averages. Within the areas of the Nuri Curriculum, which is most consistent with horticultural education, nature exploration (M = 4.69) and the integration of all areas (M = 4.59) were derived as priorities. Also, regarding the implementation of horticultural education, the following items were derived as the priority from the expert group: 30–40 minutes (M = 4.14) and 40–50 minutes (M = 4.14) for class periods, outdoor garden in a kindergarten (M = 4.66) for the venue of gardening education, outside play (M = 4.59) for the activity type, and vegetable crops (M = 4.55) for the objects of gardening activities.

Conclusion: It is significant that the goal and implementation of kindergartener horticultural education were objectively derived through collecting opinions of expert panels. Based on the results of this study, a horticultural education program for kindergarten teachers should be implemented.

Keywords: horticultural programs, Nuri Curriculum, outside play, vegetable crops

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Introduction

In May 2011, to strengthen the state's responsibility for early childhood education and childcare, a common course was announced by integrating and unifying the contents of education and childcare for five-year-olds. The Ministry of Education (ME) and the Ministry of Health and Welfare (MOHW) enacted and announced the “Nuri Curriculum for 5 Year Olds” as a “Common Course” in September 2011, and the Curriculum has been implemented in common for all 5-year-olds attending kindergartens and daycare centers since March 2012. After that, the Ministry of Education reorganized the play-oriented curriculum focused on infants as the main content of the “Innovative Plan for Early Childhood Education,” and announced the “2019 Revised Nuri Curriculum.” The Nuri Curriculum covers five areas: physical exercise and health, communication, social relations, art experience, and nature exploration, and the revised Nuri Curriculum helps teachers to educate and care for preschoolers with a focus on children's play (ME, 2019; MOHW, 2019).

Recently, research has been actively conducted in a number of fields using the Delphi analysis method. Studies in the field of early childhood education are also being conducted through an expert Delphi analysis; some of these include *Development of coexistence literacy instrument based on the early childhood education for sustainable development* (Kim and Hong, 2015); *A fundamental study for the development of a pre-training program supporting pre-service kindergarten teacher's kindergarten practicum* (Kim, 2016); *Development of evaluation scale for the early childhood education policy based on Delphi survey* (Kim and Hwang, 2015); *A Delphi study of teaching goals and content of relationship-oriented happiness for young children* (Kim and Kim, 2015).

As a study using Delphi analysis in the field of horticulture, evaluation indicators for improving the performance of horticultural therapy gardens were derived, and the evaluation items were prioritized by typing and stratification of the indicator (Ahn and Park, 2018). Base data for the elements of horticultural therapy evaluation indices were developed, and a total of 98 items were derived from four realms (Im et al., 2012).

Meanwhile, Kang (2016) reported that teachers could overcome difficulties and regain their confidence as teachers through a process of developing and teaching a “forest personality activity program” in connection with daycare centers targeting pre-service early childhood teachers, indicating that gardening activities that the teachers recognize and experience are important. A 2019 study of kindergarten and daycare teachers who carried out the revised Nuri Curriculum found that a play-centered curriculum for children was valuable to children and teachers, but teachers were at a loss as to how to handle the curriculum without standards or guidelines for them to refer to in the early stages of its introduction (Cho, 2020). This suggests that standards or guidelines for teachers on horticultural education based on the Nuri Curriculum are needed.

Research using the Delphi technique is steadily increasing in the field of early childhood education for the purpose of tool development or program development (Kim et al., 2018), and it is also being used as a method to derive the elements of evaluation indicators in the field of horticultural education. Therefore, this study was conducted to provide data that enables horticultural education to be appropriately applied to the field of early childhood education, by deriving components of the goals and implementation of horticultural education based on a Delphi survey performed targeting a group of horticultural and early childhood education experts.

Research Methods

Delphi survey

In this study, a Delphi survey was conducted targeting experts to identify the components necessary for a kindergarten horticultural education program. The Delphi analysis is a method used to achieve a consensus, and can improve the quality and reliability of information through the participation of experts; the structure of repetitive surveys in multiple rounds has the advantage of allowing experts to present their opinions freely by ensuring anonymity, and enabling experts who are difficult to gather in one place to participate at the same time (Sung, 2016). Although the

Delphi technique is composed of subjective opinions, which are the collective judgments of experts, it is more reliable than individual opinions, and the result obtained by a consensus of opinions of several people has the premise of being objective (Kim et al., 2018).

Selecting an expert panel

In a Delphi study, the expertise of the expert panel and the number of panelists are both important (Lee, 2001). An expert panel was selected by deliberately sampling professors of early childhood education, early childhood-related field experts who run kindergartens or are teachers, professors in horticulture departments related to horticultural therapy, and those who have received horticultural or early childhood-related education as a welfare horticultural therapist and have extensive practical experience. In terms of the number of expert panelists participating in the Delphi study, it was found that it was necessary to select at least 10 panelists to minimize the error of a small group of experts and maximize the reliability of the group (Noh, 2006); if such group consisted of 13 experts or more, there was no problem related to reliability (Hahm, 2012). In this study, we recruited a panel consisting of a total of 32 experts, explained the purpose and analysis method of the study, and conducted 3 rounds of surveys. Of these 32 experts, 29 panelists responded to all rounds of the survey. An analysis of 91 studies published in academic journals in South Korea in the field of early childhood education in which the Delphi method was used found that in 21.35% of the studies, the panel consisted of 26-30 experts, while 20.22% had 21-25 experts (Kim, et al. 2018), confirming that the 29 panelists used in this study is sufficient to secure reliability.

Questionnaire composition

The questionnaire in the 1st round was composed of open-ended questions, allowing the opinions of experts related to the goals and implementation of horticultural education to be freely described. The 2nd round of the survey was conducted with a closed-ended questionnaire. The composition is as follows: each question was described in sentences based on the results of the first questionnaire,

and its suitability was evaluated on a 5-point scale by respondents (panelists); if the panelists had additional opinions, they could freely describe them. In the 3rd round of the survey, questions consisting of average results of the 2nd survey were presented, and the suitability of each question was evaluated on a 5-point scale.

Delphi Survey

Delphi surveys were conducted over three rounds from September 10 to October 20, 2020 through social networking services (SNS) and E-mail.

Data analysis

The questionnaires collected from the Delphi surveys, consisting of three rounds, were analyzed by calculating the mean, standard deviation, median, interquartile range, content validity ratio (CVR), consensus, convergence, and reliability for each round using the IBM SPSS v.19.0 program. Reliability was confirmed by Cronbach's α coefficient.

Results and Discussion

Demographic characteristics of expert panel

Looking at the demographic characteristics of the expert panel, out of a total of 29 panelists, 3 were male and 26 were female, meaning that the ratio of females was significantly high (89.7%) (Table 1). By age bracket, the group consisted of 13 people in their 50s (44.8%), 11 in their 40s (37.9%), 3 in their 30s (10.3%), and 1 in their 20s, or 60s or older (3.4%). In terms of educational experts, the panel included 8 professors of early childhood education (27.6%), 6 professors of horticultural science (20.7%) with research experience in the field of horticultural therapy, and 8 kindergarten directors (27.6%) as field experts, as well as 7 horticultural therapists (24.1%). As the group was composed entirely of degree holders, including 15 holders of doctorate degrees (51.7%), 13 holders of master's degrees (44.8%), and 1 bachelor's degree holder (3.4%), it was considered that the panel's expertise in related fields was secured. The proportion of those with 15

Table 1. Demographic characteristics of survey respondents (N = 29)

Item	Type	n(%)	Total number(%)
Gender	Male	3 (10.3)	29(100%)
	Female	26 (89.7)	
Age	20's	1 (3.4)	29(100%)
	30's	3 (10.3)	
	40's	11 (37.9)	
	50's	13 (44.8)	
	Over 60	1 (3.4)	
Occupation	Professor of early childhood education	8 (27.6)	29(100%)
	Professor of horticulture (horticultural therapy)	6 (20.7)	
	Early childhood education specialist (director)	8 (27.6)	
	Horticultural therapist	7 (24.1)	
Education level	Doctoral degree	15 (51.7)	29(100%)
	Master degree	13 (44.8)	
	Bachelor's degree	1 (3.4)	
Education career	5-10 years	8 (27.6)	29(100%)
	10-15 years	5 (17.2)	
	15-20 years	7 (24.1)	
	20-30 years	7 (24.1)	
	over 30 years	2 (6.9)	
Main regions where they worked	Busan city	1 (3.4)	29(100%)
	Chungcheongbuk-do	1 (3.4)	
	Chungcheongnam-do	1 (3.4)	
	Daegu city	12 (41.4)	
	Gyeonggi-do	1 (3.4)	
	Gyeongsangbuk-do	4 (13.8)	
	Gyeongsangnam-do	3 (10.3)	
	Jeollanam-do	1 (3.4)	
	Seoul city	5 (17.2)	

years or more of education experience was 55.1%, indicating that the panel had a wealth of relevant education experience, and the breakdown by work experience is as follows: 8 people with 5-10 years of education experience (27.6%), 7 people with 15-20 years (24.1%), 7 people with 20-30 years (24.1%), and 2 people with more than 30 years (6.9%). The distribution of expert panelists by the main region in which they worked is as follows: 12 people in Daegu (41.4%), 5 in Seoul (17.2%), 4 in Gyeongsangbuk-do (13.8%), 3 in Gyeongsangnam-do (10.3%), and 1 person each in Gyeonggi-do, Busan, Jeollanam-do, Chungcheongbuk-do, and Chungcheongnam-do (3.4%).

Delphi survey round 1

The questionnaire for Delphi survey round 1 was composed of questions about the elements necessary for establishing the goals of and implementing horticultural education, in an open-ended form that would allow the expert panelists to describe their opinions more freely. In Delphi survey round 1, the panel of experts presented various opinions. The opinions presented in sentence form were structured through a process of extracting and comparing keywords from them carried out by three experts separately (one doctor and a PhD candidate in horticultural science, and one doctor in early childhood education). As a result,

Table 2. Results on the goals of horticultural education by Delphi survey round 1 (N = 32)

Content	Category	No. of item	Total
Current problems of horticultural education	Horticultural education environment	3	20
	Horticultural program	6	
	A kindergarten teacher	3	
	Horticultural therapist	2	
	Kindergarten student	6	
The need for horticultural education in the smart age	Emotional development	7	26
	Cognitive development	1	
	Creativity development	1	
	Social development	5	
	Physical health promotion	2	
	Environmental education	2	
	Scological education	3	
	Convergence education	1	
	Future horticulture industry	4	
The Direction of horticultural education	Nature, Ecological Education	5	19
	Emotional development	6	
	Ecological education	2	
	Environmental ducation	2	
	Cognitive development	2	
	Acquisition of plant knowledge	1	
	Creativity development	1	
Horticulture education for Nuri Curriculum	the integration of all areas	1	5
	Physical Exercise and Health	1	
	Social relations	1	
	Art experience	1	
	Nature exploration	1	
Total			70

a total of 70 question items for survey round 2 were derived (Table 2).

The goal items of horticultural education were structured into the problems, ‘smart’ era-focused needs, and direction of horticultural education for early childhood, and the areas of horticultural education that best match the Nuri Curriculum. The expert panel presented various opinions on the problems of horticultural education for kindergarten students, such as “one-off horticultural education focused on a specific day,” “children being afraid of soil and gardening tools,” etc. Regarding the need for horticultural education in the ‘smart’ era, they suggested “cognitive, emotional, creativity, and social development,” and on the direction of horticultural education, “respect for life, understanding

nature, emotional development through horticultural activities, etc.” On the areas of horticultural education that best fit the Nuri Curriculum, they suggested the area of “physical development.” Taken together, a total of 20 items were derived from the problems of horticultural education, including 3 items for horticultural education environment, 6 for horticultural programs, 2 for kindergarten teachers, and 6 for kindergarten students. From the need for gardening education in the smart era, a total of 26 items were derived: 7 items for emotional development, 1 for cognitive development, 1 for creativity development, 5 for social development, 2 for physical health and its improvement, 2 for environmental education, 3 for ecological education, 1 for integrated education, and 4 for future horticultural industry.

From the direction of horticultural education, a total of 19 items were derived, including 6 items for emotional development, 5 for nature and ecology education, and 2 each for integrated education, environmental education, and cognitive development. From the horticultural education areas that best fit the Nuri Curriculum, a total of 5 items were derived: 1 item each for the integration of all areas, physical exercise and health, social relations, art experience, and nature exploration. In Delphi survey round 1, the experts agreed that kindergarten horticultural education was needed in the 'smart' era, and mentioned emotional development (7 items) as the need that most fits the course; even regarding the direction of horticultural education, the items cited most often were related to emotional development (6 items). Therefore, the expert panel considered emotional development to be most important in horticultural education for early childhood.

Based on the method, class periods and place of horticultural activity, and the type of activities and objects related to the Nuri Curriculum, which was suggested in a study on the preference of early childhood teachers in gardening

activities through conjoint analysis (Jeong et al., 2020), question items for the implementation of horticultural education consisted of class periods and a venue suitable for the education, and activity areas and objects of the Nuri Curriculum; a total of 18 were derived (Table 3). As for class periods of horticultural education, it was suggested that "25 minutes is appropriate considering the concentration capacity of preschoolers" and "about 60 minutes is adequate for creative activities." Regarding the venue for horticultural education, opinions included that "It can be done anywhere", "The rooftop of the kindergarten can be used" and "Safety cannot be secured on the rooftop." As for the type of activities in the Nuri Curriculum, opinions included "Those can be operated in integrating of all areas," "Free choice of kindergarten students is important," etc. For the objects of horticultural activity, "helping to improve diet through vegetable crops" was suggested. Putting these together, for class periods of horticultural education, a total of 4 items were derived, including 20 to 30 minutes, 30 to 40 minutes, 40 to 50 minutes, and more than 60 minutes; as the venue for horticultural education,

Table 3. Results on the implementation of horticultural education by Delphi survey round 1 (N = 32)

Content	Category	No. of item	Total
Class period	20-30 minutes	1	4
	30-40 minutes	1	
	40-50 minutes	1	
	60 minutes	1	
Place	Any place is possible	1	6
	An outdoor garden in kindergarten	1	
	A rooftop garden in kindergarten	1	
	An outdoor garden or forest outside of kindergarten	1	
	An out-of-kindergarten playground	1	
	Indoor place of kindergarten	1	
Activity type	Any activity.	1	4
	A large and small group	1	
	Free selection	1	
	Outside play	1	
Object	All Targets Possible	1	4
	Fruit crops	1	
	Vegetable crops	1	
	Floricultural crops	1	
Total			18

a total of 6 items were derived, such as outdoor garden of kindergarten, rooftop garden of kindergarten, outdoor garden or forest other than kindergarten, playgrounds other than kindergarten, and indoor space of a kindergarten. For activity type of the Nuri Curriculum, a total of 4 items were derived: any activities regardless of type, large and small group, free choice, and outdoor play; for objects of horticultural activities, a total of 4 items were derived: all objects, fruit trees, vegetables, and flowers. Through analyzing class periods of gardening activities preferred by kindergarten teachers through conjoint analysis, it was found that their preferred class period for gardening activities was 30 minutes (Jeong et al., 2020), but the expert panel presented various class periods, ranging from 20 to 60 minutes. This is considered to be due to the fact that not only kindergarten teachers but also horticultural education experts and horticultural therapists participating in the expert group presented their opinions on horticultural education hours.

As described above, based on the Delphi survey round 1 performed targeting the expert panel, a total of 88 items were derived, including 70 items for the goals of horticultural education and 18 items for the implementation of horticultural education.

Delphi survey round 2

The questionnaire for Delphi survey round 2 is presented in the form of sentences with 88 items derived from the experts' opinions suggested in round 1, and structured to score each item on a 5-point Likert scale from 1 point (very inappropriate) to 5 points (very appropriate). Through the analysis of Delphi survey round 2, we confirmed the reliability of the contents of horticultural education goals, and all were found to be at a reliable level, as follows

(Table 4): the problems of horticultural education (Cronbach's $\alpha = .867$), the need for horticultural education in the smart era (Cronbach's $\alpha = .889$), and the direction of horticultural education (Cronbach's $\alpha = .926$), and the horticultural education areas that most fit the Nuri Curriculum (Cronbach's $\alpha = .720$).

The minimum CVR value is determined according to the number of participating experts (Lawshe, 1975; Sung 2016). As 32 experts participated in Delphi survey round 2, the minimum CVR value applied was .33 or more (Lawshe, 1975) for 30 experts. When the expert consensus level was .75 or more and the convergence level was .50 or less, it was judged that the expert panel's opinions formed a consensus (Sung, 2016). Based on this, in this study, the opinions of experts were determined to be a consensus when the following conditions were satisfied: content validity of .75 or higher, convergence level of .50 or lower, and minimum CVR value of .33 or higher. As a result, for the problems of horticultural education, it was found that the expert panel reached a consensus on a total of 7 items: activities focused on a specific day, event-oriented activities, kindergarten teachers' lack of awareness of the need for horticultural education, kindergarten teachers' lack of professional knowledge on horticultural education, insufficient systematic gardening, education opportunities for kindergarten teachers and differences in the content and level of classes according to the competence of horticultural education experts (Table 5).

As the minimum values of consensus, convergence, and content validity were confirmed in relation to the need for horticultural education in the smart era, a consensus among the expert panel was derived for 18 items (Table 6). The items derived from expert consensus are as follows: nurturing the desire to live with nature, emotional intelligence and stability, social development, experiencing the growth

Table 4. Reliability analysis of the results from Delphi survey round 2

Item	Content	No. of items	Cronbach's α
Goals	Current problems of horticultural education	20	.867
	The need for horticultural education in the smart age	26	.889
	The direction of horticultural education	19	.926
	Areas that best correspond to horticultural education for infants in the Nuri Curriculum (example presentation)	5	.720

Table 5. Results on the problems of horticultural education by Delphi survey round 2 (N = 32)

Category	M	SD	Med	QD		A ^z	B ^y	CVR ^x	Pass
				25%	75%				
Proceeding around a specific day	3.66	0.94	4	3	4	1.00	0.00	0.44	○
Event activity	4.03	1.15	4	4	5	0.75	0.50	0.56	○
Outcome-oriented experience activities	3.50	1.22	4	2.25	4	1.00	0.00	0.19	
Lack of space	3.50	1.11	3	3	4	0.67	0.50	0.06	
Lack of time	3.28	1.02	4	2	4	1.00	0.00	0.06	
Fear of tools and soil	2.84	1.02	3	2	4	0.67	0.50	-0.38	
Risk of safety accidents	2.75	1.02	3	2	3	1.00	0.00	-0.63	
Lack of awareness of horticultural education among kindergarten teachers	3.66	0.90	4	3	4	1.00	0.00	0.38	○
Lack of professional knowledge of horticultural education for kindergarten teachers	4.09	0.47	4	4	4	1.00	0.00	0.88	○
Lack of systematic educational opportunities for gardening for kindergarten teachers	4.38	0.61	4	4	5	0.75	0.50	0.88	○
Lack of horticulture experts	4.00	0.76	4	4	4.75	0.81	0.38	0.56	○
Differences in horticultural education Professionals' capabilities	3.84	0.95	4	4	4	1.00	0.00	0.56	○
Learning-oriented education	3.50	0.98	4	3	4	1.00	0.00	0.06	
Lack of application skills for convergence education	3.75	0.88	4	3	4	1.00	0.00	0.31	
Lack of horticultural program	3.69	0.90	4	3	4	1.00	0.00	0.31	
Be short on concentration	2.81	1.09	3	2	4	0.67	0.50	-0.44	
The lack of physical activity in infants	2.53	1.05	2	2	3	0.50	0.50	-0.63	
Lack of motivation for infants	2.87	1.13	2.5	2	4	0.40	0.75	-0.19	
Infants' lack of awareness of plants	3.00	1.19	3	2	4	0.67	0.50	-0.31	
Budget problems	3.50	1.08	4	3	4	1.00	0.00	0.13	

^zThe closer to 1, the more valid^yThe closer to 0, the more valid^xValid when the value is 0.33 and over.

process of plants and the joy of harvesting, cognitive development, physical activity development, learning respect for life through caring, expanding gardening activities into various areas of play, emotional stimulation and sensibility development, holistic development, five senses development, increased creativity of early childhood, awakening human instincts through contact with nature, improvement of early childhood diet, improvement of environmental pollution problem, change of curriculum from human-centered to ecology-centered, parents' education and their awareness of gardening, the necessity of convergence education in the smart era. In particular, emotional intelligence and stability were found to have high content validity (CVR = 1.00), confirming the importance of horticultural education.

For the direction of horticultural education, 19 items derived from Delphi survey round 1 were presented, and the experts reached a consensus on 18 items (Table 7). The items derived through expert consensus are: nurturing the desire to live with nature, curiosity about the process of plant growth and learning about life, promoting holistic development of preschoolers, recognizing the value of life, understanding biodiversity, feeling and expressing the beauty of nature, developing a positive attitude toward sustainable development, providing opportunities for preschoolers to understand themselves, understanding the importance of the environment, psychological health and stability, ethics for care, increasing problem-solving skills in the caring process, being considerate in the caring process,

Table 6. Results on the need for horticultural education in the smart age by Delphi survey round 2 (N = 32)

Category	M	SD	Med	QD		A ^z	B ^y	CVR ^x	Pass
				25%	75%				
Providing a life with nature	4.50	0.80	5	4	5	1.00	0.00	0.94	○
Emotional Intelligence and Emotional Stability	4.56	0.50	5	4	5	1.00	0.00	1.00	○
provide social development	4.31	0.82	4	4	5	0.75	0.50	0.88	○
Active response to the changing times	3.84	0.85	4	3	4.75	0.81	0.38	0.25	
Experience the growth process of plants firsthand	4.50	0.80	5	4	5	1.00	0.00	0.94	○
Providing cognitive development for infants	4.06	0.62	4	4	4	1.00	0.00	0.69	○
To promote physical control and development	4.28	0.58	4	4	5	0.75	0.50	0.88	○
Life-respecting education through care	4.44	0.56	4	4	5	0.75	0.50	0.94	○
Extendable to a wide range of plays	4.13	0.71	4	4	5	0.75	0.50	0.63	○
Because it can increase sensitivity.	4.38	0.55	4	4	5	0.75	0.50	0.94	○
Universal development	4.28	0.52	4	4	5	0.75	0.50	0.94	○
Five senses development	4.28	0.52	4	4	5	0.75	0.50	0.94	○
The growth of creativity in infants	4.00	0.57	4	4	4	1.00	0.00	0.69	○
Knowing Human Instincts	3.94	0.88	4	3.25	4.75	0.81	0.38	0.50	○
Instinct to return to nature	3.69	0.90	4	3	4	1.00	0.00	0.19	
Peer attachment formation	3.72	0.92	4	3	4	1.00	0.00	0.19	
The improvement of the diet of kindergartener	4.06	0.76	4	3.25	5	0.75	0.50	0.50	○
Possible daily life	3.69	0.90	4	3	4	1.00	0.00	0.06	
Improve environmental pollution	3.84	0.92	4	3	4.75	0.81	0.38	0.38	○
Function of beautifying the surrounding environment	3.63	0.83	4	3	4	1.00	0.00	0.13	
Ecological-Oriented curriculum	4.25	0.76	4	4	5	0.75	0.50	0.75	○
Accurate recognition of consumers in the future horticultural Industry	3.69	0.82	4	3	4	1.00	0.00	0.19	
Parents education and their awareness of gardening	3.84	0.88	4	3	4.75	0.81	0.38	0.44	○
Need a tour of smart farms	3.63	0.79	4	3	4	1.00	0.00	0.19	
Recognition of automation in the production of horticultural plants	3.19	1.00	3	3	4	0.67	0.50	-0.06	
The need for convergence education	3.81	0.90	4	3	4	1.00	0.00	0.50	○

emotional intelligence and cultivation, building healthy eating habits, convergence education, creativity enhancement, physical, mental and cognitive growth and balanced development, acquiring knowledge about plants. The items of understanding the plant growth process and learning about life (CVR = 1.00) and recognizing the value of life (CVR = 1.00) were found to have high content validity.

In terms of horticultural education areas that best fit the Nuri Curriculum, the expert panel reached a consensus on all five items, including the integration of all areas, physical exercise & health, sociality, art experience, and nature exploration (Table 8).

Regarding the implementation of horticultural activities,

the experts reached consensus on 2 possible class periods, which were 30-40 minutes and 40-50 minutes. As the venue for horticultural activities, the experts reached consensus on three items: the outdoor garden in kindergarten, the rooftop garden in kindergarten, and the outdoor garden or forest other than kindergarten (Table 9). For the objects of gardening activity, the experts reached consensus on all 4 items, including all objects, fruit crops, vegetables, and flowers.

As a result of Delphi survey round 2, a total of 60 items were drawn: 48 items from the goals of horticultural education, and 12 from the implementation of horticultural education.

Table 7. Results on the direction of horticultural education by Delphi survey round 2 (N = 32)

Category	M	SD	Med	QD		A ^z	B ^y	CVR ^x	Pass
				25%	75%				
Improving the mind of living with nature	4.50	0.57	5	5	5	1.00	0.00	0.94	○
Learning about life	4.44	0.50	4	4	5	0.75	0.50	1.00	○
promote universal development	4.09	0.73	4	4	5	0.75	0.50	0.69	○
Recognizing the value of life	4.44	0.50	4	4	5	0.75	0.50	1.00	○
Understanding biodiversity	4.16	0.68	4	4	5	0.75	0.50	0.69	○
Feeling and expressing the beauty of nature	4.41	0.56	4	4	5	0.75	0.50	0.94	○
Attitude toward sustainable development	4.03	0.86	4	4	5	0.75	0.50	0.44	○
Opportunity to understand oneself	3.69	0.82	4	4	4	1.00	0.00	0.06	
Understand the importance of the environment	4.19	0.54	4	4	4.75	0.81	0.38	0.94	○
Feeling happy	4.28	0.73	4	4	5	0.75	0.50	0.81	○
To learn the ethics of care	4.31	0.59	4	4	5	0.75	0.50	0.88	○
Increase problem-solving skills	4.16	0.63	4	4	5	0.75	0.50	0.75	○
Learning to be considerate	4.25	0.51	4	4	5	0.75	0.50	0.94	○
Emotional intelligence, emotional cultivation	4.22	0.71	4	4	5	0.75	0.50	0.81	○
A healthy diet	4.13	0.71	4	4	5	0.75	0.50	0.63	○
Learning convergence	3.84	0.68	4	4	4	1.00	0.00	0.38	○
Creativity enhancement	3.97	0.60	4	4	4	1.00	0.00	0.63	○
holistic development	4.09	0.78	4	4	5	0.75	0.50	0.63	○
knowledge and skill in plants	4.09	0.64	4	4	4.75	0.81	0.38	0.69	○

Table 8. Results on the area of Nuri course consistent with horticultural education by Delphi survey round 2 (N = 32)

Category	M	SD	Med	QD		A ^z	B ^y	CVR ^x	Pass
				25%	75%				
integration of all areas	4.38	0.61	4	4	5	0.75	0.50	0.88	○
Physical Exercise and Health	4.03	0.65	4	4	4	1.00	0.00	0.63	○
Social relations	3.97	0.65	4	4	4	1.00	0.00	0.56	○
Art experience	4.00	0.72	4	4	4.75	0.81	0.38	0.50	○
Nature exploration	4.53	0.62	5	5	5	1.00	0.00	0.88	○

Delphi survey round 3

The questionnaire for Delphi survey round 3 was presented in sentences with 60 items derived from the suggestions made by the experts in round 2. Based on the result of Delphi survey round 2, the mean and the interquartile range (IQR) containing 50% of respondents were presented, and the experts were asked to rate the importance. Ratings were structured on a 5-point Likert scale from 1 (very inappropriate) to 5 (very appropriate). Through the Delphi analysis round 3, the contents of horticultural educa-

tion goals were found to be at a reliable level for all items (Table 10) as follows: Cronbach's $\alpha = .749$ for the problems of horticultural education, Cronbach's $\alpha = .927$ for the need for horticultural education in the smart era, Cronbach's $\alpha = .910$ for the direction of horticultural education, and Cronbach's $\alpha = .623$ for the horticultural education areas that best match the Nuri Curriculum (Table 10).

In the 3-round questionnaire, as 29 experts participated in the final survey, the minimum CVR value applied was within the range of 0.37 for 25 persons and 0.33 or more for 30 persons (Lawshe, 1975). When the content validity,

Table 9. Results on the implementation of horticultural education by Delphi survey round 2 (N = 32)

Item	Category	M	SD	Med	QD		A ^z	B ^y	CVR ^x	Pass
					25%	75%				
Time	20-30 minutes	3.50	1.05	3.5	3.5	4	0.86	0.25	0.00	
	30-40 minutes	3.72	0.85	4	4	4	1.00	0.00	0.38	○
	40-50 minutes	3.69	0.82	4	4	4	1.00	0.00	0.38	○
	60 minutes	3.50	1.08	4	4	4	1.00	0.00	0.13	
Place	All places	3.81	0.93	4	4	4.75	0.81	0.38	0.31	
	Outdoor garden in kindergarten	4.47	0.51	4	4	5	0.75	0.50	1.00	○
	Rooftop garden in kindergarten	4.06	0.56	4	4	4	1.00	0.00	0.75	○
	Outdoor garden or forest outside of kindergarten	4.09	0.93	4	4	5	0.75	0.50	0.56	○
	Out-of-kindergarten playground	3.78	0.94	4	4	4	1.00	0.00	0.31	
	Indoor place of kindergarten	3.53	0.95	3.5	3.5	4	0.86	0.25	0.00	
Activity type	All activities	3.62	1.04	4	4	4	1.00	0.00	0.19	
	Large and small group	3.87	0.75	4	4	4	1.00	0.00	0.56	○
	Free selection	3.84	0.57	4	4	4	1.00	0.00	0.50	○
	Outside play	4.41	0.62	4	4	5	0.75	0.50	0.88	○
Object	All objects	4.06	0.98	4	4	5	0.75	0.50	0.38	○
	Fruit crops	3.88	0.71	4	4	4	1.00	0.00	0.63	○
	Vegetable crops	4.50	0.57	5	5	5	1.00	0.00	1.00	○
	Floricultural crops	4.31	0.74	4	4	5	0.75	0.50	0.81	○

Table 10. Reliability analysis of the results from Delphi survey round 3

Item	Content	No. of items	Cronbach's α
Goals	Current problems of horticultural education	7	.749
	The need for horticultural education in the smart age	18	.927
	The direction of horticultural education	18	.910
	Areas that best correspond to horticulture education for infants in the Nuri Curriculum (example presentation)	5	.623

convergence, and minimum CVR value were satisfied, it was judged that the experts had reached a consensus (Table 11). Through Delphi survey round 3, it was found that the expert panel reached a consensus on a total of 7 items as problems of horticultural education: activities focused on a specific day, event-oriented activities, teachers' lack of awareness of the need for horticultural education, kindergarten teachers' lack of professional knowledge of horticultural education, insufficient systematic gardening education opportunities for kindergarten teachers, lack of horticultural experts in early childhood education, and differences in the content and level of classes according to the competence of horticultural education experts. Event-oriented activities

(M = 4.24) and the lack of kindergarten teachers' opportunities for systematic gardening education (M = 4.21) had a higher mean among the above items. Through Delphi survey round 3 targeting the experts, it was confirmed that kindergarten teachers' lack of opportunities for systematic gardening education was a problem in the application of horticultural education.

Regarding the need for horticultural education in the smart era, the consensus, convergence, and minimum CVR value were confirmed, and the expert panel reached a consensus on 16 items (Table 12). The derived items are as follows: providing a life with nature, emotional intelligence and stability, social development, experiencing the growth

process of plants and the joy of harvesting, cognitive development, physical activity development, education on respect for life through caring, expanding gardening activities into various areas of play, emotional stimulation and sensibility development, holistic development, development of

the five senses, awakening human instincts through contact with nature, improvement of early childhood diet, improvement of environmental pollution problems, changes in curriculum from human-centered to ecology-centered, and need for convergence education in the smart era. Looking at the

Table 11. Results on the problems of horticultural education by Delphi survey round 3 (N = 29)

Category	M	SD	Med	QD		A ^z	B ^y	CVR ^x	Pass
				25%	75%				
Proceeding around a specific day	3.93	0.70	4	3	4	0.75	0.5	0.45	○
Event activity	4.24	0.74	4	4	5	0.75	0.5	0.66	○
Lack of awareness of horticultural education among kindergarten teachers	3.93	0.70	4	3	4	0.75	0.5	0.45	○
Lack of professional knowledge of horticultural education for kindergarten teachers	4.03	0.63	4	4	4	1	0	0.66	○
Lack of systematic educational opportunities for gardening for kindergarten teachers	4.21	0.62	4	4	5	0.75	0.5	0.79	○
Lack of horticulture experts	4.10	0.67	4	4	5	0.75	0.5	0.66	○
Differences in horticultural education professionals' capabilities	3.97	0.87	4	3.5	5	0.625	0.75	0.52	○

^zThe closer to 1, the more valid.

^yThe closer to 0, the more valid.

^xValid when the value is not less than 0.33 and not less than 0.37.

Table 12. Results on the need for horticultural education in the smart age by Delphi survey round 3 (N = 29)

Category	M	SD	Med	QD		A ^z	B ^y	CVR ^x	Pass
				25%	75%				
Providing a life with nature	4.41	0.91	5	4	5	0.80	0.50	0.59	○
Emotional Intelligence and Emotional Stability	4.55	0.69	5	4	5	0.80	0.50	0.79	○
provide social development	4.1	0.67	4	4	5	0.75	0.50	0.66	○
Experience the growth process of plants firsthand	4.55	0.74	5	4	5	0.80	0.50	0.86	○
Providing cognitive development for kindergartener	4.1	0.77	4	4	5	0.75	0.50	0.66	○
To promote physical control and development	4.17	0.71	4	4	5	0.75	0.50	0.66	○
Life-respecting education through care	4.59	0.73	5	4	5	0.80	0.50	0.86	○
Extendable to a wide range of plays	4.28	0.75	4	4	5	0.75	0.50	0.79	○
Because it can increase sensitivity.	4.38	0.68	4	4	5	0.75	0.50	0.79	○
Universal development	4.31	0.81	4	4	5	0.75	0.50	0.72	○
Five senses development	4.55	0.69	5	4	5	0.80	0.50	0.79	○
The growth of creativity in kindergartener	4.14	0.79	4	3.5	5	0.63	0.75	0.52	
Knowing human instincts	4.21	0.68	4	4	5	0.75	0.50	0.72	○
The improvement of the diet of kindergartener	4.21	0.68	4	4	5	0.75	0.50	0.72	○
Improve environmental pollution	4.14	0.74	4	4	5	0.75	0.50	0.59	○
Ecological-oriented curriculum	4.34	0.67	4	4	5	0.75	0.50	0.79	○
Parents need education and horticulture awareness	4.07	0.75	4	3.5	5	0.63	0.75	0.52	
The need for convergence education	4.1	0.90	4	3	5	0.50	1.00	0.45	○

priority according to means, it was found to be prioritized in the order of education on respect for life through caring ($M = 4.59$), emotional intelligence and stability ($M = 4.55$), direct experience of plant growth process ($M = 4.55$), and five senses development ($M = 4.55$).

As for the direction of horticultural education, the mean and the interquartile range (IQR) containing 50% of respondents were presented for 18 items derived from Delphi survey round 2. Through an analysis of the experts' rating of those based on a 5-point Likert scale, consensus was found to have been reached on all items (Table 13). The items derived through consensus include: nurturing the desire to live with nature, curiosity about the process of plant growth and learning about life, promoting the holistic development of preschoolers, recognizing the value of life, understanding biodiversity, feeling and expressing the beauty of nature, attitude toward sustainable development, opportunity for preschoolers to understand themselves, understanding the importance of the environment, psychological health and stability, ethics for caring, increasing problem-solving ability in the caring process, being consid-

erate in the caring process, emotional intelligence and cultivation, building healthy eating habits, convergence education, creativity enhancement, physical, mental and cognitive growth and balanced development, and acquiring knowledge about plants. Looking at the priorities with higher means, they were found to be ranked in the order of nurturing the desire to live with nature ($M = 4.50$), learning about life with curiosity about the process of plant growth ($M = 4.44$), and recognizing the value of life ($M = 4.44$).

In terms of the horticultural education areas that are most consistent with the Nuri Curriculum, it was found that a consensus among the experts was reached on all five items, including the integration of all areas, physical exercise and health, sociality, art experience, and nature exploration (Table 14). In this study, the integration of all areas was found to have higher content validity ratio ($CVR = 1.00$) as the experts' consensus in Delphi survey round 3, confirming the importance of horticultural activities in the integration of all areas.

In the implementation of horticultural activities, the experts reached a consensus on 2 items for class periods,

Table 13. Results on the direction of horticultural education by Delphi survey round 3 ($N = 29$)

Category	M	SD	Med	QD		A ^z	B ^y	CVR ^x	Pass
				25%	75%				
nurturing the desire to live with nature	4.50	0.57	5	5	5	1.00	0.00	0.94	○
Learning about life	4.44	0.50	4	4	5	0.75	0.50	1.00	○
Promote universal development	4.09	0.73	4	4	5	0.75	0.50	0.69	○
Recognizing the value of life	4.44	0.50	4	4	5	0.75	0.50	1.00	○
Understanding biodiversity	4.16	0.68	4	4	5	0.75	0.50	0.69	○
Feeling and expressing the beauty of nature	4.41	0.56	4	4	5	0.75	0.50	0.94	○
Attitude toward sustainable development	4.03	0.86	4	4	5	0.75	0.50	0.44	○
Understand the importance of the environment	4.19	0.54	4	4	4.75	0.81	0.38	0.94	○
Feeling happy	4.28	0.73	4	4	5	0.75	0.50	0.81	○
To learn the ethics of care	4.31	0.59	4	4	5	0.75	0.50	0.88	○
Increase problem-solving skills	4.16	0.63	4	4	5	0.75	0.50	0.75	○
Learning to be considerate	4.25	0.51	4	4	5	0.75	0.50	0.94	○
Emotional intelligence, emotional cultivation	4.22	0.71	4	4	5	0.75	0.50	0.81	○
A healthy diet	4.13	0.71	4	4	5	0.75	0.50	0.63	○
Learning convergence	3.84	0.68	4	4	4	1.00	0.00	0.38	○
Creativity enhancement	3.97	0.60	4	4	4	1.00	0.00	0.63	○
Integrated development	4.09	0.78	4	4	5	0.75	0.50	0.63	○
Knowledge and skill in plants	4.09	0.64	4	4	4.75	0.81	0.38	0.69	○

Table 14. Results on the area of Nuri course consistent with horticultural education by Delphi survey round 3 (N=29)

Category	M	SD	Med	QD		A ^z	B ^y	CVR ^x	Pass
				25%	75%				
integration of all areas	4.59	0.50	5	4	5	0.80	0.50	1.00	○
Physical exercise and health	4.03	0.63	4	4	4	1.00	0.00	0.66	○
Social relations	4.21	0.62	4	4	5	0.75	0.50	0.79	○
Art experience	4.14	0.70	4	4	5	0.75	0.50	0.66	○
nature exploration	4.69	0.54	5	4	5	0.80	0.50	0.93	○

Table 15. Results on the implementation of horticultural education by Delphi survey round 3 (N = 29)

Item	Category	M	SD	Med	QD		A ^z	B ^y	CVR ^x	Pass
					25%	75%				
Time	30~40 minutes	4.14	1.03	4	4	5	0.75	0.5	0.59	○
	40~50 minutes	4.14	1.06	4	3.5	5	0.63	0.75	0.52	○
Place	Outdoor garden in kindergarten	4.66	0.67	5	4	5	0.80	0.5	0.93	○
	Rooftop garden in kindergarten	3.97	0.73	4	3	4.5	0.63	0.75	0.45	○
	Outdoor garden or forest outside of kindergarten	4.31	0.76	4	4	5	0.75	0.5	0.66	○
Activity type	Large and small group	4.00	0.93	4	3	5	0.50	1.00	0.45	○
	Free selection	4.07	0.88	4	3	5	0.50	1.00	0.31	
	Outside play	4.59	0.57	5	4	5	0.80	0.50	0.93	○
Object	All objects	4.41	0.83	5	4	5	0.80	0.50	0.72	○
	Fruit crops	3.90	0.90	4	3	5	0.50	1.00	0.38	○
	Vegetable crops	4.55	0.51	5	4	5	0.80	0.50	1.00	○
	Floricultural crops	4.21	0.68	4	4	5	0.75	0.50	0.72	○

including 30-40 minutes and 40-50 minutes. Regarding the venue for gardening activities, 3 items were derived: outdoor garden in a kindergarten, rooftop garden in a kindergarten, and outdoor garden or forest other than the kindergarten; for the type of activities related to the Nuri Curriculum, there were 2 items: large and small groups, and outdoor play (Table 15).

Through comprehensively analyzing the 3 rounds of Delphi surveys conducted to derive the components of horticultural education for early childhood, items for the goals of horticultural education were derived, including 7 items related to the problems of horticultural education, 16 related to the need for horticultural education in the smart era, 18 related to the direction of horticultural education, and 5 related to the horticultural education areas which are most consistent with the Nuri Curriculum. For the problems of horticultural education, event-oriented activities (M = 4.24) and the lack of kindergarten teachers' oppor-

tunities for systematic gardening education (M = 4.21) were identified as priorities, confirming that the lack of systematic education on gardening for kindergarten teachers was a problem in applying horticultural education. As pre-service teachers can overcome difficulties and build confidence as teachers through the process of developing and teaching a "forest personality activity program," the horticultural activities that early childhood teachers recognize and experience are important (Kang, 2016). It is considered that the implementation of horticultural activities for early childhood teachers could address the lack of opportunities for systematic horticultural education and even contribute to the recovery of such childhood teachers' confidence. Regarding the need for gardening education, certain items were derived as priorities, including education on respect for life through caring (M = 4.59), emotional intelligence and stability (M = 4.55), direct experience of plant growth process (M = 4.55), and development of the five senses (M = 4.55),

which highlighted the need for horticultural education in the area of preschoolers' emotional intelligence and stability. This finding is in line with those of the following studies: ecological-experience activities for young children influenced the use of self-emotions, perception and consideration of others' emotions, control of emotions and suppression of impulses (Kang and Park, 2010); and, as a result of horticultural activities of preschoolers, their use of self-emotions, and the perception and consideration of others' emotions were statistically significantly improved (Jeong et al., 2009). As for the direction of horticultural education, it was found that cultivating a mind to live with nature ($M = 4.50$), learning the process of plant growth and life ($M = 4.44$), and learning the value of life ($M = 4.44$) were important, with higher mean values. As for the horticultural activity areas that are most consistent with the Nuri Curriculum, nature exploration ($M = 4.69$) and the integration of all areas ($M = 4.59$) were identified as priorities. The revised Nuri Curriculum has enabled teachers to use various integrated methods with autonomy. Through reflecting this, the integration of all areas was also drawn as a high consensus ($CVR = 1.00$) (ME, 2019; MOHW, 2019).

As for the implementation of horticultural education, the following items were derived: 2 items regarding horticultural education hours, 3 regarding the venue for horticultural education, 2 regarding activity types related to Nuri Curriculum, and 4 regarding the objects of horticultural activities. Items such as 30-40 minutes ($M = 4.14$) and 40-50 minutes ($M = 4.14$) for horticultural education hours were identified; those on the venue for horticultural education, including outdoor garden in a kindergarten ($M = 4.66$), outdoor garden or forest other than a kindergarten ($M = 4.31$), and rooftop garden in the kindergarten ($M = 3.97$). As has been found in previous studies, horticultural activities in a four-season ornamental rooftop garden influenced preschoolers' intellectual development (Jeong et al., 2014), and forest experience activities improved their scientific inquiry ability and attitude of respect for life (Lee and Choi, 2015), and also affected their stress reduction (Yun et al., 2019). As for the venue for gardening activities, it was confirmed that all places where safety is secured are available, as the result obtained. For the activity type related to Nuri Curriculum, the expert panel determined outside play

($M = 4.59$) as a priority, and for the objects, vegetables ($M = 4.55$). As for the effect of the objects of gardening activities on kindergarteners, a study using herb plants reported such activities influenced their preference for herb plants (Shin et al., 2012); in another study, when horticultural activities were performed using colorful vegetables, young children responded naturally to the color of vegetables and fruits, and showed a decrease in consumption of an unbalanced vegetable diet (Son et al., 2015). An analysis on the preference of early childhood teachers in horticultural activities based on a conjoint analysis found that early childhood teachers preferred vegetable crops as the object of horticultural activities (Jeong et al., 2020). The opinions of the expert panel in this study were in line with the findings on the preference of early childhood teachers.

Conclusion

This study was conducted to provide basic data in developing horticultural programs in the regular curriculum for early childhood, by deriving the objective components of early childhood horticultural education using the Delphi survey method to extract experts' opinions and judgments. The expert panelists selected for the Delphi survey included professors of early childhood education, kindergarten directors, horticultural science professors, and horticultural therapists; of those selected, 29 panelists responded to all rounds of survey. In the 1st round of the survey, an open-ended questionnaire was used, consisting of 4 question items for the goals of horticultural education and 4 for the implementation of horticultural education. In the 2nd and 3rd round, the questionnaires were composed of closed-ended questions and the items were rated based on a 5-point scale.

Through the three rounds of Delphi surveys, the following items were derived under the category of the goals of horticultural education: 7 items regarding the problems of horticultural education, 16 regarding the need for horticultural education, 18 regarding the direction of horticultural education, and 5 regarding areas consistent with the Nuri Curriculum. Items derived under the category of the implementation of horticultural education included 2 items regarding horticultural education hours, 3 regarding the

venue for horticultural education, 2 regarding the activity types applicable to Nuri Curriculum, and 4 regarding the objects of horticultural activities. First, these results are significant in objectively deriving the components of goals and implementation in early childhood horticultural education by collecting the opinions of an expert panel and forming a consensus. Second, it is considered that this study can be used as basic data in developing horticultural education programs for young children, such as horticultural programs linked to the Nuri Curriculum, a regular curriculum for young children. Third, it has significance in that it confirms the necessity of horticultural education for early childhood teachers, as the lack of opportunities for systematic gardening education among early childhood teachers was identified as a priority in the problems of horticultural education.

In the future, it is necessary to objectively investigate the effectiveness of such education by developing a horticultural program for young children, to which the findings of this study can be applied, executing it for an actual class of children, and comparing and analyzing the results. It is considered that a study to develop a systematic horticultural program targeting early childhood teachers should be conducted so that they can directly experience gardening activities.

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