



Are Forest healing programs useful in promoting children's emotional welfare? The Interpersonal relationships of children in foster care

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ABSTRACT

Forest healing programs are conducted for children in foster care, as their potentially turbulent environments may hinder development—particularly that of healthy interpersonal relationship skills. This study analyzed the impacts of forest healing programs on children's psychological health. These programs include activities that utilize a variety of natural components including aroma, landscape, and others to raise the immunity of the human body and to promote health. The program was run 72 times from 2015 to 2018 at National Forest Therapy sites. Self-reported surveys were administered before and after the program, and were used to determine the participants' interpersonal relationship skills and analyze the overall effectiveness of the program. The highest possible score on the survey was 50, indicating healthy interpersonal relationships. The results show a statistically significant overall increase of 1.77 points on average from 2015 to 2018. This study finds that forest healing programs can function as social promotion programs that utilize the forest's beneficial environment and the city's abundant resources, and that they represent an effective step toward improving the well-being of children in urban areas.

1. Introduction

1.1. Background

Modern society is highly industrialized, and advancements in technology have enhanced both the standards and conveniences of living. These developments are especially apparent in urban areas, which are densely populated as a result. The Korean National Statistical Office's data from 2018 indicate that major metropolitan cities account for 32.551 million out of a total 51.607 million Koreans, meaning 63.1% of the total population is concentrated in urban areas.

Urban areas are characterized by rapidly changing social structures and little to no sense of community, both of which may generate high levels of stress (Adli, 2011; Guite et al., 2006; Park, 2016). Conversely, forests and plants have the opposite effect, and may promote emotional fulfillment. During visits to forests, patients with exhaustion disorder were put at ease, reported feeling psychological stability, were prompted to reflect on their lives, and described their experience as restorative (Sonntag-Öström et al., 2015). Being near urban green spaces has positive effects on one's mental health (Nutsford et al., 2013); exposure to

green spaces has shown a biologically (salivary cortisol) significant negative correlation between stress and green spaces (Ward Thompson et al., 2012). Green spaces are potent psychological buffers against the negative health impact of stressful life events (Van den Berg et al., 2010). Middle school students with an inability to adapt to school showed a reduction in stress, reactive characteristics, and disruptive behavior after participating in school violence prevention programs with applied forest therapy (Shin, 2013). Walking in forests may be physiologically and psychologically relaxing for young women (Song et al., 2019). Through studies on the effects of therapy-intended activities centered on forest factors (trees, plants, aromas, landscape), forest activities have been verified to have positive effects such as emotional and physiological restoration and promotion of emotional stability (Jeong, 2012; Kim et al., 2019; Lee, 2013; Stigsdotter et al., 2017; White et al., 2013). Studies on the value of green space for children have determined that access to urban green spaces is tied to enhanced emotional happiness (Flouri et al., 2014), and these spaces may play a positive role in allowing children and adolescents the opportunities to form friendships (Seeland et al., 2009).

The Korean Forest Service has defined and legalized forest therapy as

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“an activity that utilizes a variety of natural components including aroma, landscape, and more to raise the immunity of the human body and to promote health” (Korea Ministry of Government Legislation, 2019a,2019b) (Clause 4 Article 2) and has been pursuing it at a policy level. The 6th Forest Basic Plan (2018) called for expanding forest therapy into a cycle that can continuously contribute to the restoration and promotion of participants’ health. Therapy facilities, program management, and research teams have consistently endeavored to better secure empirical evidence of the effectiveness of forest therapy. Studies on the benefits of forest therapy and urban green spaces are ongoing, and their findings continue to be implemented.

1.2. Characteristics of children in foster care

Foster care is a term defined by the Child Welfare Act as applying to a child “if his/her guardian is inadequate for nurturing the child or has no ability to nurture the child like when the child has no guardian, is away from the guardian, or is abused by the guardian.” (Korea Ministry of Government Legislation, 2019a,2019b) (Clause 4 Article 3). The main causes for children being in foster care, enumerated by frequency of occurrence, are abuse, parents’ divorce, having a single parent, and being an illegitimate child (Table 1). Abuse accounts for the highest percentage of children being placed in foster care, and these children will often continue to face high levels of stress upon finding themselves in unfamiliar environments, even if these new environments are safe. The importance of abuse prevention and the emotional protection of children in foster care cannot be overstated.

Adolescent children in foster care are already in a physically and psychologically turbulent period of their lives. They find themselves lacking coping skills or the social support necessary to meet the requirements of social situations, and therefore, have a higher risk of becoming maladjusted (Nho et al., 2008). Moreover, environments that make it difficult to form stable attachments are known to generate a sense of deprivation, alienation, and low self-esteem, leading to personal, social, and emotional identity crises and a higher risk of experiencing anxiety and a sense of social isolation (Kim, 2014). Therefore, children in foster care have an arduous time acquiring sociality, and as they are so often socially withdrawn, it is difficult for them to form relationships (Kim, 2014). As substitutes for loving relationships with parents (which crucially affect children’s personality formation), relationships with nursing assistants at children’s shelters are significant to the maturation of children in foster care. However, due to nursing assistants’ high turnover rate, children are vulnerable to developing childhood attachment to inconsistent figures, resulting in continued social isolation. These children tend to lack sociality, a sense of accomplishment, and interpersonal relationship skills. Therefore, in their social lives as adults, they are likely to be easily influenced by others. For example, they will likely have a negative tendency toward social adaptation, just as they try to rely on others or are unable to adapt to work (Lee, 2010).

1.3. Adolescent interpersonal relationships and their importance

Interpersonal relationships consist of social interactions between an individual and the people in their environment. Adolescents’ interpersonal relationships are largely divided among the most prominent people around them, such as parents (or primary caregivers), teachers, and friends (Park and Bae, 2012). In adolescence, interpersonal relationships

with friends significantly impact growth because, beyond the family zone, adolescents place a high value on relationships with people closer to their age, and these peers often become more important than their families and teachers as they grow older (Shin, 2014). Adolescents’ experience with interpersonal relationships may affect their adaptiveness to reality, and may even influence their future interpersonal relationships. Primary caregivers, friends, and teachers exert considerable influence on an adolescent’s personality formation and socialization, and teachers and friends exert special influence on children, as they spend more time at school than at home (Lee, 2016). Schools help adolescents acquire the knowledge and skills necessary for socialization, thus adapting well to schooling is a crucial task of adolescence (Choi, 2004). It is important for adolescents to form healthy relationships, as what is learned and experienced in these young relationships affects character development, social relationships, and learning—all of which enable adolescents to grow into healthy adults (Lee and Oak, 2012). The adolescent development of self-control has been noted to result in especially high satisfaction and low conflict levels in adult relationships. Therefore, the development of interpersonal relationship skills in adolescence has long-term consequences for sociality, as these skills provide a foundation for better and more intimate adult relationships (Allemand et al., 2019).

1.3.1. Study purpose

Out of the 280 children’s shelters nationwide, 157 are located in major cities like Seoul, Busan, Daegu, Gwangju, and Daejeon, according to data from the Ministry of Health and Welfare, 2018. Of the 12,789 children living in foster shelters, 7458 (58.3%) inhabit these cities, and this percentage increases when small and medium-sized cities are included in a wider “urban” category. As these children are concentrated within cities they are exposed to the stress of urban environments. Children in foster care, when compared to children living with family, show a greater risk of maladjustment due to the high levels of stress caused by environmental conflicts, such as broken families (Nho et al., 2008). These children most often receive material-oriented support; however, there is a need to provide support activities that bolster emotional and social stabilization (Lee et al., 2017).

This study carried out forest therapy programs, particularly for children in foster care, who, compared to other children, are more likely to experience adaptive difficulties due to insufficient role models from whom to learn socialization and interpersonal relationship skills (Jung, 2009; Wallerstein and Lewis, 2004). These programs were run by the social contribution activities of the Hyundai Motor Chung Mong-Koo Foundation, and to maintain the service and investigate potential improvements to child welfare policy, this study was conducted alongside the activities of the foundation. These programs are expected to result in positive changes in participants’ interpersonal relationships and relationship skills, even if carried out in urban areas. However, based on studies that researched the sociality of adolescents consistently exposed to green areas, it is expected that forest areas will exert more positive effects on interpersonal relationships (Kim and Kim, 2017). Forest healing programs also had positive effects on interpersonal relationships among youth activity competencies such as the self, accomplishment motives, problem-solving, conflict regulation, intrapersonal relationship, leadership, citizenship, and physique (Oh et al., 2016a). Students from schools that provided them with green spaces showed more interest in interpersonal relationships and schooling (Waliczek et al., 2001), and greater overall well-being (Ma et al., 2019). Thus, forest

Table 1
Causes for the placement of children into foster care in 2018 (Statistics Korea, 2019).

Children in Foster Care	Abandonment	Single parents, illegitimate children	Missing child	Delinquency, runaway, vagrancies	Abuse	Parental poverty, unemployment	Parental death	Parental illness	Parents’ divorce and more	Others
3918	230	623	18	231	1415	198	284	92	737	90

healing programs were organized specifically for children in foster care by the instructors who run the National Therapy Forests program and the National Center for Forest Therapy. Moreover, changes in the interpersonal relationships of participants pre and post forest healing programs have been analyzed in the interest of utilizing forests to guarantee the welfare of children in foster care.

2. Materials and methods

2.1. Participants

The participants of this study were those children in foster care who had participated in “The healing classes in a forest to search for my dream” run by the National Therapy Forests and National Center for Forest Therapy. These classes were held 38 times from February 2015 to October 2016, 17 times from February 2017 to October 2017, and another 17 times from February 2018 to October 2018. Some participants were enrolled in more than 1 program session over this time period (The same children could take part more than once.). The participants consisted of 3992 children who were middle-school aged or older, as they were considered able to complete self-reported surveys. All study participants and their foster care providers provided informed consent, and the study’s design was approved by the appropriate ethics review board (WKIRB-201705-BM-027). Socio-demographic characteristics of the participants indicated that female participation was slightly higher at 52.3%, and that participants mainly resided in childcare facilities (58.3%), treatment institutions (13.1%), and group homes (11.7%) (Table 2).

2.2. Forest healing programs and target sites for children in foster care

2.2.1. Forest healing programs for children in foster care

Each run of the forest healing program lasted for 2 nights and 3 days, and was composed of age-inclusive and age-specific activities, such as general forest games, aromatherapy sessions, art and music workshops, forest therapy sessions, and lectures. These activities were organized slightly differently between different runs of the program, depending on the characteristics and facilities of each target site. However, the programs had common factors, such as forest therapy activities, which made heavy use of the forest environment. All programs included lectures for enhancing self-sufficiency via means tailored specifically to the participants (Table 3, Fig. 1). The potential effects of meeting other children from similar environments were considered when organizing

Table 2

Socio-demographic characteristics of study subjects.

Classification	Categories	Frequency (Persons)	Percentage (%)
Gender	Male	1905	47.7
	Female	2087	52.3
	Total	3992	100
Grade	Middle school	2034	60.8
	High school	1312	39.2
	Total	3346	100
Residential institutions	Childcare facilities	1797	58.3
	Vocational training facilities	7	0.2
	Treatment institutions	403	13.1
	Self-sufficiency support facilities	82	2.7
	Temporary care facilities	79	2.6
	Complex facilities	132	4.3
	Group homes	362	11.7
	Foster homes	134	4.3
	Surrogate(relatives) foster homes	86	2.8
	Total	3085	100

Table 3

Target-site specific activities for children in the program.

Place of Operation	Activity	Purpose	Contents
A	Recharge in the forest.	Relaxation, stress reduction	Walking meditation through landscape therapy, chilling in a hammock, mindful breathing meditation, foot baths & spas
	Rejuvenate with fragrances.	Emotional stability, enhanced immunity, inspiration for a sense of accomplishment and independence	Drawing a mandala, making aroma oil, aroma candle, and oil diffusers
	Exercise underwater.	Relaxation, improved cardiopulmonary function	Stretching underwater, walking in the water, having a bathing pool experience
	Find relief via therapy machines in the forest.	Muscle fatigue relief, promoting blood circulation	Using dry saunas, sound wave therapy equipment, aqua therapy equipment
	Walk in the woods.	Relaxation, enhanced sociality	Forest walking, using color therapy, walking barefoot along a sensory path
	Get motivated by lectures.	Strengthened independence competence	Attending mentor’s lectures on “being independent” Forest stretching/ gymnastics, threaded net, forest trail walking, abdominal breathing, aroma massage
B	Relieve stress with forest healing.	Relaxation, stress reduction	Cooperation and competition between groups through playing dominoes Quiz games, drawing natural resources, team building games in the woods by completing therapeutic tasks
	Play dominoes in the forest.	Advocating harmony and the sense of intimacy	Promoting friendship and learning how to manage time through making clocks
	Fulfill a group mission in the woods.	Enhanced spirit of teamwork	Journaling your way into happiness, Expressing your gratitude
	Make a wooden clock.	Learning time management	
C	Create a gratitude journal with natural objects.	Increased positive thinking, friendship promotion	
	Get motivated by lectures.	Same as A	
	Walk along forest trails.	Enhanced positive thoughts	Forest trail walking, making floral garlands
	Observe the night sky above the forest.	Strengthened independence competence	Night walking, star observation, meditation
	Make your own fragrance in the forest.	Enhanced immunity, stress reduction, sensitivity stimulation	Making an aroma oil handkerchief, feeling the fragrance
	Rope activities.	Enhanced spirit of teamwork and self-esteem	Learning rope knotting rules, stretching
	Make your own dreamcatcher. Build up your dream forest.	Relaxation and stability	Making dreamcatchers

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Table 3 (continued)

Place of Operation	Activity	Purpose	Contents
D	Get motivated by lectures.	Promotion of self-esteem, emotional stability Same as A	Forest trail walking, DIY glass bottle crafts
	Between us and tree	Enhanced sociality and self-esteem, establishment of identity	Learn how to respect and appreciate differences between people through forest healing program
	Log field day.	Enhanced spirit of teamwork and unity	Making stepping-stones, kudzu ball bowling, flipping acorns
	Forest explorers.	Enhanced nature affinity	Forest exploring, quiz games
	Wiggling fragrance.	Inspiration for a sense of accomplishment	DIY pressed flowers with a few sculptural leaves from the forest
	Five Senses BINGO.	Enhanced nature communication ability using five senses	Using natural objects, play BINGO in the forest
	Get motivated by lectures.	Same as A	

the programs. Thus, there were opportunities for children from diffuse communities with much in common to come together, socialize, and form friendships.

2.2.2. Target sites

The programs were carried out at 4 sites within the National Center for Forest Activities (Target Sites A, B, C, and D) (Figs. 2a and 2b). The center provided an auditorium and lecture halls, experience rooms, outdoor activity facilities, and living accommodations, as well as therapy courses, forest experience trails, and forest exploration courses. Instructors who developed and operated the programs were stationed at each site to provide therapy services to participants. Target Site A is located over Gyeongbuk Yeongju and Yecheon, occupying an area of about 2,889 ha. The trees in the area are predominantly oak, nut pine, and larch. There are nine major forest trails; their cumulative length is 45.5 km. These trails feature a barrier-free deck road for the elderly and people with disabilities, as well as gardens, valleys, and barefoot-gardens. Target Site B is located in Hoengseong, Gangwon-do, and occupies an area of about 712 ha. The trees in the area are predominantly oak, larch, nut pine, and, most notably, Norway spruce. Six major forest trails run through the site, and their total length is about 22 km. Target Site C is located in Jangseong-gun, Jeollanam-do, and occupies an area of about 503 ha. The trees in the area are predominantly cypress and Japanese cedar. There are six forest trails with a total length of 11.2 km. Target Site D is located in Chilgok, Gyeongsangbuk-do, and occupies an area of about 73 ha. The trees in the area are predominantly oak. There

are four major forest trails that have a total length of about 2.86 km, all of which feature a barrier-free deck road.

2.2.3. Measurements

This study followed a single-group pretest-posttest design as part of the overarching quasi-experimental design. This was because it was not possible to select experimental and control groups equally through random assignment since it was difficult to exclude participants from the program, which was supported by inclusive corporate social responsibility organizations. Moreover, the number of participants in the forest healing programs was very large. The assessment of change in the children's interpersonal relationships consisted of self-reported participation surveys, administered before and after the program to those participants who were middle-school aged or older. Data for the pre-program assessment were collected using surveys sent to each foster institution, which the participants completed by themselves after their participation in the program was confirmed. The post-program assessment was carried out among the same participants following the last program activity. To identify the changes that participants experienced during the program, the survey gave them an anonymous identification number (Fig. 3).

2.2.4. Measures for interpersonal relationships

To confirm changes in the interpersonal relationship skills of the participants, the Relationship Change Scale (RCS)—developed by Schelin and Guernsey (1971), adapted by Seon Mo Moon (1980), and modified by Suk Kyun Jeon (Jeon, 1994) and Jinsun Lee (Lee, 2010), was used. The Cronbach's α value for the scale was 0.928 in this study. The survey consists of 10 questions on friendliness, sensitivity, understandability, credibility, openness, and communication. It is graded on a five-point Likert scale, having response options from “strongly disagree (1 point)” to “strongly agree (5 points),” and therefore, the highest total score is 50. The test was designed so that higher scores would indicate better interpersonal relationship skills. RCS has been used as a measurement tool in various studies to identify interpersonal changes: for institutionalized adolescents who participated in the Independence program (Lee, 2010), for university students who participated in a group art therapy program (Hong and Yoo, 2018) and expression training on emotional awareness (Park and Park, 2014), and high school students with intellectual disabilities who participated in a dating skill program (Chang and Kim, 2011), etc.

2.2.5. Data analysis

The data from the survey were systemically processed and analyzed using SPSS v.20. Frequency analysis was used to analyze the participants' socio-demographic characteristics. Paired *t*-tests were used to compare pre- and post-program participation. The formula for a paired *t*-test is $T = \frac{\text{mean1} - \text{mean2}}{\frac{s_{\text{diff}}}{\sqrt{n}}}$. Analysis of covariance (ANCOVA) was used to

determine whether socio-demographic characteristics and frequency of participation affected the results of the interpersonal measurement. This model assumes that the dependent variable *y* is influenced by treatment *i* and is at the same time linear with covariate χ . The ANCOVA model is



Fig. 1. Photos of the program activities.



Fig. 2. a Program sites A through D. b Several views of the operation sites: The forest path of Site C; The deck path from Site A; The panorama of Site B.

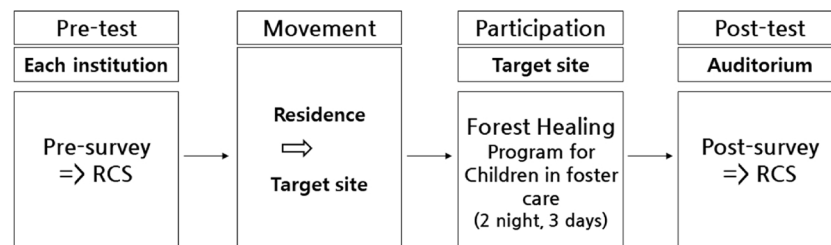


Fig. 3. Method used to collate measurements.

$y_{ij} = \mu + \alpha_i + \beta \chi_{ij} + \varepsilon_{ij}$. In this equation, α_i is the treatment impact, μ is the population mean, and ε_{ij} is the assumption of the error term. Independent samples t-tests were used for the comparisons of change by frequency of participation and questions by topic. The formula is $t = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$. The statistical significance was set at $**p < .05$.

3. Results

Forest healing programs lasting 2 nights and 3 days were conducted

at the National Center for Forest Therapy for four years. The participants were children in foster care. Their interpersonal relationship skills were assessed against the parameters of friendliness, sensitivity, understandability, credibility, openness, and communication. Table 4 shows the changes in the scores of the participants each year and determines whether they qualify as having undergone statistically significant change. The results demonstrate that the forest healing programs can be considered to have a positive impacts on interpersonal relationships of children in foster care.

In 2017 and 2018, when the forest healing programs had been implemented for three or four years the level of change in a participant's

Table 4
Survey topics and contents.

Question topics	Question number	Question contents
Friendliness	1	I have a good relationship with others.
	6	I don't feel distant from others.
Sensitivity	2	I know well what others hope and what they want to do.
	3	It is easy to communicate with others.
Understandability	4	It is not difficult to understand what others are feeling.
	10	I understand what to do with interpersonal relations in the future.
Credibility	5	I tend to trust others.
	7	I am confident in my interpersonal relationships.
Openness	9	I am very likely to share my interest with others.
	8	I don't have trouble communicating with others.

interpersonal relationships was determined by accounting for the frequency of their participation in the surveys (whether or not the participants took part in the previous year). After considering this, the data showed that, in 2017, one-time participants gained a 2.97 point increase from 36.36–39.33, while twice-or-more participants gained a statistically significant 3.5 point increase from 37.96 to 41.46. In 2018, one-time participants gained a 2.69 point increase from 36.85 to 39.54, while twice-or-more participants scored a statistically significant 3.41 point increase from 37.83 to 41.24. These data indicate that participating twice or more in the program will yield significantly greater results than participating only once (Tables 5 and 6).

To determine whether socio-demographic characteristics (gender, grade, and residential institutions) and frequency of participation (1 time and 2 or more times) impact change in interpersonal relationships, we analyzed whether there were differences between pre-and post-change depending on gender, grade, residential institutions, and frequency of participation. First of all, to find out the equality of regression slope, the analysis of the interaction between gender and pre-results, grade and pre-results, and residential institutions and pre-results, showed that the significant probability was $**p < 0.117$ for gender, $**p < 0.110$ for grade, and $**p < 0.108$ for residential institutions (Table 7). However, the frequency of participation was $**p < 0.035$, indicating that the slope was not the same. Accordingly, the ANCOVA showed that the significant probability was $**p < 0.470$, grade was $**p < 0.100$, and $**p < 0.057$ for residential institutions, therefore, there was no difference between gender, grade, and residential institutions. However, the significance of participation frequency was $**p < 0.024$, which differed according to the frequency of participation (Table 8).

Thus, the degree of the program's impact on the results of the

interpersonal relationship skills survey was nominally quantified to identify whether participants in 2017 and 2018 displayed a positive difference regarding the frequency of their participation. The topics and questions are presented in Table 4. Analysis of the results indicated that participants in 2017 had a significant positive difference in some of the questions on "understandability" and "openness." Participants in 2018 have a significant positive difference in "sensitivity" and "credibility," and also in some of the questions on "understandability" and "openness." Participants in both the years showed a significant positive difference in "understandability," with regard to the question "It is easy to communicate with others," and in "openness," with regard to the question "I am very likely to share my interest with others."

4. Discussion

The forest healing programs, implemented annually from 2015 to 2018, led to a significant enhancement of the interpersonal relationship skills of their participants. However, it was difficult to control all the conditions affecting the operation, such as the forest environments (Hong and Lee, 2018a), weather conditions (Lim et al., 2014), and instructors (Hong and Lee, 2018b; Min, 2013). Therefore, differences in the impact of the program may emerge, depending on the site used and the duration of the individuals' participation. However, on-site instructors developed and operated all of the program's activities based on forest therapy within a forest environment, so there was a high standard of dedication and care present in all iterations of the program. Since there were at least 700 participants per year and a total of 3921 participants over four years and continuously high participation, it can be seen that there were significantly positive results for the interpersonal relationship skills of the participants after they completed the programs. In addition to this study's research, horticultural therapy programs (caring for plants, watching the process of their growth, experiencing the work of gardening) have also studied the benefits of nature and green spaces, and have helped persons with Schizophrenia improve their communication abilities, especially to form relationships and share their emotions with others (Jeong et al., 2004). The social competence of many adolescents has improved through participation in forest healing programs, which utilize the forest's environment (foliage, air, water, sunlight, etc.) in therapy while considering adolescents' interpersonal capabilities (Oh et al., 2016a). Afterschool forest healing programs were also found to have positive effects on children, especially with regards to the formation of their interpersonal relationships (Jang and Koo, 2017). This study found that programs based on forest therapy that make use of various natural elements can exert a positive impact on interpersonal relationship skills.

It was also found that participation in nature healing programs significantly increases the children's interpersonal relationship skills in adolescence. Moreover, it was found that participating more than twice results in an even more significant increase in interpersonal relationship skills than one-time participation. The results of this study are consistent with those of past studies: that a higher frequency of participation in cultural activities enhances adolescents' self-efficacy (Kim et al., 2011), that a higher frequency of participation in integrated pungmul (Korean traditional percussion music) programs narrows the social distance between students with and without disabilities (Choi, 2003), and that a positive correlation exists between college life adaptability and the frequency of participation in recreational sports activities (Jeong, 2005). The differences in survey results between those attending forest healing programs for the first time and those who had already attended twice or more were striking. The results from 2018 revealed that participating multiple times was often reflected in statistically significant improvements in the "sensitivity" and "credibility" categories of the survey. In 2017 and 2018, new and old participants both showed significant improvement in the categories of "understandability" and "openness." (However, those who had participated more than twice still showed significantly greater improvement than those who were participating for

Table 5
Change in the degree of interpersonal relationship skills of children in foster care by participation year ($**p < .05$).

Classification	N (Statistically significant figure)	Mean	Standard deviation	t	p-value
2015	Before	34.71	7.73	-4.43	.000**
	After	35.64	8.85		
2016	Before	35.37	7.81	-7.07	.000**
	After	36.97	8.63		
2017	Before	36.91	7.44	-8.125	.000**
	After	39.35	8.01		
2018	Before	37.27	7.66	-10.681	.000**
	After	40.27	8.25		
Total	Before	35.76	7.77	-14.121	.000**
	After	37.53	8.77		

Table 6

Change in the interpersonal relationships of children in foster care as determined by frequency of participation in forest healing programs in 2017 and 2018 (** $p < .05$).

Classification			N (Statistically significant figure)	Mean	Standard deviation	T	p-value
2017	Frequency of participation (1 time)	Before	346	36.36	7.51	-6.992	.000**
		After		39.33	8.80		
	Frequency of participation (2 or more times)	Before	175	37.96	7.97	-5.258	.000**
		After		41.46	8.03		
2018	Frequency of participation (1 time)	Before	444	36.86	7.62	-7.619	.000**
		After		39.54	8.35		
	Frequency of participation (2 or more times)	Before	310	37.83	7.54	-7.517	.000**
		After		41.24	7.88		

Table 7

Results of analysis the interaction effects of socio-demographic characteristics and frequency of participation and pre changes in interpersonal relationships changes to check equality of regression slope. (** $p < .05$).

	Sum of squares	df	Mean square	F	p-value
Gender*pre	221.267	2	110.633	2.146	.117
Grade*pre	131.474	1	131.474	2.555	.110
Residential institutions*pre	675.470	8	84.434	1.643	.108
Frequency of participation*pre	212.655	1	212.655	4.312	.038**

the first time.) It can be inferred from the topics that showed the most overall improvements in 2017 and 2018 (Table 9) that participating in forest healing programs can teach one how to share their interests with others, which can lead to opportunities to learn how to communicate more openly. These programs provide opportunities for children in foster care to experience healthy relationships with nature, instructors, and children with similar backgrounds, and can teach them crucial social skills that will benefit them for the rest of their lives. The programs may contribute to a child's welfare by bolstering their emotional and social stability, because forest environments have been repeatedly observed to positively affect emotional and psychological stability (Lee et al., 2019; Oh et al., 2016b; Reeve et al., 2017; Song et al., 2018). This study has confirmed that forest healing programs exert a positive impact on the interpersonal relationship skills of children in foster care. Therefore, this study has significance in that it identifies the possibilities of forest therapy programs as alternatives to emotional and social stabilization activities in institutions, which are currently heavily biased towards material benefits. This study is meaningful in that it provides opportunities for the development and advancement of forest healing programs by verifying the value of these programs for specific subjects.

Table 8

Results of analysis if there are different changes in interpersonal relationships depending on gender, grade, residential institutions, and frequency of participation. (** $p < .05$).

		Sum of squares	df	Mean square	F	p-value
Gender	Before	84874.061	1	84874.061	1645.089	.000**
	Gender	183.145	4	45.786		
	Error	172628.074	3346	51.592		
	Total	4944986.000	3352			
Grade	Before	85382.281	1	85382.281	1658.796	.000**
	Gender	139.063	1	139.063		
	Error	172072.369	3343	51.472		
	Total	4935575.000	3346			
Residential Institutions	Before	78590.341	1	78590.341	1526.597	.000**
	Gender	779.370	8	97.421		
	Error	158406.253	3077	51.481		
	Total	4562157.000	3087			
Frequency of participation	Before	16694.273	1	16694.273	337.297	.000**
	Gender	242.794	1	242.794		
	Error	44742.886	904	49.494		
	Total	1528731.000	907			

However, this study had several limitations. First, the program assessment was carried out with a group pretest-posttest without a matched control. As this study aimed to not only identify the impact of the forest healing program on interpersonal relationship skills of children in foster care, but also confirm the potential for utilizing programs at the child welfare level, no participants were excluded from the program. The number of participants in the forest healing programs was large, thus making it difficult to recruit a corresponding comparison group. Because the effects of the program could not be evaluated by setting a control group, they were measured pretest-posttest at a large scale every year. A control group will be needed in the future, when follow-up studies are conducted to examine the effects of environments (forests, cities) on children in foster care. Second, the learning effect of exposing repeat participants to identical assessments has not been excluded. The percentage of subjects who participated in the program more than once was about 40% in 2018. Because participants went through the same programs and surveys, there is a high possibility of a learning effect affecting results. However, since the interpersonal relationship skills of the repeat participants were more positive than those of participants attending the program for the first time, the impact of the program on interpersonal relationship skills may still be considered very positive. Therefore, further research on the effects of re-participation in the program is necessary. Third, the post-program surveys were administered by the same instructors who had conducted the program. This may have led to the possibility that the participants gave socially desirable responses rather than being totally frank and honest in evaluating the program. The program operated on a large scale. The difficulties involved in preparing a completely independent space for a large number of participants and hiring new staff made the program's instructors the most effective vector for administering the survey. However, the results of this study should be able to be reliably replicated at a smaller scale. Fourth, there is a need to conduct studies on the sustainability of the effects of forest healing programs when their crucial environment, the forest, is inaccessible in the children's day-to-day

Table 9Comparison of question results enumerated by topic and the frequency of participation in the forest healing programs in 2017 and 2018 (** $p < .05$).

Classification			N (Statistically significant figure)		T	p-value
Question topics	Question number	Year of participation				
Friendliness	1	2017	Before	521	1.875	.061
			After	521	.649	.517
	6	2018	Before	754	.929	.353
			After	754	1.958	.051
		2017	Before	521	4.017	.000**
			After	521	2.539	.011**
Sensitivity	2	2018	Before	754	2.940	.003**
			After	754	2.151	.032
	3	2017	Before	521	1.991	.047**
			After	521	-.001	.999
		2018	Before	754	-.291	.771
			After	754	2.879	.004**
Understandability	4	2017	Before	521	1.832	.067
			After	521	2.658	.008**
	10	2018	Before	754	1.106	.269
			After	754	2.532	.012**
		2017	Before	521	1.392	.165
			After	521	1.362	.174
Credibility	5	2018	Before	754	.314	.754
			After	754	2.888	.004**
	7	2017	Before	521	1.416	.157
			After	521	1.546	.123
		2018	Before	754	2.229	.026**
			After	754	3.269	.001**
Openness	9	2017	Before	521	1.937	.053
			After	521	-.013	.990
	7	2018	Before	754	1.546	.123
			After	754	1.989	.047**
		2017	Before	521	2.404	.017**
			After	521	2.421	.016**
Communication	8	2018	Before	754	2.369	.018**
			After	754	2.058	.040
	9	2017	Before	521	.716	.474
			After	521	2.663	.008**
		2018	Before	754	1.424	.155
			After	754	3.402	.001**
		2017	Before	521	1.683	.093
			After	521	.303	.762
			Before	754	1.292	.197
			After	754	1.608	.108

lives. As most of the forest environments where this study was conducted are far from urban environments, it is difficult to implement forest therapy as described by this study in everyday life. Furthermore, getting out of daily routines and entering different environments can be either beneficial or harmful, depending on the subjects and cases. The participants in this study are adolescent children in foster care, and the contrast of getting out of their daily life may be an advantage in the short-term, but a weakness in the long-term. The program outlined in this study, which was carried out on children in foster care, should be considered for its positive short-term effects. At the same time, an increase in the frequency of forest therapy can be achieved by running healing programs in accessible, local environments within living zones, such as urban forests. Fifth, there was no explicit control over the personal factors of the participants that could affect their interpersonal relationships. We concede that this was because of data inadequacy. We realize that controlling for participants' personal traits would have made the study more robust and we plan to do this in future research. Through studies on factors affecting children's interpersonal relationships in the operation of forest healing programs, the program can be further improved. To promote the forest environment at the child welfare level, the following goals must be realized: First, forest resources and existing forest welfare facilities must be improved at the child welfare level. Second, cooperative systems for space utilization, program achievement, and labor supply must be established between the Korean Forest Service, local governments, and individuals to help children in urban environments have more frequent access to forest therapy. Third, social

awareness of the need for underprivileged children to participate in forest healing activities must be raised. Fourth, government welfare policy and CSR (corporate social responsibility) for children must lend continuous support to research on the effectiveness of forest healing programs.

5. Conclusions

The purpose of this study was to raise awareness of the need for related research to ensure that children can fully enjoy the benefits of forests. For this purpose, we confirmed that forest-based therapy programs were able to positively improve the interpersonal relationship skills of adolescent children in foster care. Although adolescence is a critical period for the development of sociality, child welfare in foster institutions is mostly skewed toward providing material comfort. Raising awareness of the need for child welfare in terms of their social development is crucial. Thus, studies need to be carried out on the most effective means to improve child welfare, and to examine existing programs' effectiveness. Forest-based therapy programs have significant advantages over other methods in providing opportunities for children to interact with various living and natural objects, and to benefit from the psychological and physiological effects of the forest environment itself. The continuous study of the benefits of forest therapy and the special consideration of child welfare recipients, it will be possible to improve the quality of child welfare and enhance the professionalism and effectiveness of forest healing programs.

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CRediT authorship contribution statement

Jaeyoon Hong: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data curation, Writing - original draft, Writing - review & editing, Visualization. **Sujin Park:** Validation, Resources, Supervision, Project administration. **Miyeong An:** Investigation, Resources, Data curation.

Declaration of Competing Interest

The authors declare that there is no conflict of interest.

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