The Effect of Horticultural Activity Experience in Childhood on Bioethics of University Students

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ABSTRACT

Background and objective: The experience of caring for plants through horticultural activity makes life valuable and precious. This study was conducted to find out the relationship between horticultural activity experience in childhood and the bioethics of university students.

Methods: 159 university students living in Seoul and the metropolitan area were surveyed on general matters, horticultural activity experience, and bioethics. The collected data were analyzed by conducting descriptive analysis on general characteristics and horticultural activity experience using SAS 9.4, and the Mann Whitney U and Kruskal-Wallis Test, as well as Dunn post-hoc test for Kruskal-Wallis were conducted to determine the difference in bioethics depending on horticultural activity experience.

Results: First, there was no significant difference in bioethics scores depending on horticultural activity experience in childhood. Second, for type of horticultural activity experience, the bioethics scores of the group that had 'solo experience' of horticultural activity were significantly higher than the other two groups (p < .01). Third, for duration of horticultural activity experience, the bioethics scores showed significant results in the subjects with less than 1 year of solo experience compared to those with less than 1 year of group experience and with at least 1 year of group experience (p < .05). Fourth, as a result of examining the type of plants experienced by the group with less than 1 year of solo experience, vegetables and cacti and succulents accounted for 46.7%. For the type of activity, sowing accounted for the highest ratio (80%), followed by planting seedlings (13.3%) and repotting (6.7%).

Conclusion: As a result of examining the relationship between horticultural activity experience in childhood and bioethics of university students, it was found that those with solo experience had higher bioethics than those with group experience, and those who had less than 1 year of experience had higher bioethics than those who had at least 1 year of experience. As for the type of plant and activity experienced by the subjects, the highest ratio was found in vegetables.

Keywords: biomedical ethics, biotechnology ethics, experimental education, ethics of respect for life

Introduction

These days, we come across the tendency and seriousness of showing contempt for life throughout society on media and the Internet (Bae and Kim, 2017). This phenomenon is represented by several incidents in which people treat their own lives recklessly, commit violence towards others, or even kill lives just because they feel like it (Lee, 2019). As such, we are in a situation where we desperately need education about respect for life, in this era filled with various social pathologies caused by the loss of respect for life. This kind of education must be provided during childhood when values about humans and nature are formed (Simson and Straus, 1998; Son, 2008; Ju, 2021).

Currently, children's education about respect for life includes communing, exploring, and experiencing the topics of self, others, and the natural environment (Yoo and Kim, 2018). Accordingly, kindergartens are providing education...
on growing vegetables and flowerbeds as well as ecology education as education about respect for life, but this is only temporary (Keum, 2017), and most elementary schools are teaching by role in a short-term, sporadic form outside the regular curriculum (Choi, 2014). However, bioethics education must be integrated into a subject, and hands-on field learning focused on actual practice is effective in bioethics education (Son, 2008, Jung, 2012, Kim, 2017).

Therefore, education about respect for life must not be about knowledge transfer or a one-time experience but an activity of experiencing life through repetition of continuous experiences (Lee, 2012).

Accordingly, horticultural activities allow people to feel the mystery of life by experiencing the growth process of the plants they grow (Montessori, 1964), and to view living things with respect by cherishing the plants (Kwack and Kwack, 2000; Kim, 2008; Kim, 2020). People can also understand natural conditions and cycles, and feel the importance of surrounding nature and living things (Yang, 2005). Therefore, it is believed that experiential education through growing and observing plants is necessary for children's bioethics education.

It has been reported that this horticultural activity experience in childhood can have a positive effect on raising awareness of respect for life (Kim and Lee, 2012; Choi, 2014; Yoon, 2022), and this horticultural experience makes children respect life even after they grow up (Son, 2008; Lee, 2012). However, there is no domestic research proving the relationship between horticultural experience in childhood and awareness of respect for life in adulthood.

Therefore, this study examined how horticultural activity experience in childhood affects awareness of bioethics in university students and which type of horticultural activity is appropriate, through which it aims to contribute as basic data that can lay the foundation of education for horticultural activity experience in childhood to raise awareness of bioethics.

Research Methods

Procedures

This study was conducted after obtaining approval from the Institutional Review Board of K University (KUIRB-2019-0327-01). A survey was conducted from December 7 to 14, 2019, and data was collected using a survey agency Surveybilly.

Subjects

Selection of subjects

The subjects were recruited without exclusion criteria among university students living in Seoul and the metropolitan area that were willing to participate in research.

Number of subjects and basis for calculation

For sample size, ANOVA was conducted to secure the power of research based on the formula by Cohen (1988), calculating the medium effect size of 0.25, significance level of $\alpha$ 0.05, and statistical power (1- $\beta$) of 0.80. The results showed that the minimum sample size was 159, but data was collected from 168 subjects considering a 5% dropout rate. However, when analyzing the results, data of total 159 subjects was used excluding 9 of them who did not remember experiencing horticultural activity or did not provide responses.

The general characteristics of the subjects are as follows (Table 1). 59.70% were female and 40.30% were male, and most were seniors (47.20%), followed by juniors (24.50%), sophomores (14.50%), others (9.40%), and freshmen (4.40%). For age, 76.10% were aged 20-24, followed by 25-29 (11.90%), 30-34 (5.70%), 35 or more (5%), and less than 20 (1.30%). 75.47% did not have a religion and 24.53% did.

Research tool

General matters

The questionnaire consisted of total 4 items about the gender, year of university, age, and religion of the respondents.
Horticultural activity experience

There were total 7 items about horticultural activity experience on a nominal scale, including whether the respondents have horticultural activity experience, activity period, type of plant used (flowers, vegetables, trees, foliage plants, herbs, succulents and cacti, other plants), type of horticultural activity experience (sowing, planting seedlings, repotting, watering, fertilizing, breeding, pruning), whether there was a companion in the experience, whether their parents have horticultural experience, and whether were indoor or outdoor plants. The classification of the type of horticultural plants was reviewed by three doctorate holders in horticulture. The reliability of horticultural activity experience was Cronbach $\alpha = 0.632$.

Awareness of bioethics

This tool was used by Kim (2017) to examine the awareness of bioethics among university students and workers in social welfare facilities, and its reliability and validity are tested when it was developed through exploratory analysis, survey, and factor analysis. The reliability of this tool was high with Cronbach $\alpha = 0.937$, and the reliability in this study was Cronbach $\alpha = 0.830$. The tool consisted of total 33 items, such as 11 items on biomedical ethics, 11 items on respect for life ethics, and 11 items on biotechnology ethics.

Statistical analysis method

Statistical analysis was conducted using SAS 9.4 (SAS Institute Inc., Cary, NC). Frequency analysis and descriptive analysis were conducted on the general characteristics of the subjects, horticultural experience, and awareness of bioethics. As for the difference in awareness of bioethics according to horticultural experience, there was much difference in the number of subjects between groups and there were only a few subjects within the group. Thus non-parametric tests such as Mann Whitney U and Kruskal-Wallis Test were conducted, and Dunn post-hoc test for Kruskal-Wallis was conducted when a significant difference was found.

Results and Discussion

Comparison of bioethics depending on horticultural activity experience

As a result of comparing the bioethics scores depending on horticultural activity experience in childhood, 134 out of 159 subjects responded that they had horticultural activity experience, and 25 responded that they did not, indicating that 84% of the subjects had horticultural experience, and there was no significant change in bioethics scores be-
between groups depending on horticultural activity experience (Table 2). These results might have been affected by the huge difference in the number of subjects between groups.

Comparison of bioethics depending on horticultural activity experience and type of participation

Since there was no difference in the bioethics scores depending on horticultural activity experience, this study analyzed bioethics by additionally classifying the subjects into three groups with no experience, solo experience, and group experience, as there seemed to be a difference between these three groups. As a result of comparing the bioethics scores between the three groups, there was a difference between the three groups. A post-hoc test also proved that there was a difference between the groups (Table 3, Fig. 1).

In other words, the bioethics scores in the 'solo experience' group was significantly higher than the two groups that had no experience and group experience. These results show that the subjects could have respect for life and nature in the process of becoming familiar with plants (Lee, 2002) by caring for plants responsibly (Son et al., 2002; Han and Yoo, 2014) and interacting with plants (Son et al., 2004). Moreover, these results can support the study results that interacting and empathizing with plants by growing them increases awareness of bioethics (Lee, 2002), and that education about respect for life can be done through life experience, and actual experience can be the most ideal education to learn about respect for life (Kang, 2004).

Meanwhile, there was a significant difference in 'respect for life ethics' in the sub-items of bioethics, such as biomedical ethics, respect for life ethics, and biotechnology ethics, and a post-hoc test also showed that there was a difference (Table 3). This can support the argument that people can come to value plants and life (Relf and Kohr, 2003; Kim, 2020) through the process of actually taking care of plants and empathizing with them through horticultural activity experiences (Lee, 2002).

![Fig. 1. Comparison of bioethics on types of participation in horticultural activity experience.](image)

### Table 2. The comparison of bioethics score according to horticultural activity experience

<table>
<thead>
<tr>
<th>Classification</th>
<th>No experience (N = 25)</th>
<th>Experience (N = 134)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bioethics</td>
<td>84.2 ± 10.9</td>
<td>85.6 ± 14.8</td>
<td>0.9680</td>
</tr>
</tbody>
</table>

*Means±SD.

**NS at p < .05 by Mann-Whitney U Test**

### Table 3. The comparison of bioethics with no experience, solo experience and group experience in horticultural activity

<table>
<thead>
<tr>
<th>Classification</th>
<th>No experience (N = 25)</th>
<th>Solo experience (N = 15)</th>
<th>Group experience (N = 119)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bioethics awareness</td>
<td>20.4 ± 6.5</td>
<td>21.9 ± 9.5</td>
<td>20.0 ± 6.4</td>
<td>0.8625</td>
</tr>
<tr>
<td>Respect for life ethics</td>
<td>34.8 ± 5.5a</td>
<td>41.1 ± 5.4b</td>
<td>33.7 ± 6.8a</td>
<td>0.0007***</td>
</tr>
<tr>
<td>Biotechnology ethics</td>
<td>28.9 ± 7.5</td>
<td>35.6 ± 10.9</td>
<td>30.2 ± 8.6</td>
<td>0.0994NS</td>
</tr>
<tr>
<td>Total</td>
<td>84.2 ± 10.9</td>
<td>98.6 ± 19.2b</td>
<td>83.9 ± 13.3a</td>
<td>0.0095**</td>
</tr>
</tbody>
</table>

*Means±SD.

**NS, **, *** Nonsignificant or significance p<0.01, 0.001 by Kruskal-Wallis.

different letters within rows significant difference based on Dunn Kruskal-Wallis multiple range test at p < .05
Comparison of bioethics depending on type of horticultural activity experience and duration of participation

As a result of comparing horticultural activity experience by duration, none of the subjects who had solo experience had a duration of more than 1 year, so the subjects were compared by classifying them into a group with less than 1 year of solo experience, a group with less than 1 year of group experience, and a group with at least 1 year of group experience. The results showed that the subjects with less than 1 year of solo experience showed significant results, and as a result of the post-hoc test, those with less than 1 year of solo experience showed a significant difference in bioethics scores compared to the other two groups (Table 4, Fig. 2). These results show that less than 1 year of horticultural experience showed significant results in bioethics, implying that the duration of horticultural experience to improve awareness of bioethics can have an effect in less than 1 year. This can support the study results that a 3-month breeding program for children (Son, 2008) and a 6-month gardening and forest experience program (Choi, 2014) improved awareness of bioethics.

Meanwhile, 'less than 1 year of solo experience' had significant results in two sub-items of bioethics, 'respect for life ethics' and 'biotechnology ethics', and the post-hoc test result showed a significant difference compared to the other two groups. This result can support the argument that, through the process of actually taking care of and becoming familiar with plants, thoughts about nature and plants can provide an opportunity to later think morally about issues related to bioethics (Chu, 2008).

The number of plants experienced and type of activity experienced by subjects with less than 1 year of solo experience

The subjects who experienced horticultural activities solo showed high bioethics scores, and those with less than 1 year of experience showed a significant difference. Thus, the frequency of the number of plants and type of horticulture experienced was examined among 15 subjects with less than 1 year of solo experience.

The subjects could choose multiple responses for the plants they experienced. As a result, the percentages of plants that take up 1-5 items are as follows. There were 7 subjects (46.47%) that have experience with vegetables and cacti and succulents each, 5 (33.3%) with trees, 3 (20%) with flowers and foliage plants, and 2 (133%) with

Table 4. The comparison of bioethics with less than one year in solo, less than one year in group and more than one year in group of horticultural activity experience

<table>
<thead>
<tr>
<th>Classification</th>
<th>Solo experience Less than one year (n = 15)</th>
<th>Group experience Less than one year (n = 86)</th>
<th>More than one year (n = 24)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomedical ethics</td>
<td>21.9 ± 9.5 (^a)</td>
<td>19.2 ± 6.1</td>
<td>21.9 ± 7.6</td>
<td>0.3284^NS</td>
</tr>
<tr>
<td>Respect for life ethics</td>
<td>41.1 ± 5.4a(^b)</td>
<td>33.6 ± 6.7b</td>
<td>35.3 ± 7.8b</td>
<td>0.0012^**</td>
</tr>
<tr>
<td>Biotechnology ethics</td>
<td>35.6 ± 10.9a</td>
<td>31.1 ± 9.0ab</td>
<td>27.3 ± 7.3b</td>
<td>0.0352^</td>
</tr>
<tr>
<td>Bioethics awareness</td>
<td>98.6 ± 19.2a</td>
<td>83.8 ± 13.2b</td>
<td>84.5 ± 16.0b</td>
<td>0.0134^</td>
</tr>
</tbody>
</table>

\(^a\)Means±SD. 
NS, ** Significant or significance p < .05, .01 by Kruskal-Wallis.
\(^b\)Different letters within rows significant difference based on Dunn Kruskal-Wallis multiple range test at p < .05

Fig. 2. Comparison of bioethics on type and periods in horticultural activity experience.
others (Table 5). The subjects showed a high rate of cultivation experience in vegetables and cacti and succulents. This is because vegetables, which is one of the materials for children's horticultural activity programs, grow quickly and can be harvested and used for various activities, making them educationally and ecologically effective (RDA, 2021). Moreover, cacti and succulents grow slowly, but are interesting and easy to manage, and thus they can be used as materials for children's horticultural activities. Meanwhile, considering that 73.3% of the subjects had no experience growing flowers, foliage plants, and herbs, it can be seen that they had little experience with typical horticultural plants, and that they may not remember the plants they had experienced in childhood. In addition, the difficulty in distinguishing the names and classifying the horticultural plants may have also affected this result.

Meanwhile, for type of horticultural activity experienced by the subjects, 15 subjects did not give multiple responses. As a result, out of total 9 activities such as sowing, planting seedlings, repotting, watering, fertilizing, breeding, pruning, weeding, and harvesting, 12 subjects (80%) experienced sowing, 2 (13.3%) experienced repotting, and 1 (6.7%) experienced planting seedlings (Table 6). This implies that sowing and planting seedlings are the most common gardening activities for children (Lee, 2023), and considering that sowing accounted for 80%, sowing was the activity that the subjects had much experience with and was also memorable to them. Breeding activities such as sowing allow people to feel the mystery of life by understanding the source of plant life and cherish living things by observing plant growth (Kim 2003, Lee, 2012, Son, 2008), which is why experiencing this activity may have contributed to improving awareness of bioethics (Lee, 2012).

### Conclusion

This study examined the effect of horticultural activity experience in childhood on awareness of bioethics among 159 university students living in Seoul and the metropolitan area. First, 134 of the subjects had horticultural activity experience, and 25 did not, showing that 84% of the subjects had horticultural experience, and there was no significant difference in bioethics between the two groups.

Second, as a result of comparing the bioethics scores between the three groups with no experience, solo experience, and group experience, the bioethics scores of the group that had 'solo experience' of horticultural activity were significantly higher than the other two groups. This result shows that the subjects' experience interacting with plants and growing them responsibly affected the bioethics scores. Meanwhile, there was a significant difference in 'respect for life ethics', a sub-item of bioethics, which suggests that the subjects came to value plants and life through the process of actually taking care of plants.

Third, as a result of classifying horticultural activity experience by duration and comparing groups with less than 1 year of solo experience, less than 1 year of group experience, and at least 1 year of group experience, the subjects with less than 1 year of solo experience showed significant results. This shows that the duration of horticultural experience can affect awareness of bioethics in less than 1 year. Meanwhile, there were significant results in two sub-items of bioethics such as 'respect for life ethics' and 'biotechnology ethics', which imply that the subjects have come to value living things in the process of taking care of plants.
and their thoughts about nature and plants could lead to moral thinking about issues related to bioethics.

Fourth, this study examined the frequency of the number of plants and type of horticultural activity experienced among 15 subjects in the group with less than 1 year of solo experience. The ratios of vegetables and cacti and succulents were high, which showed that the subjects had much experience cultivating plants that grow quickly and can be harvested as well as plants that grow slowly but are easy to manage. Meanwhile, for the type of horticultural activity experienced by the subjects, there were sowing, planting seedlings, and repotting. Sowing accounted for the highest ratio, which implies that people can feel the mystery of life and cherish living things by observing plant growth, which may affect bioethics.

Therefore, future horticultural activity programs for children's bioethics education shall encourage children to grow plants on their own, and the duration of the programs shall be less than 1 year. However, since there is a huge difference in population between groups, it is necessary to conduct follow-up research that examines bioethics of adolescents who can remember their childhood considering the population size between groups in order to generalize the study results.

References


