



The impact of a short-term nature-based education program on young children's biophilic tendencies

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Abstract. The current research examined the effectiveness of four-week nature-based education program on young children's affinity toward nature (biophilia). The sample of the study is comprised of 40 preschools children between the age of 60 to 66-month-old residing in Mersin, Turkey. Children's biophilic tendencies were measured before and after the intervention to gauge the effect of their regular interaction with nature and play in such an environment. Children's biophilia were measured using a visually supported scale that included both biophilic and non-biophilic items. A quasi-experimental design with one group pre-test and post-test design were employed to measure the difference in biophilic tendencies before and after the intervention was given. The results showed that a short-term, nature-based education program in a natural area was effective in terms of increasing children's affinity toward nature. The improvement in children's level of biophilia after the implementation of the program was statistically significant.

Keywords: Environmental education program, nature-based education, early childhood, affinity toward nature, biophilia

Received: 07.11.2019

Accepted: 18.04.2020

Published: 15.06.2020

INTRODUCTION

The purpose of education is to shape human behavior in a positive manner. Although daily practices of teaching positive behavior and attitude differ based on culture and educational systems for different countries, the goal of creating and maintaining positive change is similar across countries. While these desired behaviors are sometimes related to the betterment of individuals by developing skills in scientific areas, such as mathematics and literature, they are sometimes related to the benefit of society as a whole by creating responsible individuals and promoting positive behavior to improve the world they live in. In today's modern world, there has been an increasing concern from man-made environmental problems such as global warming, depletion of natural resources, and declining biodiversity (Gunderson, 2014). Solving these problems requires a multidisciplinary approach that involves researchers and experts in environmental and educational studies.

How do individuals develop responsible behaviors towards the environments? The effective implementation of environmental education supports the development of responsible behaviors in individuals and has long-term outcomes which will affect the society and the world they live in (Hungerford & Volk, 1990). The development of these environmental behaviors in individuals requires increase in their awareness, sensitivity and positive attitudes, as stated in the Tbilisi Declaration in 1978. This declaration advocates the establishment of a human and environmental relationship, especially the formation of environmentally sensitive individuals in all age groups. It is well established that this relationship and sensitivity in individuals is established with environmental education in the early childhood (UNESCO, 1978).

From an education standpoint, educational researchers suggested that the lost connection between the nature and humankind could be contributing these environmental problems and this lost connection can be established through educating children with the aim to bring out positive behavioral change toward nature early in life. It is important to determine the factors that affect the individuals' behavior change related to natural environment (Mayer & Frantz, 2004). Individuals' relationship with nature is not an isolated one and it is associated with the

emotional development (Clayton & Opatow, 2003). Hungerford, Peyton and Wilke (1980) claims that the development of environmental sensitivity and healthy establishment of human-environment relationship can be promoted especially by supporting emotional development. The limited amount of time children spent in nature weakens their ties with the environment and this, in turn, negatively impact their development (Louv, 2005). According to Schultz (2002), behavioral changes in children could be achieved if they increase their connection and bond with natural environment through engagement in different kinds of natural elements and develop experiences.

One of the most effective ways to strengthen children's ties with nature is to support their tendencies to be close to nature that is inherent in them (biophilia). In other words, supporting children's biophilic tendencies matters the most in early childhood (Kahn & Kellert, 2002; Kellert, 1997; Wilson, 1984; Yilmaz, 2017; Yilmaz & Olgan, 2017). Biophilia is defined as "an innate tendency to focus on life and lifelike processes" (Wilson, 1984, p.1). Many researchers (Chawla, 2006; Sobel, 2008; White, 2004) emphasized that it is in order to strengthen children's ties with nature, to support their love of nature and help them develop a positive attitude towards nature, it is essential to develop environmental education programs in line with children's biophilic tendencies, development and learning.

There are numerous proven benefits of spending regular time in natural environment for children's health, learning, and development. According to Wilson (2008), one of the best ways to improve children's holistic development is spending time in natural settings. Many research studies revealed regular interaction with nature can nurture children's physical health (Fjørtoft, 2004), motor skills (Fjørtoft, 2001), and attention span (Mårtensson et al., 2009). The benefits of interaction with the nature is clear for children's development and biophilic tendencies. Nature itself, with its unpredictability, variability and rich materials, encourage children's natural curiosity for discovery, which in turn, enhance their skills and knowledge about the natural concepts (Fjørtoft, 2001). The relationship between a child and the nature can be thought as a reciprocal one that benefits both parties (NAAEE, 2010; White, 2004). Children, especially at young ages, should be provided more opportunities in natural environment in form of nature-based education. Once the affection and love for nature is nurtured in early years of life, children may develop environmental ethic, positive attitudes and responsible behaviors toward nature (Fisman, 2005; Palmberg & Kuru 2000; Wilson, 1996).

Natural environment, while providing rich opportunities for children and helping them gain skills and abilities, benefits from the child's affection, tendencies and positive behavior toward the environments in the long run. In another word, when children spend time in nature early in their life, their tendencies toward protecting and caring for nature increase. Natural experiences in very early years of life could help children develop some feelings of respect, love, and care for the natural environment (Ballantyne & Packer, 1996; Hadzigeorgiou, 2001; White, 2004). However, it is critical to strengthen those feelings for the nature within early years of children's life as it is only then these feeling become part of the way children see the world (Kahn & Kellert, 2002; Tilbury, 1994; Wilson, 1994; 2008). The importance of this education early in life is also emphasized in other studies. Children's environmental attitudes, perspectives and behaviors affect their emotional bond with nature and interest in environmental topic, and these interests are formed in the early years of life (Chawla & Cushing, 2007; Clayton & Opatow, 2003; Felonneau, 2004; Wells & Lekies, 2006; Wilson, 1994).

One of the effective ways to increase children's interaction and strengthen their bond with the nature is to develop and implement a well-designed environmental education program. To this extend, many researchers (ex., Ergazaki & Andriotou, 2009; Littledyke, 2004; Palmer, 1995) investigated children's understanding of science concepts associated with the environment. The researchers' main target was designing environmental education programs that could impact and improve both children's attitudes toward environment and their behaviors.

When studying early childhood environmental education, researchers use different methods to measure children's attitudes and tendencies toward nature. Using context related visual materials, interviews, or scales are common ways to measure children's tendencies. There are several examples of experimental design research trying to asses children's attitudes

toward environment (Kalvaitis & Monhardt, 2012; Kesicioğlu & Alisinanoğlu, 2009); their understanding of environment related concepts and environmental knowledge (Gülay, Yılmaz, Turan-Güllaç, & Önder, 2010; Hadzigeorgiou, Prevezanou, Kabouropoulou, & Konsolas, 2017; Karimzadegan & Meiboudi, 2013); and environmental awareness (Grodzińska-Jurczak et al., 2006; Gülay-Ogelman, 2012; Soydan & Samur, 2014; Şenocak et al. 2013).

In one example, Gülay, Yılmaz, Turan-Güllaç and Önder (2010) aimed to increase children's knowledge about soil and soil related concepts. The results of their study showed that there was a statistically significant difference between the knowledge scores of children in experimental group and control group. Environmental education program about soil was effective and increased children's knowledge about the topic. In fact, children in experimental group increased their knowledge in terms of the functions of the living things on/under soil, the characteristics of the soil, the way to protect soil, erosion, and the benefits of soil by the end of the project. In another example, Hadzigeorgiou, Prevezanou, Kabouropoulou and Konsolas (2011), in their two-group design research, investigated the effectiveness of narratives on preschool children's environmental knowledge with a quasi-experimental research design with control and treatment groups. They found that using narratives is an effective way to teach young children about the nature and increase their nature awareness. Although the researchers studied with preschool children and employed experimental design, they did not include the outdoor or nature-based environmental education program in this research.

The number of research studies with a quasi-experimental design is limited investigating children's affinity toward nature through the implementation of specific environmental education program (e.g., Gülay & Ekici, 2010; Gülay-Ogelman & Durkan, 2014; Yılmaz, Yılmaz-Bolat, & Gölcük, 2020). There is yet to be a study investigating the effects of nature-based environmental education program on preschool children's affinity toward nature. Based on the idea that once children's sense of connection with the natural environment develops early, both their positive attitude toward environment and their emotional affinity toward nature could be strengthened (Manzo, 2003).

While measuring the effect of a nature-based program on children's tendency and affection toward nature, teacher related factors could also impact the outcome. Teachers' support or teacher-student relationship could possibly affect children's behaviors and perceptions. It is usually accepted that children's positive perception about their immediate environment is related to the support they receive from their teachers and this support can increase their motivations (Roorda, Koomen, Spilt, & Oort, 2011). Teacher effect is not limited to children's motivations as a positive relationship between children and teachers. It can also increase children's achievement (Hattie, 2008), intrinsic value (Katz, Kaplan, & Gueta, 2009) elevated level of interest (Wentzel, Battle, Russell, & Looney, 2010) and effort (Wentzel, 2009).

In this study, the aim was to increase children's sense of connection with natural environment while controlling for possible teacher impact. To this extend, the researchers ask the following questions in order to examine the effectiveness of a nature-based environmental education:

- (1) Is there statistically significant increase in preschool children's biophilia scores before and after they are exposed to a short-term nature-based education program?
- (2) Is there a teacher related difference on children's biophilic tendencies after the children were exposed to a short-term nature-based education program?

METHODS

Procedure

Before the data collection procedures began, the researchers acquired ethical permission from the Mersin University Ethical Committee and a permission from the Ministry of National Education in Mersin. The school management of the early childhood education center and teachers who work with children, and parents were notified and informed about the purpose of the study. Parents also signed a consent form on behalf of their children to participate in the study.

There were three different groups of children from three different classes within the same school. Each group of children visited a natural, unstructured area within the campus at Mersin University for one day in a week for four consecutive weeks. From beginning to end, the project lasted four weeks. At the beginning of the project, during the first week, parents of the children participating were invited to children's school to be informed about the study and two researchers gave a seminar about the benefits of nature-based education program and its' possible benefits to their children's learning and development. In addition, the researchers also talked about the aim of the project, gave a glimpse of activities that were included the nature-based education program for their children. At the end of the first week, the researchers invited all the parents and teachers to the campus where the nature-based education program was going to take place to answer any risk related questions. This setting was wooded section of the campus and was only open to foot traffic. The purpose of this invitation was to inform parents about the environment where children would visit for four weeks and what type of activities, they would practically be engaged in this setting. The researchers met the teachers and parents in this particular place. They took a short walk to the places where children would visit during the project. During this walk, the parents had a chance to observe the environment considering whether or not it is safe for their children. At the end of the walk, the researchers implemented three activities that children were going to engage in during the project with the participation of parents and teachers. Then, they had lunch together and left the setting with all their questions answered. During the second week, the researchers visited children's schools to conduct the pre-test using Children's Biophilia Measure (Rice & Torquati, 2013; Yilmaz & Olgan, 2017) and this procedure lasted two school days in that week. The purpose of the pre-test was to determine children's levels of affinity toward nature (biophilia). For the next four weeks, the program was implemented with children visiting the designated area at the campus for once a week and engaging in the activities as described in the nature-based education program. During the implementation, both teachers and the researchers were actively involved to the process. During the final week of the project, the researchers visited children's school and administered the post-test using the previously mentioned Biophilia Scale to the children.

Quasi-Experimental Design for Researching Teacher Effects

A quasi-experiment method, one group pre-test/post-test research design, was employed in the current research to explore the effect of nature-based education program on 60-72-month-old-children. In a one-group pretest-posttest design, researchers measure the dependent variable (DV) before the treatment and measure DV again after the treatment is completed. In this research, the aim was to examine the effectiveness of a nature-based program on young children biophilic tendencies. This design is appropriate when there is no control group involved in research and researchers are interested in the behavior change over a short period of time before and after the treatment is given (Price, Jhangiani, Chiang, Leighton & Cuttler, 2017).

Environmental Education Program

The environmental education program was prepared by the developmental milestones described in the Ministry of National Education Preschool Program for 36-72-month-old children. There was a total of 12 semi-structured activities, and three activities were implemented by the researchers and the teachers of the children for each four weeks of the program. The researchers considered children's whole development; therefore, while planning the activities, they included variety of gains and indicators from all developmental domains. However, since children's affinity toward nature (biophilia) could be best strengthened by supporting their emotional development (Clayton & Opatow, 2003), the gains and indicators of the activities mainly aimed to support children's emotional development domain. The researchers used Children's Biophilia Measure which consists of 22 items and 4 factors. These factors were children's preferences for being outdoors, enjoyment of sensorial aspects of nature, curiosity about nature, and interacting with nature. Therefore, the researchers aimed to increase the levels of children's affinity toward nature (biophilia) through the activities

supporting these four sub-domains. In fact, there were three semi-structured activities supporting each four factors.

In addition to these semi-structured activities, children also had 30 minutes walk near a natural pond when they visit the setting each week. Children's attention was drawn to different natural elements which can be felt by using all of their senses. Lastly, each week, children had 30 minutes unstructured free play time to discover the natural environment. Children's each visit lasted three hours each week. Children were involved in variety of activities. For example, in one of these activities children were required collect natural materials such as tree branches, pine cones, stones and leaves, and they were tasked to build shelter for an animal of their choosing. Children decided which animal living in the nature needed protection and chose to build shelter for that animal. This activity was led by children and they chose their design and size when building these shelters.

Participants

The participants included forty 60 to 66-month-old children who enrolled in a public preschool in Yenisehir district of Mersin. This study was part of ongoing nature-based education program that took place in Mersin University campus. The researchers took advantage of this ongoing project. The convenience sampling method was employed to select the participants. This method is appropriate when selecting individuals for study when subjects are readily available and willing to take part in the study (Creswell, 2012). The participants were selected from three different classes from the preschool and the number of children selected from each class was 8, 18, and 14 respectively (See Table 1). The study was conducted in the spring semester of 2018 at Çiftlikköy Campus of Mersin University.

Instruments - Data Collection Material

Children's Biophilia Measure, which is originally developed by Rice and Torquati (2013), and adopted into Turkish language by Yılmaz (2017), was used as a measurement tool in this research. The instrument consists of 22 items, half of which includes biophilic items whereas the rest includes biophobic items. The adopted version of the scale had an adequate reliability, having .68 Cronbach's alpha coefficient (Yılmaz, 2017; Yılmaz & Olgan, 2017). Also, the demographic information form was used by the researchers. Children's Biophilia Measure contains 22 items (11 biophilic and 11 non-biophilic). The items were read to each child in pairs and two pictures representing a biophilic and a non-biophilic each choice was shown by the researcher. Children were expected to make a selection from either the first picture representing the biophilic attitude toward nature or the other one represented the non-biophilic attitude. They were also allowed to select both if they deem to. Two examples from the items are given below:

"This boy/girl likes to play in creeks and lakes" (biophilic), or "This boy/girl does not like to get wet and dirty" (non-biophilic)

"This boy/girl likes to play with sticks, leaves, and pine cones (biophilic item)-This boy/girl doesn't like to play with sticks, leaves, and pine cones" (non-biophilic item)

Data Collection and Data Analysis Procedures

Firstly, the descriptive statistics was used to determine the participating children's demographic characteristics. Then, the researchers run paired sample t-test to see the differences of the participants' pre-test and post-test scores. In fact, the researchers aimed to investigate whether the nature-based environmental education program would affect children's affinity toward nature (biophilia). Since there were three groups of the children in this project, as follow up analysis, the researchers used Analysis of Variance (ANOVA) to test if there was a significant difference among these groups and control any group related variance.

RESULTS

Descriptive information for children participating in this study are reported in Table 1. Among 40 children participating in this study, there were 26 (65%) girls and 14 (35%) boys. There were 3 different groups of students from each class with its own teacher present. Teacher #1 had only 8 children consisting of 6 girls and 2 boys. Teacher #2 had the biggest group of children with 12 girls and 6 boys. Lastly, teacher #3 had only 8 girls and 6 boys. Average age in months was 64.43 months for all children and for class group#1, class group #2, and class group #3 were 70.75 months, 64.5 months and 60.71 months respectively.

Table 1. Frequencies by age and gender

		Gender			Average
		Girl	Boy	Total	
Group	1	6	2	8	70,75
	2	12	6	18	64,50
	3	8	6	14	60,71
Total		26	14	40	64,43

The first step was to determine the effect of the nature-based environmental education program on children's affinity toward nature. To do this, we looked at the pre-test and post-test score difference using paired sample t-test for all children. Before conducting the test, we checked to see whether our data satisfied the assumptions of t-test. Children's pre-test and post-test scores were measured using Children's Biophilia Measure and each answer they provided were recorded as either 1 or 2 and their total scores for each pre- and post-test calculated by summing up each answer before and after the test. When children selected both answers, their responses were coded as biophilic. The dependent variable, biophilic tendency scores, was continuous. Everyone in the study was assumed to be independent of each other. Visual inspection of the histogram for the dependent variable revealed somewhat normal distribution. The data was approximately normally distributed. There were no outliers in the data. For both pre-test and post-test scores, all individual scores were within either 2 standard deviation below or 2 standard deviation above the mean.

After satisfying the assumptions of paired sample t-test, the test was conducted to compare biophilic tendencies before children were exposed to nature-based environmental education after they completed the program. Descriptive information (mean, N, standard deviation and standard error) for both pre-test and post-test groups are reported in table 2. The mean scores were pre-test group was 19.78 while the mean score post-test group was 20.23.

Table 2. Pre-test and post-test means

	Mean	N	Std. Deviation	Std. Error Mean
Pre-test	19.78	40	1.510	.239
Post-test	20.33	40	1.309	.207

T-test results are reported table 3. There was a significant difference in the group for pre-test (M=19.78, SD=1.5) and post-test scores (M=20.33, SD=1.3); $t(39) = -2.2, p = 0.034$. These results suggest that a 4-week nature-based education does have an effect on biophilic tendencies toward the nature.

Table 3. T-test results comparing pre-test and post-test biophilic score difference

	Mean	Std. Deviation	Std. Error Mean	95% CI of the Difference		t	df	Sig.(2-tailed)
				Lower	Upper			
Pre-testPost-test	-0.55	1.584	0.251	-1.057	-0.043	-2.196	39	0.034

First, the assumption of normality was checked. The dependent variable is a continuous variable and independent variable consist of three different groups. We calculated the difference of pre- and post- test scores for each individual was calculated and generated histogram for each group was generated. Visual inspection looked plausible and no outliers were observed. It was assumed that the observations are independent. It was also checked whether there were any outliers in the dependent variable. All individual scores were within either 2 standard deviation below or 2 standard deviation above the mean. The last step was to conduct Levene test to make sure homogeneity of variances did not differ. The results showed that there was no statistically significant ($F(2,37) = 2.845, p = 0.071$) variance differences.

Table 4. Test of homogeneity of variances

Levene Statistic	df1	df2	Sig.(p)
2,845	2	37	0,071

The next analysis tested whether there was a difference in the three different groups that participated in this study. To do this, conducted Analysis of Variance (ANOVA) was conducted and the results are reported in table 5. The results one-way ANOVA analysis is shown in Table 5. There was not a statistically significant difference between groups as demonstrated by one-way ANOVA ($F(2,37) = 2.04, p = 0.14$).

Table 5. ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.(p)
Between Groups	9.74	2.00	4.87	2.04	0.14
Within Groups	88.16	37.00	2.38		
Total	97.90	39.00			

DISCUSSION and CONCLUSIONS

In this section, the findings of this study are discussed with relevant literature and compared to that of other similar studies done on biophilia in children. Then, possible implications for teachers and school principals are discussed.

It was expected to observe an improvement on children's biophilic tendencies after a short period of nature-based education. Contrary to studies in the literature (eg., Gülay & Ekici, 2010; Gülay-Ogelman & Durkan, 2014; Şallı et al., 2013; Yılmaz, Yılmaz-Bolat, & Gölcük, 2020) claiming that the effect of short-term environmental education is limited, this study found statistically significant effect and an increase in children's biophilic tendencies was observed. When children are deprived of interaction with nature and their idea of nature is only nurtured and shaped by negative stories of what they hear from close family members and friends, they may end up developing biophobic tendencies (Emmons, 1997). By participating in a nature-based education programs, these children might have overcome fear of natural environments and increase their affection and interests in nature. The participant in the study were typical urban children with limited or no access to natural, unstructured areas. The implemented intervention might have provided these children with just the right amount time and a place needed to interact with nature (Tanrıverdi, 2009) and as suggested by literature (Fisman, 2005; Özdemir & Uzun, 2006; Tanrıverdi, 2009) the intervention with hands-on activities might have helped these improvements observed in this study. Mersin is a big city with over a million people living in its borders and access to natural, unstructured areas without a car ride or some sort of transportation is almost impossible. The natural setting that was used in this study is unique as it is located centrally in Mersin University but accessing this natural area requires permission from the university management. In addition, this result indicates that even the short-term environmental education program supports the emotional development of children and strengthens their connection with nature. A longer nature-based

education program could be much more effective when such program become a part of general education program.

These results might also be explained with type of the activities children were allowed to do in this study within natural environment with a rich biodiversity (Karakaya-Akçadağ & Çobanoğlu, 2018). Usually, within brick and mortar schools' activities are teacher-led, children have limited time to lead their play and they only have access to limited number of man-made materials such as manufactured toys. In this study, children were allowed to lead their own play and followed their own steps. These findings are supported by existing literature. Developing a positive outlook toward the nature occurs during early years of life and a regular interaction with nature and its elements helps this process (Kals & Ittner, 2003; Kellert 2002; Phenice & Griffore, 2003; Sobel, 2004). The findings of this study match other studies with older age groups. One such example is longitudinal study from Canada. Robertson (2008) studied with 3 to 5 years old and looked at the effects of a nature-based education on biophilic tendencies later in life at 4th and 6th grade. He found that these children had more affection toward animals and interacted with nature more. In another example, Bogner (1998) studied the impact of short-term outdoor ecology education on children's environmental attitudes and behaviors. The researcher found that children enrolled in an outdoor education program were more sensitive in terms of environmental protection and more willing to act to protect the environment. These studies confirm our finding that nature-based education programs, even for short period of time can improve children's biophilic tendencies and as proven with other studies these positive gains could stick for a long time.

The last analysis in this study looked at the impact of each individual teachers on children biophilic tendencies. There were no statistically significant differences among 3 teachers. This meant that there was no variance based on teacher characteristics. Although teachers were not instructed as to how they should make the study's nature-based education program part of their daily instruction during the study period, it was suspected that they could have emphasized the importance of nature in their daily classroom during the study. Finding no difference among all three groups based on teachers cleared this suspicion. In parallel with this result, Gülay (2011) claims that to increase the effectiveness of environmental education programs in early childhood education the expected gain in children and the target behavior changes should be treated as a whole, and different teaching methods should be employed to reach expected results. In other words, environmental education programs should be integrated into all educational activities in a way that reinforces the learning of children, rather than only within a limited period of instruction time.

Parents might have limited knowledge to provide nature-based education for children and for this reason teachers and school principals should take responsibility to incorporate a nature-based education into programs of early childhood education institutions. Providing regular opportunities for these children requires collaboration among parents, teachers and school principals. Many early childhood institutions lack resources and do not have access to such a natural environment to integrate nature-based education to their programs but with empirical evidence provided, teachers and principals could seek public support from other agencies to help them achieve this goal. Some schools may have already access to a wooded area for a nature-based education within school facilities, but this is not likely for many schools. If no such an area is available, young children can be transferred to a designated area with a school bus. Of course, this requires teachers to develop elaborated planning and collaboration among parents, teachers and school principals.

LIMITATIONS

Although this study examines children's affection and tendency toward nature with quasi-experimental design, it is not without its limitations. First, the nature-based education program used in this study is short in time and a longer program could be more effective to measure the effect. Second, this study lacks any follow-up data collection point and measuring the effect of a nature-based education after a certain period of time could help researcher determine the lasting effect of this program.

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