Indonesian Society for Science Educators
Journal of Science Learning
journal homepage: ejournal.upi.edu/index.php/jslearning

The Effect of Nature Education Activities on Biophilia Levels of Science Teacher Candidates

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ABSTRACT As a result of increasing the level of interest in living and living systems (biophilia), it will be possible to educate more protectionist individuals against nature and the environment. This study was conducted to investigate the effect of nature education activities on biophilia levels of science teacher candidates. This research was conducted at public research university in Bayburt, Turkey, in the Department of Science Education during the spring semester of the 2017-2018 academic year. The activities were done in an integrated manner to the Environmental Science course. The study group included a total of 62 science teacher candidates. These students were distributed equally to the experiment and control group. The study was used a quasi-experimental method with a group of experiments and control. In the study, the Biophilia Scale was applied as a data collection tool. Independent samples t-tests and dependent samples t-tests were used for analyzing the data. As a result of the analysis, the findings indicated that nature education and in-class activities positively affected teacher candidates' biophilia levels. The findings also indicated that the knowledge and experience they gained due to students' scrutiny, touching, smelling, and even tasting the species at in-class and nature activities affected their biophilia levels.

Keywords Nature education, Out-of-school Activities, In-class Activities, Biophilia, Science education

1. INTRODUCTION

Human beings have been a part of nature since they came into existence by acting as a part of the ecosystem, just like other living things. Today, human beings have become destructive to nature because they change their environment on a macro scale. The inevitable end for all living spaces on earth is imminent due to nature's self-centered and utilitarian perspective. If our view on nature is not a priority, nature but only human-centered, the situation will inevitably worsen. Although the idea of "protecting nature" is thought to come to the fore with environmental pollution, it can be said that it started with protecting areas and animals considered sacred to people and based on ancient times (Kurdoğlu, 2007). According to the 1995 report of the World Wide Fund for Nature (WWF), sanctuaries have probably been the most ancient habitat protection method on the planet (Wild, McLeod, & Valentine, 2008). Whatever the reason is, it is a fact that protected natural areas have a great biological heritage. However, the conflict between human activities and biodiversity conservation efforts is increasing daily in all European ecosystems (Young et al., 2005). Since Anatolia has hosted many civilizations for centuries, its natural resources have been severely damaged (Aslım, Yiğit, İzmirli & Yaşar, 2012). Biological diversity is threatened by elements such as overfishing, vegetation from nature (Karagöz et al., 2010), invasive species, environmental problems, habitat loss, natural disasters, genetically modified organisms, and endangered creatures (Çakmak, 2008).

It is undoubtedly possible to protect nature with education, to be conscious and realistic. However, especially in developing countries, the use of natural areas under the name of investment cannot be prevented despite tens of binding national and international protection laws (Kurdoğlu, 2007). Therefore, in order for our people to become more sensitive to the environment (Başlar & Şahin, 1993), it is essential to implement the necessary training (Karagöz, Özbek, & Sarı, 2016).

Informal education, the student spends a large class of his time. It is known that this education in schools is

Received: 15 April 2021
Revised: 24 May 2021
Published: 01 August 2021

different from the realities of life (Ramey-Gassert, 1997). It is a situation that students are confined to classrooms in their education life and may have been kept away from real life (Özür, 2010). Informal education should also not be neglected in addition to formal education by making use of its opportunity for the education of these individuals (Özyıldırım & Durel, 2017). Activities such as free lectures, programs, and camp training, which are widespread in institutions, most of which are in the establishment's status, are developments in increasing participants' sensitivity to their environment (Meydan, Bozyiğit, & Karabulut, 2012).

For this reason, the number of these institutions providing only informal education is increasing day by day (Meydan et al., 2012). In this context, the environments that individuals offer to act comfortably and collaboratively and make autonomous decisions enable us to reach the desired learning outcomes (Atal, & Koçak Usluel, 2011). Furthermore, individuals in out-of-school learning activities can acquire practical skills by having experience (Çebi, 2018). Humberstone and Stan (2010) emphasized that out-of-school learning activities provide beneficial experiences for students and teachers. For this reason, it is known that experiences gained from out-of-school activities are remembered for a long time (Lakin, 2006).

School outside activities about nature education have recently become popular in Turkey's field (Erdogan, 2011). With nature education, individuals can learn about the natural environment and thus understand the cause-and-effect relationships (Erdoğan, Bahar, & Uşak, 2011; Yerkes & Haras, 1997). Nature education, including nature-related issues, aims to provide participants with a broad vision of ecology (TÜBİTAK, 2018). The broad vision of ecology mentioned here is understanding and recognizing natural environments (Ozaner, 2004; Keleş, Uzun, & Uzun, 2010). In general, it can be said that nature education is utilitarian education carried out in nature. However, it is possible to turn the elements of nature into educational material (Keleş, 2011). Wilson (2007) stated that humans have an emotional connection with nature and other living things genetically, and therefore the preference to be in natural environments is a genetic phenomenon.

Biophilia is a hereditary need and tendency that emerges to connect with living systems and survive (Kahn, 1997). Biophilia is a word of Latin origin, translated as "bio-philia = living-interest", meaning a tendency to vitality. The reasons for our instinctive closeness to nature, green, and animals are hereditary and date back to ancient times. Therefore, human beings depend on nature and living systems. Today, we live in a rapidly urbanizing world where access to nature is limited (Turner, Nakamura, & Dinetti, 2004). In this context, as we move away from nature, we experience physical and mental diseases. Because human health and well-being are affected by the quality of living environments (Lopez, 2012), it is thought that being in natural environments is good for some mental illnesses or is related to beneficial factors (Bratman et al., 2019). Stress and anxiety decrease even in rooms with windows to natural environments (view) (Yin et al., 2020). Nature-designed residential areas, biophilic designs, culturally maintain people's connection with nature (Kellert, 2012,2018; Kellert, Heerwagen, & Mador, 2011). People often want to be close to living things and living systems to increase human welfare by choosing nature itself instead of the environments they create (Lumber, Richardson, & Sheffiel, 2017).

If biophilia in humans is determined, this level can be increased by species-based, appropriate nature education activities. With the increasing level of biophilia, it will be possible to raise individuals who are more concerned and protective of nature and the environment (Cooney & Dickson, 2005; Katcher & Wilkins 1993; Simaika & Samways, 2010;). The deep love for nature (biophilia) is also known as the responsibility of a person to protect nature (Perkins, 2010). Therefore, individuals' biophilia levels can be increased with nature education activities by helping to develop environmental awareness, sense of responsibility, and environmental knowledge (Erdoğan & Özsoy, 2007; Yerkes & Haras, 1997).

1.1 Purpose of the Study

This research aims to determine how biophilia levels of students studying in the third grade of Science Education undergraduate program change with nature education activities. For this purpose, answers to the following questions were sought during the research process:

Regarding the Biophile Scale (BS) at the end of nature education activities;

- Is there a significant difference between the pre-test and post-test scores of the experimental group?
- Is there a significant difference between the pre-test and post-test scores of the control group?
- Is there a significant difference between the post-test scores of the students in the experimental and control groups?

2. METHOD

2.1 Research Model

In this study, a quasi-experimental design including experimental and control groups was used. Unfortunately, education studies do not provide many opportunities for real experimental studies because it is impossible to distribute individuals to groups in school and classroom environments (Özmen, 2014). In this context, no special effort was made to match the individuals in the experimental and control groups through an unbiased assignment. However, care was taken to ensure that they were as similar as possible (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2016).

Table 1 Process steps followed in experimental and control groups

Experimental Group Activities	Control Group Activities
Meeting, making the purpose and promotion of nature education activities to be held	Meeting, making the purpose and promotion of nature education activities to be held
Implementation of BS (as pre-test)	Implementation of BS (as pre-test)
Fish examination activity (Examination of some bulbous plants in spring plants at the end of this activity)	Activity of examination of fish (Samples of fish species preserved in alcohol and formaldehyde were used. Also, examination of herbarium samples of some bulbous plants which are among the first spring plants)
Bird watching activity (Observation of birds in the dump, examining the quarries as an example of habitat loss and examining the plants in the countryside around the dump)	Bird watching activity (Sample powerpoint presentations were prepared and photographs and visuals parallel to the experimental group and a documentary about birds were used)
Examination of endemic plants (Examination of steppe tulip). In addition, water birds were observed during this activity.	Examination of endemic plants (examination of herbarium samples of steppe tulip). In addition to this activity, waterfowl powerpoint presentation was used.
Examination of reptiles (snakes and lizards)	In the study of reptiles (snakes and lizards), samples of snake and lizard species preserved in alcohol and formaldehyde were used.
Activity of studying mammals (Anatolian Yellow Scorpion and grasshopper species among Arthropods were also examined).	A powerpoint presentation was prepared using visuals parallel to the animals examined in the experimental group for the study of mammals, and scorpion alcohol samples were analyzed.
Conducting frog and salamander inspection activity (plants and songbirds were also observed).	In the frog and salamander study, samples of frog and salamander species preserved in alcohol and formaldehyde were used (also a documentary about nature was used).
Implementation of BS (as a final test).	Implementation of BS (as a final test).

2.2 Study Group

The number of students in the study group is 62 in total. The convenience sampling method was used among the non-random sampling methods. Convenience sampling is a sampling aiming to prevent loss of time, money, and overtime (Büyüköztürk et al., 2016). Thirty-one of these students are in the experimental group, and 31 are in the control group. By comparing the Biophile Scale pre-test scores of the groups, it was revealed that they were equivalent. In the study, nature education activities were carried out in the experimental group and classroom activities in the control group within the framework of the environmental science course.

2.3 Data Collection Tools

In the study, Biophile Scale (BS) was used as a data collection tool. BS was first developed by Glock, Meyer, and Wertz (1999) and consisted of expressions created to understand the connection of children and young people to nature. These expressions were translated into Turkish as 39 items, and it is a scale that contains 25 items. Furthermore, validity and reliability were ensured with the data collected from 868 university students. BS was developed and used within the scope of the doctoral study (Sefalı, 2019). Thirty minutes were given for the application of BS, which consists of 25 items with the 5-point Likert-type, and was applied as a pretest-posttest. The reliability coefficient of the test was determined to be 0.88. Content validity of the test was provided by taking expert opinions.

2.4 Data Collection and Implementation Process

In the study, the process steps shown in Table 1 were applied to the group of students with nature education activities and the group of students who did in-class activities.

As shown in Table 1, the interaction of the students in the experimental group was ensured, and a species-based activity path was followed. This situation was carried out in parallel in the control group, and museum samples and video/slide shows of living things were used. The implementation lasted for an academic period. Photos of the activities related to the experimental and control groups are given in Figure 1.

2.5 Examined Organisms

The experiment and control group participants were allowed to see and examine the living things closely during the activities in the study. In the experimental group, the species of the plants and animals were examined in living and natural environments. In contrast, the control group was examined museum materials (herbarium plant samples and animal samples preserved in formaldehyde) and visual presentations. When looking at the living things examined in activities, the species of Asteraceae, Fabaceae, Brassicaceae, Lamiaceae, and Poaceae were examined as Turkey's common flowering plants (Day, Kemp, Yáñez-Arancibia, & Crump, 2012). Also, the species of arthropods, beetles (Coleoptera), locusts (Orthoptera), and scorpions (Arachnida); some fish, frog, bird, and mammal species were studied as animal species. At the same time, habitat investigations were made.

2.6 Data Assessment

In the study, independent samples t-test analysis was conducted to test how biophilia levels changed between the experimental group students in which nature education

Figure 1 Photos of activities in the research. a-b-c: Photos of the control group, a. Investigation of "steppe tulips" of plants activity, b. Fish activity, c. Examination of the alcohol sample of the "kocabaş snake", d-e-f: Photographs of the experimental group, d. Examination of the "nalburunlu bat" in the Mammals activity, e. study of "water snakes", f. Study of the "küpeli water snake" in nature.

activities were applied and the control group students. They were applied in-class activities using BS as a data collection tool. The dependent samples t-test was used to determine whether there was a difference before and after the experimental procedure by examining the biophilia levels of the control group and experimental group students.

3. RESULTS

In the study, the findings related to the dependent samples t-test applied to determine whether there is a significant difference between the BS pre-test and post-test results applied to the control group are presented in Table 2.

According to the findings in Table 2, it was determined that there is a significant difference between the pre-test and post-test of the control group ($t(30) = -5.31$, $p<.05$). In the control group where in-class activities were applied, the average pre-test biophilia levels of the students were ($\bar{x} = 2.52$), while the average post-test biophilia levels were ($\bar{x} = 3.08$). In addition, when the effect size of the difference between the pre-test and post-test scores of the control group was calculated, Cohen d was found to have a significant effect size ($d = 0.316$) (Cohen, 1988).

In the study, the findings related to the dependent samples t-test applied to determine whether there is a significant difference between the BS pre-test and post-test results applied to the experimental group are presented in Table 3.

According to the findings in Table 3, it was determined that there is a significant difference between the pre-test and post-test of the experimental group ($t(30) = -9.16$, $p<.05$). In the experimental group in which nature education activities were applied, the average pre-test biophilia levels of the students were ($\bar{x} = 2.66$), while the average post-test biophilia levels were ($\bar{x} = 3.76$). In addition, when the effect size of the difference between the pre-test and post-test scores of the experimental group is calculated, it is seen that Cohen d, ($d = 0.482$) has a significant effect size (Cohen, 1988).

The post-test scores of the experimental and control groups were compared to determine the change in biophilia levels of the participants with nature education and classroom activities. As a result of the independent samples t-test, a significant difference was found between the post-test scores of both groups ($p<.05$). The findings obtained are presented in Table 4.

Table 2 Analysis of the pre-and post-test BS in control group

Control Group	N	$\bar{X}$	Sd	t	Sd	p	eta square
BS pre-test	31	2.52	.536	-5.31	.582	.000	.316
BS post-test	31	3.08	.572				

Table 3 Analysis of the pre-and post-test BS in experimental group

Experimental Group	N	$\bar{X}$	Sd	t	Sd	p	eta square
BS pre-test	31	2.66	.448	-9.16	.669	.000	.482
BS post-test	31	3.76	.591				

Table 4 Independent sample t-test analysis of the BS post-test scores of the experimental and control groups

Groups	N	$\bar{x}$	Sd	t	Sd	p	eta square
Experimental	31	3.76	.572	4.65	.148	.000	.265
Control	31	3.08	.591				

At the end of the application in Table 4, it was found that there is a statistically significant difference between the groups according to the data obtained from the BS ($t(60) = 4.65$, $p = .000$). According to the data in this table, the arithmetic mean and standard deviation value of the experimental group ($\bar{x} = 3.76$, $Sd = .572$) and the arithmetic mean, and standard deviation value of the control group ($\bar{x} = 3.08$, $Sd = .591$) were calculated. Therefore, it was determined that there is a significant difference in terms of biophilia levels of the students according to the BS post-test scores. In addition, when the effect size of the difference between the post-test scores of the experimental and control groups is calculated and the Cohen d value is examined ($d = 0.265$), it is seen that it has a significant effect size (Cohen, 1988).

4. DISCUSSION

In the light of all the data obtained from BS, in-class and nature education activities applied to increase the biophilia levels of the students gave positive results in both experimental and control groups and significantly increased biophilia levels. However, it was observed that the biophilia levels of the experimental group students who participated in the nature education activities increased significantly compared to the control group students who participated in the classroom activities.

Studies are showing that out-of-school activities are loved and fun by students. Because the students do not see the activities, they do as a lesson and spend time as a game or a hobby. Many studies show the positive effects of this informal education in out-of-school learning environments on students (Bamberger, & Tal, 2008; Bodur, 2015; Bozdoğan, 2007/2008; DeWitt & Osborne, 2010; Sandford, Duncombe, & Armor, 2008). Nature itself is a science laboratory. It is possible to organize all kinds of studies, researches, and training on science here. It has been determined that extracurricular activities related to science education positively affect students' attitudes (Bozdoğan, Okur, & Kasap, 2015; Güler, 2011; Jarvis & Pell, 2002/2005). Öner (2018) reported how vital the role of nature in science teaching is and that students who have little interaction with nature have difficulty relating their learning. This study was implemented in nature, which is one of the learning environments out of school. It aimed to increase the biophilia levels by exposing the students to interact with the studied creatures for a long time.

In the study, when the findings obtained as a post-test with the BS applied to compare the biophilia levels of the experimental and control groups after the activities were examined, it was found that the biophilia levels of the students in the experimental group were higher than the students in the control group. The high biophilia levels of the students in the experimental group with nature education activities are thought to be since the students in this group can examine the materials used in the activities live, touch, and feel these creatures. They have examined these creatures in their natural environment for a long time. Some studies show that contact with living creatures is good for people and even therapy (Allen, 1997; Clements, Benasutti, & Carmone, 2003; Frumkin, 2001; Jhonson & Meadows, 2002; Lust, Ryan-Haddad, Coover, & Snell, 2007; Shore, Douglas, & Riley, 2005;). The fact that there is a significant difference between the pre-test and post-test scores of the control group shows that in-class activities related to nature education also increase the biophilia levels of the students. However, the fact that the students in the control group did their activities over the dead materials and the activities performed as a presentation and documentary might have caused the increase in biophilia levels not as much as in the experimental group.

It was determined that the participants' perspectives on the world were positively affected by nature education studies, and the experiences gained were shared with other people (Güler, 2010). Similarly, it is possible for the knowledge acquired through nature education to become permanent and faster (Erten, 2004; Farmer, Knapp, & Benton, 2007; Ozaner, 2004). They also drew attention to how nature travels develop an awareness of the relationships between the individual himself, others, and the natural world (Kaplan & Kaplan, 1989; Keleş et al., 2010).

Since the concept of biophilia is an unpredictable value, it is vital to protect genes, populations, species, or interactions (Cooney & Dickson, 2005). Since our connection with nature is experiential, biophilia is best derived from learned experiences (Tidball, 2012). So biophilia is not an innate love; instead, it is learned by instilling responsibility into nature (Katcher & Wilkins, 1993). Some researchers working on the concept of biophilia have drawn attention to the aspects of biophilia that will be learned later and utilitarian in protecting nature rather than being inherited (Katcher and Wilkins 1993; Miller 2005; Samways, 2007; Stokes 2006; Tidball, 2012). It appears that accepting biophilia as a learned trait to help preserve biodiversity is far more helpful than trying to claim it is innate (Sala, 2009; Simaika & Samways, 2010). It is known that emotional factors play an essential role in people's identification of species (Martınez-Lopez, Montes,

& Benayas, 2007), and well-informed people have ecological-scientific thoughts (Tidball, 2012). Therefore, it is possible for individuals to become more concerned and protective towards nature and the environment due to increasing their biophilia levels by learning (Cooney & Dickson, 2005; Katcher & Wilkins 1993; Simaika & Samways, 2010).

5. CONCLUSION

As a result, it was ensured that the participants got close to living beings with both in-class (control group) and nature education (experimental group) activities. Mainly, with the nature education activities conducted in the experimental group, the students were made to touch, smell, and taste (some plants) living things and perceive the vitality and natural environments more clearly. Therefore, the biophilia levels of students have a better view and study of living things and nature have increased their biophilia levels. Therefore, it is essential to determine and increase individuals' biophilia levels to protect nature and understand the importance of living things. In addition, the importance of the concept of biophilia has been revealed in this study.

6. RECOMMENDATION

Some suggestions have been made within the scope of this study. Looking at these suggestions.

It is essential to determine and increase individuals' biophilia levels to protect nature and understand the importance of living things.

In nature education activities, different species should be examined as much as possible to increase the biophilia levels. Suppose it is assumed that a sufficient number of species are examined in this study. In that case, the fact that endemic rare, invasive, and endangered species have also been examined can be effective in increasing the biophilia level.

The general and distinctive features of the species to be studied in nature education activities should be well known. If species are very close to each other, examining that species with its closest relatives can facilitate species distinctions.

One of the most striking aspects of nature education activities is studying the species that people fear or disgust. For students, their attitude to these species depends on the researcher's attitude towards these creatures. Therefore, the researcher should be well planned to show the fundamental aspects of these creatures by explaining them, and the way they approach the living things will not be adversely affected. For example, the researcher's attitude towards dangerous species (poisonous) or grasping an aggressive snake like the Big Head Snake (non-venomous) by the head and showing how to hold it.

The use of some examples in nature in the classroom environment will effectively increase the biophilia level of students. For example, for nature education activities, museum samples of living things (such as herbarium samples) can be prepared by teachers and used in the classroom environment. In addition, it is possible to benefit from mineral stones, dried plant samples, seashells collection, and feather collection.

Gender variable can be used as advice while determining the change in the biophilia level differences of the participants in nature education activities.

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