IJERE International Journal of Educational Research Review

International Journal of Educational Research Review

Evaluation of Nature-Based Production Activities with Computer Science for Middle School Students: The Sample of the "Inspired by Nature" Project[1]

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Article History:
Received 26.03.2023
Received in revised form 13.08.2023
Accepted
Available online 01.10.2023

The aim of the research is to examine the effects of informatics production workshops conducted together with nature workshops on the scientific attitudes of the participants, their beliefs in science and their attitudes towards STEM. Sequential explanatory design, which is one of the mixed research methods in which quantitative and qualitative approaches are used together, was used in the research. Secondary school students participating in the research went through a 70-hour training process. At the end of this process, it was seen that there was no significant change in the scientific attitudes and scientific views of the participants as a result of the measurements made with the measurement tools, but there was a positive increase in their attitudes towards STEM.

Keywords: Nature education, informatics production, STEM

INTRODUCTION

Gardner's theory of multiple intelligences, introduced in 1983, has affected many educational systems across the globe. In the original theory, there are seven types of intelligence, which are: Logical-Mathematical, Verbal-Linguistic, Visual-Spatial, Intrapersonal, Interpersonal, Musical-Rhythmic, and Bodily-Kinesthetic. Soon after, Gardner added a new intelligence type, "Naturalist intelligence" (Louv, 2019). According to Gardner, naturalist intelligence is the ability to identify, classify, and manipulate the elements of the environment, objects, animals, or plants (Sadiku, Ashaolu & Musa, 2020). The individuals with high naturalist intelligence tend to have a strong inclination towards the natural world, a strong sense of responsibility towards the environment, and enjoy exploration, adventure, and open-ended experiences (Sadiku et all, 2020).

Taking these characteristics into account, it is possible to feel that the natural inclinations of all children are being described. It is a visible fact that children have a need to discover nature directly. It is easier for children and adults to identify with their immediate environment. Therefore, the presence of nature in a person's immediate environment provides the opportunity to get to know and learn about it (acquiring knowledge through experience with their senses) (Çukur & Özgüner, 2008). Children especially use their senses to understand and explore the world. Since the main source of sensory stimuli is the natural environment, the freedom to explore and play with the natural environment in their own environments and time is of fundamental importance for the healthy development of children's inner lives (Louv, 2019).

In recent years, the Montessori and Reggio Emilia approaches, which are particularly popular in preschool education, has emphasized the importance of the environment. In these approaches, the environment is where learning takes place, and the environment is also a teacher for the child. Nature is a rich learning space for children. Every natural space is an infinite source of knowledge and therefore contains unlimited potential for new discoveries (Louv, 2019). Children need to explore the natural environment, and they use their own initiative for learning to take place in natural environments (Thompson & Thompson, 2007).

It is widely accepted that there are many beneficial effects of learning and working in natural environments or the environments close to nature. For example, research has shown that more campus green spaces are associated with an increase in quality of life among university students (Bogerd, Dijkstra, Koole, Seidell, Vries, & Maas, 2020). However, there are strong advocates for the claim that changing world conditions means changing people's lifestyles, and as a result, they are becoming disconnected from nature (Okur-Berberoğlu & Uygun, 2013). Children live through their senses. Since the primary source of sensory stimuli is the natural environment, the freedom for children to explore and play with the natural environment using their senses in their own surroundings and time is of fundamental importance for the healthy development of their inner lives. In today's society, most children living in big cities are deprived of these unlimited opportunities offered by nature. Even though these environments are regarded as virtual and abstract environments for most of today's children, who are surrounded by technological devices, natural environments, where children should spend a large part of their daily lives, have become more abstract for them nowadays.

[1] *A part of this study was presented as a paper at the IXth International Eurasian Educational Research Congres.*

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Depriving children of a learning environment with unlimited sensory stimuli is one of the great injustices that can be done to them. Most children also do not want to disconnect from the virtual environment they are in. To make children, who are increasingly moving away from nature and spending more time with technology, be aware of the importance of nature in our lives, it will be helpful to speak in the language they speak. Showing them that many of the technological inventions they are familiar with were developed by taking inspiration from nature might be the first step for this goal. It is quite important to tell children and young people that many technological innovations that play significant roles in solving many problems we encounter in daily life and facilitating our daily tasks were developed by taking inspiration from nature. There are many solutions in nature, and we are learning more and more from nature. The detailed examination of nature and the realization of its rules for the development of new inventions that people create to solve the problems they encounter or to facilitate their lives is called Biomimicry (Biomimicry Institute, 2022).

Natural organisms have unique structures that allow them to efficiently convert physical stimuli into biological signals, enabling them to survive in challenging environments. For example, many mammals such as cats, mice, seals, and insects have mechanical-sensory whiskers. Research has been conducted based on the exceptional ability of mammalian whiskers to detect very small amounts of strain and vibration. Significant progress has been made in developing bionic whiskers that can efficiently detect different environmental factors. The hair-like structure of whiskers is highly suitable for designing strain/touch sensors, pressure sensors, temperature sensors, airflow sensors, vibration sensors, and position sensors. Additionally, the surfaces of octopuses, gecko feet, and mussels inspire researchers to develop pressure, tactile/strain, and temperature sensing devices that can be worn on the skin. Most wearable sensors are inspired by these structures. Furthermore, the elegant beak of the avocet bird has inspired the aerodynamic nose design of high-speed trains in Japan, and the skin of the octopus has inspired the invention of 3D-textured stretchable surfaces that transform into a synthetic "camouflage skin".

It is important for future engineers, scientists, and all professional groups leading technological innovations to realize the potential of nature. It is a known fact that gaining this awareness at a young age is crucial, as nature serves as a living model for children, and the events and phenomena in nature can be grasped permanently through direct interaction with natural elements (Özdemir, 2010; Başal, 2003). For this purpose, there are many nature education programs. Çukur & Özgüner (2008) examined the studies related to this subject in Turkey. In their study, they stated that in the theses related to nature education in Turkey, instead of focusing on nature education or science, environmental education, environmental issues, environmental sensitivity, environmental consciousness, and attitudes towards the environment were addressed. They also noted that the dominant idea was that sensitivity towards the environment in children can only be increased through environmental education provided in schools. However, as Eş & Öztürk-Geren (2014) pointed out, some problems such as time constraints due to the intensity of the educational programs, large class sizes, inadequate resources, and teachers' lack of experience/inadequate knowledge about student-centered approaches, lead to traditional teacher-centered methods in instruction. Hence, this causes students to develop negative attitudes towards the courses, especially science courses that need to be learned through hands-on experiences, which should be closely related to nature. In addition, in Turkey, many out-of-school projects have begun to be implemented to overcome the disadvantage of the lack of school environments that will provide learners with the opportunity to learn in natural settings through trial and error. Especially, TUBITAK's 4004 Nature and Science Schools Program is an important opportunity for creating such environments.

It is clear that the perception of information tools needs to change in today's society, where they have taken on an important role in human life. It cannot be ignored that the use of these tools is directly related to a country's economic standing among the world's nations. The gap between societies that only consume information tools and those that use them in production activities is increasing. When many countries are examined, Japan's position in production leadership is noteworthy. Due to the experiences that made Japan's economy difficult in the past, their priorities of education and technological development are clearly stated by the government. They express that they can effectively use human resources in this way, and only through this method can they rebuild a collapsed society and economy. In today's conditions, where technological innovations largely determine the economic development of countries, training future engineers and science experts, and promoting science and technology literacy are more important than ever before (Miaoulis, 2009). Many countries have begun to realize this situation and have started to make changes in their education systems accordingly. In 2010, the United States published a report called "Prepare and Inspire: K-12 Education in Science Technology, Engineering, and Mathematics (STEM) for America's Future". This report emphasizes that the nation's future depends on a well-educated generation in the fields of science, technology, engineering, and mathematics (STEM) (President's Council of Advisors on Science and Technology [PCAST], 2010). STEM has become a state education policy in the United States. One of the key ways to improve the quality of the STEM workforce is to promote behaviors such as trial and error, learning by doing, inquiry, free thinking, and supporting different ideas, both in the education system and in the business world (TUSIAD, 2014).

The expected outcome from the new generation is not only to acquire knowledge, but also to participate in production activities at a young age or to have an idea of how these processes work. Today, such production needs are largely solved using information technologies. The ability to produce with information technologies has become a fundamental skill that every individual should acquire, just like reading and writing, rather than being a skill exclusive to professionals in the field. In the project under study, computer coding, 3D design, electronic design/coding, robotic coding, and augmented reality work are not technical skills that only a few students interested in technology or a professional skill would learn, but rather they are some of the many tools used in the production process of smart technologies that they see around them, and the aim is to help them understand this phenomenon with a scientific perspective. When the students participating in the project use information technology to produce or develop a technological innovation, they have the opportunity to observe the nature and the environment through the nature observations and workshops prepared within the framework of STEM education. They seek answers to the problems they have identified during nature observations by following scientific research steps inspired by nature and trying to find solutions by producing a project with information tools. The impact of these activities on students' scientific attitudes, belief in science, and attitudes towards STEM and the contribution of the education from the perspective of parents to students are the subject of this research. The questions to be answered in the research are as follows:

1. Does nature-based computer production activities have an effect on students' scientific attitudes?
2. Does nature-based computer production activities have an effect on students' belief in science?
3. Does nature-based computer production activities have an effect on students' attitudes towards STEM?
4. What is the contribution of nature-based computer production activities to students according to the views of parents?

METHOD

The sequential explanatory design, which makes use of both quantitative and qualitative approaches, was used as a mixed research method in this study. In mixed research, one or more research sequences are present, and quantitative and qualitative approaches are administered together in these types of studies (Mertkan, 2015). In the sequential explanatory design model, quantitative data is predominantly collected and analyzed first, and then qualitative data is collected (Baki & Gökçek, 2012). In this research, quantitative data was first collected from the students through scales before and after the project, and after collecting quantitative data at the end of the project, the opinions of parents were collected qualitatively through interview method.

The study group of the research consisted of middle school 5th, 6th, 7th, and 8th grade students who were studying in Kırşehir province and districts in the 2020-2021 academic year. The number of the students participating in the activities during the project was determined as 40 people. The participants were randomly selected on the basis of their grade level from among the voluntary students who applied online on the project website on the announced date. Furthermore, it was tried to ensure that the participants were gender-mixed, but it was noticed that there were mostly girls among the applicants. Four students were excluded from the scope of the research due to presenting incomplete data during data collection. The distribution of the participating students according to their genders can be seen in Table 1.

Table 1. *Distribution of the study group by gender*

Gender	f	%
Female	22	61,1
Male	14	38,9
Total	**36**	**100**

Table 1 shows that 61.1% (n=22) of the students participating in the study were female students and 38.9% (n=14) were male students.

The activities of this project are supported by the TUBITAK Nature Education and Science Schools Program. The TUBITAK Nature Education and Science Schools Support Program aims to bring knowledge to society and disseminate it by visualizing knowledge as much as possible, making it understandable through interactive applications, and encouraging participants to notice scientific facts, stimulating their curiosity, research, inquiry, and learning desires (TUBITAK, 2019). Especially informal environments are significant in terms of completing the knowledge and skills learned in schools, enabling research and experimentation, and contributing to their ability to think inquisitively and multi-dimensionally to access knowledge (Noel-Storr, 2004). This research designs a ten-day training carried out in such an informal environment. The main objective of the education conducted as part of a Nature Education and Science Schools Project supported by TUBITAK is to make middle school children realize that nature is the inspiration for most technological innovations, and to enable them to experience with workshops, live examples, and sample cases that they can produce solutions with information tools to the problems they face.

Data Collection Tools

In the study, the "Scientific Attitude Scale (SAS)", "Scientific Opinion Determination Scale (SODS)", and "Attitude Scale towards STEM" were used to collect quantitative data. The SAS, developed by Moore and Foy (1997), was used to measure students' scientific attitudes. The scale consists of 6 subscales and 40 items. The 40 items on the scale were structured according to the sub-dimensions of willingness to exhibit scientific behavior, willingness to engage in scientific activities, understanding of the structure of scientific laws and theories, approach to events in natural sciences, the structure and purpose of natural sciences, the place and importance of natural sciences in society, as well as willingness to engage in scientific research (Demirbaş & Yağbasan, 2006). Since its development in 1970 and revision in 1997, the SAS has been widely used in many studies owing to its validity and reliability. The Cronbach's Alpha reliability coefficient of the original scale (revised in 1997) was found to be 0.78, and the Spearman Brown reliability coefficient was 0.80. The Turkish adaptation of the scale was conducted by Demirbaş & Yağbasan (2006), and the researchers reported a Cronbach's Alpha reliability coefficient of 0.76 and a Spearman Brown reliability coefficient of 0.84 after the adaptation process. The SODS, developed by Çoban & Ergin (2008), was used to determine the students' level of belief in science. The scale consists of 16 items and was developed to include three subfactors, which are scientific knowledge is closed, scientific knowledge is justified, and scientific knowledge can change. The scale was arranged in a 5-point Likert format, with 8 of the items being reverse-scored, and was designed to determine primary school students' views on scientific information. In the study by Çoban & Ergin (2008), validity and reliability studies were conducted regarding the scale, and the Cronbach α was found to be 0.83, while the test-retest reliability coefficient was found to be 0.85. To determine the students' attitudes towards STEM, the Turkish adaptation of the STEM Attitude Scale developed by the Friday Institute for Educational Innovation (2012) was performed by Özcan & Koca (2019). The original scale consisted of 37 items and was arranged in a 5-point Likert scale. The data obtained from the adapted scale was subjected to Confirmatory Factor Analysis (CFA) to examine its conformity to the original four-factor structure. The results showed that the original factor structure was preserved. The reliability of the scale was checked with the internal consistency coefficient for the entire scale and its factors. The obtained Cronbach Alpha coefficient was calculated as 0.91 for the entire scale, 0.86 for the mathematics factor, 0.87 for the science factor, 0.86 for the engineering and technology factor, and 0.88 for the 21st-century skills factor.

In the study, qualitative data was collected through a semi-structured interview form developed by the researcher and presented to expert opinion. In the interviews conducted with the parents of the students, they were asked to evaluate the training provided to their children. The data obtained from the interviews with the parents of the students were subjected to content analysis. The main aim of content analysis is to reach concepts and relationships that can explain the collected data (Yıldırım & Şimşek, 2006). In this context, codes were first created from the obtained data, and then themes were formed.

Data Collection and Implementation Process

To determine the current status of the students' scientific attitudes, scientific views, and STEM attitudes before starting education, the SAS, SODS and STEM attitude scales were administered as a pre-test. After the pre-tests, the students were included in a 70-hour training program. The basic philosophy adopted in the training was to teach the children the working principles of smart devices and technologies around them at an early age, and to create the awareness revealing that all kinds of technological development are inspired by nature and science. The aim was to enable the students to discover that the knowledge and skills they would gain during the training, such as algorithmic thinking and programming, are not only specific to the field of computing. They were encouraged to use these skills to apply theoretical knowledge gained in other courses and to realize that computer tools provide an important opportunity for production, not just consumption. For this purpose, some activities were initially planned in the workshops of the project to enable students to explore the nature of science. The students were asked to observe certain situations in their natural environment, gain inspiring experiences in nature, and identify a problem situation related to what they observed. They were then asked to search for answers to solve their identified problems by drawing inspiration from nature and creating a project using computer tools. Throughout this process, the students experienced that computer science software, hardware, and design components could be used together with knowledge from other fields to develop real products and that nature is a rich source of inspiration for this development. Scientific research steps were implicitly introduced to the students during nature trips conducted throughout the project, and the knowledge, experience, and scientific perspective gained during these trips is believed to have provided a foundation for other workshops. During the implementation of all workshops, environments were created that allowed the students to make mistakes, learn from their own mistakes, repeat something they did not like, observe each other during production, spend time observing, researching, and conducting experiments in nature, and collaborate with each other. The purpose of this research was to determine whether these activities, which were production-oriented with inspiration from nature and implemented with a scientific perspective, had an effect on the students' scientific attitudes, belief in science, and STEM attitudes. In evaluating the project, the opinions of the students' parents about its contribution are also important. Therefore, the research also aimed to analyze the opinions of the parents regarding the project and the current situation.

Analysis of Data

Quantitative data collected from the students through scales in the research were presented through descriptive statistics. Qualitative data collected from the parents through semi-structured interview forms were subjected to content analysis. The data evaluated by a researcher and an expert in the field were gathered under codes and themes. Miles and Huberman's (1994) reliability formula was used to calculate intercoder agreement. The intercoder agreement percentage was calculated as 91% The reliability percentage of 70% is considered sufficient in terms of reliability (Yıldırım & Şimşek, 2013).

Findings

In the study, the findings obtained from the measurement tools and semi-structured interview form are presented under separate headings according to the research questions.

The findings related to the "Scientific Attitude Scale (SAS)", "Scientific Opinion Determination Scale (SODS)", and "Attitude Scale Towards STEM" used in the research were displayed under different titles according to the research questions.

The findings related to the research question *"Does the use of nature-based computational production activities have an effect on students' scientific attitudes?"* are as follows:

The data from the scales used as data collection tools in the research were analyzed, specifically the "Scientific Attitude Scale". Firstly, the data of three students were excluded from the evaluation because of the missing scale data. Thus, the analysis was performed on 37 individuals. Normality tests were conducted on the pre-test and post-test scores of the students. Skewness (0.035) and kurtosis (0.598) values were found to be in the normal range for the pre-test results, while skewness (-0.437) and kurtosis (0.078) values were found to be in the normal range for the post-test results. Since the distributions were found to be normal, the dependent samples t-test was administered to examine the difference between the pre-test and post-test scores of the Scientific Attitude Scale. The results of the dependent samples t-test for the pre-test and post-test scores of the Scientific Attitude Scale are indicated in Table 2.

Table 2. *Scientific Attitude Scale Dependent Samples T-test Pre-test and Post-test Results*

	n	$\bar{X}$	ss	t	sd	p
Scientific Attitude Pre-test	37	138,945	9,195	-0,938	16,649	0,354
Scientific Attitude Post-test	37	141,513	16,846			

The Dependent Samples T-Test results for the participants' Scientific Attitude Scale pre-test and post-test are shown in Table 2. According to the results obtained from Table 2 (p>0.05), there is no significant difference in the pre-test and post-test scores of the data obtained from the sample. At the same time, the average score obtained from the pre-test (X: 138.945) and the average score obtained from the post-test (X: 141.513) are also displayed in the table. Therefore, it can be seen that there is no significant change in the participants' scientific attitudes after the implemented education.

The findings related to the research question *"Does nature-based computing production activities have an effect on students' belief in science?"* are presented under different headings based on the "Scientific Attitude Scale (SAS)", "Scientific Opinion Determination Scale (SODS)" and "Attitude Scale towards STEM". Descriptive statistics of pre-test and post-test scores of the "Scientific Opinion Determination Scale" used to determine students' level of belief in science are indicated in Table 3. As the scale data was incomplete for four students, their data was excluded from the analysis. Thus, the analysis was conducted on 36 individuals. Normality tests conducted on the pre-test and post-test scores of the scale determined that the scores were normally distributed. For the pre-test results, it was observed that the skewness (-0.601) and kurtosis (1.858) values were within the normal range. For the post-test results, it was observed that the skewness (-0.571) and kurtosis (1.693) values were within the normal range.

Table 3. *Descriptive Statistics of Scientific Opinion Determination Scale Pre-Test and Post-Test Scores*

	n	Min	Max	$\bar{X}$	ss
Scientific Opinion Determination Pre-test	36	36,00	75,00	57,083	7,338
Scientific Opinion Determination Post-test	36	34,00	76,00	59,055	8,522

When Table 3 is examined, it can be put forward that the mean scores of the Scientific Opinion Determination Scale pre-test and post-test are at an average level. Since the pre-test and post-test score means are normally distributed, a dependent samples t-test was used to determine if there was a significant difference between the pre-test and post-test scores. The results of the dependent samples t-test for the Scientific Opinion Determination Scale pre-test and post-test scores are shown in Table 4.

Table 4. *Scientific Opinion Determination Scale Dependent Samples T-test Pre-test and Post-test Results*

	n	$\bar{X}$	ss	t	sd	p
Scientific Opinion Determination Pre-test	36	57,053	7,338	-1,030	11,487	0,799
Scientific Opinion Determination Post-test	36	59,055	8,522			

When examining Table 4, it can be detected that the Dependent Samples T-Test results for the Scientific Opinion Determination Scale pre-test and post-test scores of the participants are shown. According to the results obtained from Table 4 (p>0.05), there is no significant difference in the pre-test and post-test scores of the data obtained from the sample. The average score obtained from the pre-test (X:57.053) and the average score obtained from the post-test (X:59.055) are also presented in Table 4. Therefore, it can be concluded that there was no significant change in the participants' scientific opinions after the conducted nature-based computing production activities.

The findings related to the research question "Does nature-based computing production activities have an effect on students' attitudes towards STEM?" are as follows:

Firstly, the data related to the STEM attitude scale were subjected to a normality analysis. As a result of the normality tests conducted on the STEM attitude scale pre-test and post-test scores, it was determined that the scores were normally distributed. The skewness (-0.784) and kurtosis (0.155) values were found to be within the normal range for the pre-test results. Also the skewness (-0.946) and kurtosis (1.098) values were found to be within the normal range for the post-test results.

Table 5. *Descriptive statistics of STEM attitude levels pre-test scores*

	n	Min	Max	$\bar{X}$	s
Math Factor	37	7,00	34,00	20,918	4,277
Science Factor	37	15,00	40,00	28,621	6,812
Engineering and Technology Factor	37	16,00	40,00	30,891	7,752
21st Century Skills Factor	37	15,00	55,00	43,864	9,638
Total	37	73,00	153,00	124,297	21,005

The STEM attitude scale consists of four sub-factors: "Math Factor", "Science Factor", "Engineering and Technology Factor", and "21st Century Skills Factor". Descriptive statistics of the pre-test results for these four sub-factors are displayed in Table 5. It can be argued that the pre-test averages are high for each factor when looking at the means of the factors.

Tablo 6. *Descriptive Statistics of STEM Attitude Levels Post-Test Scores*

	N	Min	Max	$\bar{X}$	s
Math Factor	37	9,00	33,00	24,378	4,596
Science Factor	37	13,00	41,00	32,783	7,714
Engineering and Technology Factor	37	14,00	45,00	37,216	8,003
21st Century Skills Factor	37	15,00	55,00	46,567	9,500
Total	37	72,00	171,00	140,945	22,676

The descriptive statistics of the post-test results of the four sub-factors of the STEM attitude scale are shown in Table 6. Considering the averages of the factors, it can be stated that the post-test averages for each factor are also high. Dependent samples T-test was used to see if there was a difference between the pre-test and post-test results. Table 7 indicates the data for this test.

Table 7.*STEM Attitude Scale Dependent Samples T-test Pre-test and Post-test Results*

	n	$\bar{X}$	ss	t	sd	p
STEM Attitude Pre-test	37	124,297	21,005	-5,290	19,144	0,00
STEM Attitude Post-test	37	140,945	22,676			

The results of the Dependent Samples T-Test for the pre-test and post-test scores of the STEM Attitude Scale of the participants are presented in Table 7. According to the results obtained from Table 7($p<0.05$), there is a significant difference between the pre-test and post-test scores of the data obtained from the sample. Additionally, when the mean score obtained from the pre-test (X:124.297) and the mean score obtained from the post-test (X:140.945) are examined, a significant increase in favor of the post-test is observed. Thus, it can be concluded that the attitudes of the participants towards STEM have positively increased after the completion of the education.

The findings related to the research question *"What are the contributions of nature-based computing production activities to students according to the opinions of parents?"* are as follows:

In order to provide a different perspective on the impact of the project on children, semi-structured interviews were conducted with parents at the end of the project to evaluate the project from their perspective. During the interviews, the parents were asked to express their views on the contributions of the project to their children. The findings related to the views of the parents on the project are presented in Table 8.

Table 8.*Parents' opinions on the Project*

Theme	Code	f
Contributions in terms of individual development	Confidence	10
	Motivation	7
	Sense of responsibility	6
	Creativity	5
	Planned study	4
	Quality time	4
	Sense of accomplishment	3
	Dexterity	2
	Overcoming the fear of animals	1
Social contributions	New friendships	14
	Teamwork	12
	Communication skill	6
	Respect for differing opinions	2
	Role modeling of teachers	1
Academic contributions	Learning by doing	11
	Permanent learning	8
	Ability to use IT tools	7
	Interest in science	7
	Interest in lessons	1

Based on the interviews with the parents of the children who participated in the project, it has been concluded that they contribute to the effects of participation in this project on the students in three main themes. According to the parents' views, the themes that emerged are social contribution, academic contribution, and contribution to individual development. The theme with the greatest impact is believed to be the "contribution to individual development" theme. The biggest contribution of the project to the students' individual development is thought to be the contribution to their self-confidence.

"My child has increased their self-confidence. They started designing projects in their minds to improve the work they did in the workshops. This situation increased their belief in themselves and also improved them mentally." (K22, Female)

"I think their self-confidence has increased. Now their self-confidence is very good. They have an idea about how robots are made and they think they can do it themselves in the future." (K20, Female)

The parents stated that the project's second-largest contribution to students' individual contributions is their motivation.

"Their motivation has definitely increased, they took on the responsibility of learning, and learned to work in groups. They also developed manual and technical skills in a short time." (K18, Male)

The parents also stated that the project helped their children's sense of responsibility develop, supported their creativity, taught them to work systematically, allowed them to spend quality time, gave them the opportunity to taste the sense of achievement, improved their manual skills, and helped them overcome their fear of animals.

They believe that the greatest contribution of the project to the students from a social perspective is enabling them to make new friends.

"The project helped reduce the negative effects of the pandemic after the pandemic. It provided a great contribution in terms of socialization by enabling my child to make new friends during these 10 full days." (K13, Female)

The parents have expressed that the second most significant contribution of the project from a social perspective is promoting teamwork.

"We think that our child's desire to produce better things with their friends through group work has increased." (K12, Male)

"They became a more social individual. The project enabled them to do things with their friends, enjoy teamwork, and the team spirit." (K11, Male)

Additionally, the parents have stated that the project has improved their children's communication skills, taught them to respect different ideas, and provided them with role models in the participating teachers.

"It contributed to many areas such as developing a sense of responsibility, improving new communication skills, and taking responsibility." (K9, Female)

"Thanks to the project, they became a more social and active individual. They made new friendships. They really liked their new teachers and started to see them as role models." (K11, Male)

In the third theme identified by the parents' opinions, "Academic Contribution," it is seen that the most agreed code is the opportunity provided by the project for children to learn by doing and experiencing.

"They realized the 'Learning by having fun' dimension of learning. Thanks to learning by doing and experiencing, they have acquired more permanent knowledge." (Female, 21)

In addition, the parents have expressed that they believe their children have achieved lasting learning, developed their skills in using information technology tools, and increased their interest in science and their classes through the activities carried out in the project.

"I believe that it has positive contributions to meaningful learning, logical thinking, scientific creativity, and technology usage skills." (K18, Male)

"We believe that the experimental studies they have seen will shed light on the lessons they will receive at school, enable them to think in a multifaceted way, and contribute to their academic success." (K5, Female)

"They have improved their skills such as creating projects, understanding the working principles of technological devices, integrating nature with science, teamwork, making observations, communication, and expressing themselves well by concretizing what they have learned in the computer science class." (K6, Male)

CONCLUSION AND DISCUSSION

According to the data obtained at the end of the project, it is visible that the students had high scores on the scientific attitude scale before starting the project. At the same time, it was observed that the scores obtained on the Scientific Perspective Determination Scale were at an average level. According to the pre-test and post-test results of the Scientific Attitude Scale and the Scientific Perspective Scale, there was no significant change in the participants' scientific attitudes and perspectives after the education. It can be understood from the pre-test results that the participating students were already interested in science since they applied to the project on a voluntary basis. In addition, as it can be comprehended from the qualitative data, there is a positive opinion (f=7) that the project increased the participants' interest in science.

The STEM attitude scale consists of a total of four sub-factors: mathematics, science, engineering and technology, and 21st century skills. It was observed that the average scores of students from each sub-factor of the STEM attitude scale were high according to their pre-test and post-test results, and their attitudes towards STEM increased positively at the end of the project education activities. According to the study of Çınar, Pırasa & Sadoğlu (2016), STEM education develops psycho-motor and spatial skills, supports cooperative learning, provides socialization, effective and permanent learning. Considering the quantitative and qualitative data of the research; it is observed that nature activities supported by computer-based production activities increase the positive attitude towards STEM. The opinions of the participating parents reveal that project education is to provide students' self-confidence, motivation, sense of responsibility, creativity, communication, using information tools and hand skills, making new friends, learning by experience, teamwork and permanent learning. The findings from this point of view, Çınar et al. (2016) supports the results. In addition, the results of the research support Noel-Storr's (2004) claim that informal environments are important in terms of completing the knowledge and skills that children have learned at school, enabling them to conduct research and experiments, and encouraging questioning and multi-dimensional thinking to reach information. .

Declarations

Conflict of Interest

No potential conflicts of interest were disclosed by the author with respect to the research, authorship, or publication of this article.

Ethics Approval

The formal ethics approval was granted by the Social and Human Sciences Research and Publication Ethics Committee of Kırşehir Ahi Evran University. We conducted the study in accordance with the Helsinki Declaration in 1975.

Funding

This research is supported by TUBITAK Science and Society Programs 4004 Nature and Science Schools Program (Project No 121B918).

Research and Publication Ethics Statement

The study was approved by the research team's university ethics committee of the Kırşehir Ahi Evran University (Approval Number/ID: 03.12.2019-35/04. Hereby, we as the authors consciously assure that for the manuscript "Evaluation of Nature-Based Production Activities with Computer Science for Middle School Students: The Sample of the "Inspired by Nature" Project" the following is fulfilled:

- This material is the authors' own original work, which has not been previously published elsewhere.
- The paper reflects the authors' own research and analysis in a truthful and complete manner.
- The results are appropriately placed in the context of prior and existing research.
- All sources used are properly disclosed.

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