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RESEARCH ARTICLE

Exploring Nature-Based Education: The Impact on Preschool Children's Scientific Process Skills and Creativity

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ABSTRACT

This study explores the relationship between creativity and scientific process skills in preschool children participating in nature-based education. The aim of the study is to examine the connection between these two variables within a nature-based learning environment, using the relational screening model. The sample comprises 34 preschool children, aged 4 to 5 years, selected through purposive sampling from a kindergarten in Konya, Turkey, which implements a nature-based curriculum. Data were collected using two primary instruments: the Scientific Process Skills Test (SPS), developed by Kavak (2021), which includes 26 items assessing three key sub dimensions of scientific process skills; and the Early Childhood Creativity Scale (ECCS), adapted for Turkish culture by Yıldız Çiçekler, Alakoç Pirpir, and Aral (2020). The ECCS consists of 12 items evaluated with a 7-point Likert scale. The findings indicate that nature-based education positively influences both creative and scientific thinking processes in preschool children, suggesting that such educational approaches foster the development of these skills in tandem.

INTRODUCTION

In the 21st century, educational models emphasize a holistic approach to children's development, aiming to cultivate their diverse skills simultaneously. In this context, nature-based education emerges as a model that supports both scientific process skills and creative thinking abilities by increasing children's direct interaction with nature (Barışan, 2024; Çiğdem, 2024; Koyuncu, 2019; Nicholson, 2000). According to ecological philosophy, humans identify with nature and learn to care for its interests by establishing an empathic relationship with it (Güler, 2019). This relationship enhances children's awareness of nature and reinforces their sense of environmental responsibility.

Nature-based education allows children to take an active role in their learning processes. Research in the fields of Science and Nature Education indicates that learning in nature effectively fosters children's scientific process skills (Saçkes, Trundle, & Flevares, 2010). These skills include fundamental scientific abilities such as observation, classification, prediction, measurement, drawing conclusions, and communication (Harlen, 2000). Nature-based learning environments enable children to apply these skills experientially. Simultaneously, learning activities conducted in nature encourage children to develop a positive attitude towards science.

Nature-based education develops children's scientific process skills in unstructured, natural environments. When children are given opportunities to explore and observe nature, their scientific inquiry skills improve, and they become more environmentally conscious. For instance, practices such as forest schools provide children with direct contact with nature, enhancing their abilities in scientific observation, data collection, and making inferences (Knight, 2013; Waite, 2016).

According to research, nature-based education improves children's scientific process skills (Fjørtoft, 2001; Uludağ & Erkan, 2023). Filiz Ünser and Gür's (2023) study on the effects of nature-based education on children's and teachers' scientific process skills revealed that nature-based learning plays an important role in the development of skills such as observation, prediction, and measurement in children. Similar results were observed in the study conducted by Akintemi and Oduolowu (2021). Thanks to the experiences gained in nature, children are supported in their freedom to explore, thus allowing them to develop scientific process skills through real-life experiences. Nature-based education not only improves scientific process skills, but also nurtures children's creative thinking abilities. Creativity is defined as the capacity to generate new ideas, approach problems from different perspectives, and develop innovative solutions (Daud, Omar, Turiman, & Osman, 2012). Supporting creative thinking in early childhood contributes to the development of individuals as innovative problem solvers in later years (Mangunwibawa, Komalig & Choiriyah, 2024; Sharibaevna, 2024; Konstantinidou, Gregoriadis, Grammatikopoulos & Michalopoulou, 2014).

Natural learning environments stimulate children's curiosity and desire to explore, supporting creative thinking processes (Fjørtoft, 2001). Activities carried out in nature provide unstructured and flexible learning environments, allowing children the freedom to produce original ideas and develop different problem-solving methods (Wilson, 2007). In nature-based educational environments, children use their imagination and creativity effectively when faced with natural stimuli. For example, a child's imagining a tree branch as a horse develops both abstract thinking and creative problem-solving skills (Knight, 2013). Sobel (2004) explains this process by emphasizing that nature provides children with opportunities to create their own games, determine rules, and develop creative solutions.

Research shows that children who spend time in nature have higher creativity and problem-solving skills. Fjørtoft's (2001) research shows that children who play in natural environments are more creative than their peers who play in structured schoolyards. This shows that the flexible and unrestricted environments provided by nature allow children to express their creativity more freely. It is seen that nature-based education develops both scientific process skills and creative thinking in children. Natural environments provide opportunities to practice scientific process skills such as observation, prediction, classification and measurement, while also supporting creativity and problem-solving abilities. The purpose of this study is to examine the relationship between the scientific process skills and creativity levels of children who receive nature-based education. In this context, it will be tried to determine whether the effect of nature-based education on these two basic developmental areas in children is positive.

METHOD

Research design

In this study, the relational screening model was used. The relational screening model is a research method that aims to examine the relationship between two or more variables (Cohen, Manion & Morrison, 2022). In this study, the relationship between the scientific process skills and creativity levels of children who receive nature-based education will be investigated.

Participants

A quantitative research design was used in the study. The data of the study were randomly selected from 140 children receiving education in a kindergarten providing nature-based education through purposeful sampling. This method aims to select individuals who have the potential to provide in-depth information about the research topic (Patton, 2014). The study sample consists of 34 preschool children learning in the nature-based preschool province of Konya. Table 1 gives the frequency distribution of the participant's gender, age, and school years.

Table 1: Frequency distribution of participants according to some variables

Variables	Category	Sum	
		f	%
Gender	Girl	14	41.2
	Boy	20	58.8
Age	4	14	41.2
	5	20	58.8
School year	1	10	29.4
	2	12	35.3
	3	11	32.4
	5	1	2.9

Data collection

In this study, two tests were used to measure children's scientific process skills and creativity, and a demographic form consisting of 3 questions was also used. The data were collected face-to-face using the scientific process skills scale and the early childhood creativity scale obtained from preschool children who participated in the study voluntarily.

Demographic form: It includes demographic factors that provide information about the children gender, age, and school year.

Scientific process skills scale*:* The Scientific Process Skills Test, developed by Kavak (2021), assessed three sub-dimensions of scientific process skills through 26 items. The scale consists of scientific communication, prediction, and measurement sub-dimensions. Scientific communication also includes questions of classification and observation. While developing the scale, each sub-dimension was defined according to the literature and the items were written according to the expected gains in the appropriate age range. When determining these gains, cognitive acquisitions and language acquisitions were taken into account in the preschool National Education programme. After receiving expert opinions, a pilot application was made for a group of 20 children. The content validity ratio (KMO) was determined with the Lawshe test. EFA was carried out based on data collected from 371 children with the items determined. The validity of the construct was demonstrated through tetra choric analysis, and the main form of the scale, consisting of 26 items and three sub-dimensions, was obtained. The sub-dimensions include the establishment of relationships, prediction, and measurement skills. The test answers are scored as "no" (0) or "yes" (1), and the total score ranges from 0 to 26. There are no scale items that need to be reverse coded. In the correlation analysis between the factors of the scale, it was found that all three factors were significantly and positively correlated with each other at a moderate level. Accordingly, a total scientific process skills score can be obtained from the overall scale. The lowest score that can be obtained from the scale is 0, and the highest score is 26.

Early childhood creativity scale: The Early Childhood Creativity Scale (ECCS) adapted to Turkish culture by Yıldız Çiçekler, Alakoç Pirpir, Aral (2020) was included. The responses to the items on the scale, which consists of a single factor and a total of 12 items, are "Almost always [7], Very often [6], Frequently [5], Sometimes [4], Rarely [3], Very rarely [2] and Almost never [It was evaluated according to a 7-point Likert type rating: 1]".

When the distribution of ECCS by months was examined, it was seen that 25% of children aged 60-65 months could get 45 points, 50% could get 55 points, and 75% could get 65 points. There are no scale items that need to be reverse coded. It was found that the arithmetic mean of the Early Childhood Creativity Scale (ECCS) was 50.23, and its skewness value was 0.070. It was examined, Cronbach Alpha coefficient belonging to the scale as a whole was found pretty high in the level of 0.96. It was also indicated that total item correlations for all the items in the scale were higher than 0.30 (between 0.72 and 0.83) and t value belonging to bottom and top 27% parts of all items was significant in the level of 0.01.According to the results obtained from the reliability and validity studies; the validity of the items in the scales was high, and the scale was reliable.

Data analysis

Data analysis was performed using SPSS 21.0 program. In the analysis of the data, the relationship between children's scientific process skills and creativity levels will be examined using Kolmogorov-Smirnov correlation analysis. Correlation analysis is a statistical method used to determine the direction and degree of the relationship between two variables (Pallant, 2020; Field, 2018). It consists of a total of 34 preschool children, 14 girls and 20 boys, aged 4-5. In order to calculate the relationship between the scientific process skills and creativity of preschool children who received nature education, the results of the Kolmogorov-Smirnov test, which is a normality distribution test, were examined. The results of this test did not show a normal distribution for most variables. In addition, considering the small number of samples, it was decided to use the Spearman Correlation test, which is a non-parametric test, for all variables.

Research ethics

The data of the research were collected from the preschool children who participated in the research voluntarily. Ethical Approval for this study was obtained from the Scientific Ethics Evaluation Committee of the Faculty of Education, Selçuk University.

FINDINGS

It examined the test of normality to calculate the relationship between the Early Childhood Creativity Scale (ECCS) and the Scientific Process Skills Scale (SPS) preschool children who received nature education (Table 2).

Table 2: Test of normality results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Prediction	,195	34	,002	,901	34	,005
Measurement	,290	34	,000	,697	34	,000
Communication	,170	34	,014	,924	34	,022
Sps total score	,136	34	,114	,920	34	,016
Creativity	,098	34	,200*	,951	34	,134
*. This is a lower bound of the true significance. a. Lilliefors Significance Correction						

The data was explored through Kolmogorov-Smirnov tests, if it has normal distribution to meet the assumptions of the correlation coefficient.

The total SPS scores, D (34) =0.136, p=0.114 and the creativity scores, D (34)=0.098, p=0.200 (p>0.05) did not deviate significantly from normal. However, the prediction scores, D (34) = 0.195, p = 0.002 and the measurement scores D (34) = 0.290, p=.00, the communication score D (34) =0.170, p= 0.014 (p<0.05) were significantly non normal. Therefore, Spearman's Correlation, which a non-parametric test, was computed for all variables.

Table 3: The results of Spearman's correlation analysis

	Creativitiy	**Scientific Process Skills**	**Measurment**	**Communication**	**Prediction**
Creativitiy	1	0.341* [0.044, 0.594]	0.418* [0.135, 0.650]	0.305 [-0.004, 0.567]	0.213 [-0.101, 0.490]
Scientific Process Skills	34	1	0.866** [0.744, 0.930]	O.947** [0.881, 0.972]	0.746** [0.570, 0.858]
Measurment	34	34	1	0.781** [0.585, 0.894]	0.568** [0.291, 0.788]
Communication	34	34	34	1	0.575** [0.288, 0.772]
Prediction	34	34	34	34	1

ns = not significant (p > 0.05), * p < 0.05, ** p < 0.01, *** p < 0.001. BCa bootstrap 95% CIs reported in brackets.

Creativity was significantly related to scientific precess skills, rs=0.34, 95% BCa CI [0.044, 0.594], p= 0.05.

According to Spearman's correlation analysis (Table 3) of the consequence of creativity and scientific process skills total scores, there is a significant positive but weak relationship between creativity and scientific process skills (rs=0.341, 95% BCa CI [0.044, 0.594], p<0.05). This suggests that nature education influences children's creative thinking and that these creative processes are linked to their scientific thinking skills.

Scientific process skills total scores and other sub dimension skills, strong correlations were found between scientific process skills and measurement (rs =0.866, p<0.01), communication (rs =0.947, p<0.01), prediction (rs =0.746, p<0.01). This shows that nature education not only enhances scientific thinking but also reinforces children's measurement, communication, and prediction skills.

Measurement and communication, the strong correlation between measurement and communication (rs =0.781, p<0.01) implies that children's ability to measure and their ability to effectively communicate what they observe or understand develop in tandem through nature education.

The correlations for **prediction skills,** between prediction skills and other variables are also moderate and positive. According to these results, nature education appears to enhance children's ability to make future predictions based on observations.

In light of these results, it can be said that nature education builds a bridge between children's creative thinking and scientific process skills. Since the development of scientific process skills exhibits strong relationships with other critical skills, nature education can contribute to children's multifaceted development. In particular, skills such as communication and measurement develop in parallel with scientific processes and affect children's discovery, understanding and transfer processes.

These results provide important clues that nature education strengthens both cognitive and social skills in children.

DISCUSSION AND CONCLUSION

According to the results of this research, a positive, although not strong, relationship was found between the creativity and scientific process skills of children who received nature education. Although the relationship between creativity and scientific process skills is weak, the literature supports that these two skills can develop together (Sobel, 2004; Wilson, 2007). This result shows that creativity and scientific process skills support and strengthen each other in nature-based learning environments. A similar research result also revealed that children who play in natural play environments exhibited stronger observation and inference skills compared to those who play in structured school yards (Fjørtoft, 2001).

However, an important finding is the strong relationships between scientific process skills and measurement, communication, and prediction skills, indicating that nature education contributes not only to children's scientific process skills but also to their development in other cognitive areas. In particular, skills such as observation, measurement, and prediction are important sub-dimensions of scientific processes, and the experiential acquisition of these skills in nature-based learning environments is consistent with the findings of this study (Harlen, 2000). The study conducted by Saçkes, Trundle, and Flevares (2010) also revealed that nature-based learning effectively develops children's scientific process skills.

Another important result is that there is a strong relationship between measurement and communication skills. According to this result, it can be said that these two skills support each other. Accordingly, if children's measurement skills develop in nature activities, they will also develop the ability to express what they observe more effectively. In summary, it is expected that the observation skills of children with high measurement skills will also increase at the right rate. Observation skills are measured in the questions in the communication sub-dimension of the scientific process skills scale used in the study. If these findings are explained according to the data collection tool used in

the study, it shows that measurement and communication skills, which are the basis of scientific research, develop together through nature education. This result is consistent with Wilson's (2007) findings regarding the supportive effect of children spending time in natural learning environments on scientific process skills.

According to another result of the study, positive and significant relationships were found between prediction skills and other scientific process skills. This result shows that children who observe during nature activities develop their skills in predicting future events. Accordingly, it is understood that children make observations in nature-based education and develop their scientific process skills by making predictions based on these observations. This finding is parallel to the findings in the studies of Fjørtoft (2001), Eshach & Fried (2005) and Knight (2013) that nature education enables children to make inferences about environmental events and make predictions about these inferences.

The findings of the study show that nature-based education improves children's creative thinking skills and scientific process skills, and that there are strong relationships between these skills. These results are also supported by other studies in the literature and confirm that nature-based learning contributes to children's multifaceted development (Uludağ and Erkan, 2023; Özkan, 2015; Tan and Temiz, 2003). In particular, the development of skills such as communication and measurement in parallel with scientific processes supports children's processes of discovery, understanding and consolidation of what they have learned.

These research results reinforce the idea of creating more nature-based activity content to support children's development in a holistic way in the preschool period.

New learning opportunities that support scientific inquiry, creativity and problem-solving skills can be provided by preparing experiences for children in unstructured nature. For this reason, preschool institutions need to encourage opportunities to provide experiences in nature, and teachers need to increase opportunities for outdoor activities and experiential learning.

More research is needed to better understand how creativity and scientific process skills interact in nature-based learning environments. Future studies could examine different topics to understand whether stronger relationships can be developed in nature during preschool.

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