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# An examination of the relationship between primary school students' environmental awareness and basic science process skills

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**The aim of the research was to examine the relationship between primary school students' environmental awareness and basic science process skills based on various variances. Within relational research model, the research was conducted with 332 grade 3 and 4 students. Primary School Environmental Awareness Scale and Basic Skills Scale were used to collect data. Demographic features were employed to determine the students' educational level, gender and class. In light of the results, the significant relationship between their basic science skills and environmental awareness was detected. A significant difference between the total scores of life in nature and environmental awareness scale was observed in favor of female students. Any significant difference was not found between sub-dimensions and total scores of environmental awareness over class level. The type of school significantly impacted their basic science process skills and level of environmental awareness. The differences which were found were in favor of private schools for both scales.**

**Key words:** Environmental awareness, primary school, science process skills.

## INTRODUCTION

Individuals need to have certain basic skills to get to know the nature, reach existing information, solve the problems that they have in daily life and comprehend the relationships between the humankind and the environment. These basic skills today are called twenty first century skills and training programs are created to bring these skills to individuals. Twenty first century individuals should think creative and critical, carry out a group work, offer solutions for problems, have high communication skills, know how to reach information and benefit from the opportunities of technology while reaching information, be open to innovations, be agreeable and responsible, have developed social and cultural skills, have initiative, be productive and have leadership skills to be successful in educational and business life (Uluyol and Eryılmaz, 2015). Twenty First Century Learning Partnership (Partnership for 21st Century Learning) which is known as P21 is an institution that forms collaborative associations among educational, business, community and government leaders. In this

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institution, twenty first century skills are collected under three main headings:

(1) Learning and innovation skills (creativity and innovativeness, critical thinking and problem solving, communication, collaboration)
(2) Knowledge, media and technology skills (information literacy, media literacy, technology literacy)
(3) Life and career skills (flexibility and adaptability, entrepreneurship and self-management, social and intercultural skills, productivity and accountability, leadership and responsibility) (P21, 2007).

To use twenty first century skills in daily life, science process skills are the abilities which should be on the ground and involve almost all of them. Process skills are defined as abilities that are compatible with several science disciplines, reflect the behaviors of scientists and can transfer among each other in general (Padilla, 1990). Science process skills involve basic skills necessary to have to specialize in science (Prayitno et al., 2017). However, if they also have field knowledge, they contribute to the science be formed (Ayas et al., 1997). Individual endowed with a science perception know the stages of science knowledge and are conscious of that technological advances will progress in line with this information and thus social development will occur through the need of the society being met (Kandemir and Yılmaz, 2011). Science process skills follow a hierarchy from the simple to the complex (Padilla et al., 1983). These skills are observation, classification, assessment, forming relationships between numbers and space, prediction, recording, using and interpreting data, setting models, inference, hypothesizing and experimentation abilities (Tan and Temiz, 2003). Especially when the field literature is examined, a great variety of classifications of science process skills which have similar characteristics turns out. The common point of these classifications is that they can be classified as basic process skills and integrated science process skills titles. Basic science process skills are evaluated as the most important part of the mental development and used often in daily life (Aslan et al., 2016). Development of science process skills brings the ability to solve problems in daily life to students (Kazeni, 2005). These skills are seen as skills that are used in preschool educational institutions and primary schools and should be brought to students from this stage. Hence, basic skills form the foundation of high-level skills. Basic science process skills were determined as observation, classification, inference, assessment, prediction, and communication. Integrated science process skills are: controlling variances, defining variances operationally, hypothesizing, interpreting data, experimenting and setting models (Padilla, 1990). The basic science process skills which are among the skills expected from the students to acquire from preschool and elementary school will form a basis for future complex skills to be acquired. Besides, they will provide individuals with significant advantages to overcome daily life problems. Daily life problems include the problems that individuals can face in themselves or their surroundings at any moment (natural or artificial).

Humankind and environment constantly interact with each other in various ways. Change of the one brings a change of the other. For this reason, several studies on the environment have been recently conducted to ensure the sustainability of the environment. Associating skills that will be acquired with the environment is taken care in order to raise environmental awareness of individuals. P21 (2007) specified the skills that individuals should have in twenty first century as well as it also determined the matters that will be brought to individuals and gave place to environmental literacy in 5 themes. After the importance of environment increased, concepts about the environment also increased and several research fields such as sustainable environment, environmental education, environmental literacy, environmental consciousness, environmental awareness, attitudes and behaviors towards environment came out. Among these concepts, environmental education is the most remarkable one with regard to that it directly affects all of the other concepts. Environmental education changes beliefs, attitudes and most of all behaviors towards the environment and also brings knowledge and experience (Frantz and Mayer, 2014). Although governments have many environmental policies, programs, and rules, the importance of creating environmental awareness has not changed especially for school children. The lack of awareness towards the environment leads to the destruction of the earth and living creatures (Mahajan and Darbari, 2014). United States Environmental Protection Agency (EPA) (2017), stated the components of environmental education as follows: awareness and sensitivity, knowledge and understanding, attitudes, skills, and participation. EPA also expressed that environmental education will develop the thinking skills of individuals (Environmental Protection Agency-EPA, 2017). Awareness is a concept that is associated with consciousness and identified with psychologically developed and mature people (Hisli Şahin and Yeniçeri, 2016). Developed and mature individual on environmental issues means an individual whose environmental awareness formed. Environmental awareness also means helping social groups and individuals to gain awareness and sensitivity towards the same problems they face against their environment (Kang and Grewak, 2015). Environmental awareness is necessary to solve environmental problems and awareness needs to be brought through environmental education to individuals (Cruz and Tantengco, 2017). This is because one of the results of environmental education is to create environmental awareness. For this reason, environmental

**Table 1.** Demographic characteristics of participants.

| Demographic Characteristics | | n | % |
|---|---|---|---|
| Gender | Female | 159 | 47.9 |
| | Male | 173 | 52.1 |
| Grade | Grade 3 | 137 | 41.3 |
| | Grade 4 | 195 | 58.7 |
| School Type | Rural public school | 111 | 33.4 |
| | City center public school | 111 | 33.4 |
| | Private school | 110 | 33.2 |

awareness will be a global phenomenon in the near future (Badoni, 2017).

Individuals having science process skills will behave correspondingly to environmental science discipline and in a way that reflects behaviors of individuals having high-level of environmental awareness. Individuals having basic process skills in associating basic process skills with environment observe the environment via 5 senses, classify those around based on their similarities and differences, make inferences, measure those around by comparing, make predictions about the future in accordance with those around, make inferences in environmental incidents in accordance with cause and effect relation and will enhance the environmental awareness by communicating with living and non-living creatures around.

It is important that individuals have science process skills and know how the relationship of environmental awareness levels of individuals is, as these skills contribute positively to individuals in many fields in daily life. In this context, when the relevant literature is reviewed, science process skills and environmental awareness studies which have not been conducted before and filling the gap about the primary school students reveal the importance of this study. The aim of the research is to examine the relationship between environmental awareness and basic science process skills of primary school students based on various variances. In accordance with this main objective, the answers to the following questions were searched:

(1) Is there any significant difference between environmental awareness levels and basic process skills of primary school students?
(2) At the environmental awareness levels of primary school students, is there any significant difference based on: a) school type, b) class level, and c) gender variances?
(3) In basic science process skills of primary school students, is there any significant difference based on: a) school type, b) class level, and c) gender variances?

## METHODOLOGY

The research in which the relationship between environmental awareness and the basic science process skills of primary students was examined based on various variances was designed in relational research model. In the relational search model, it is aimed to examine attitudes, tendencies, and opinions towards the population through the studies conducted on the study group selected from the population (Creswell, 2017). In this study, the relational search model aiming at determining the change between environmental awarenesses and basic science process skills as designed is called relational search model (Karasar, 2015).

### The sample of the study

The study group of the research was determined through a random cluster sampling method. The study was conducted with 332 studies in 3 schools of grade 3 and 4 and study in primary schools in Konya city center and counties in 2017-2018 education year and participated voluntarily in the study. The reason for choosing different school types is that there are differences in science process skills and environmental awareness. The demographic characteristics of the participants are shown in Table 1.

In Table 1, 47.9% of the students in the study group were female and 52.1% were male. 41.3% of the students are grade 3 and 58.7% of the study at grade 4. When the school types they study are examined, 33.4% of the students study in the rural public school rural public school rural public school, 33.4% of them study in the city center public school and 33.2% of them study in private schools.

### Data collection

As the tool of collecting data within the scope of the research *"Personal Information Form"*, *"Primary School Environmental Awareness Scale"* and *"Basic Skill Scale"* were used.

#### *Personal information form*

Demographic information (gender, class and school type) of the students in the study group was acquired through the form

developed by the researcher.

***Primary school environment awareness scale***

Primary School Environment Awareness Scale was developed by Yıldız and Mentiş (2017). The scale consists of 35 items and as Likert type (completely agree, agree, neutral, disagree, totally disagree). A pool of 50 questions was created for the scale and 1 item was excluded from the expert opinion, 6 items were excluded from the overlapping and 8 items were excluded from the reliability and the scale consisted of 35 items and 4 sub-dimensions. Sub-dimensions were determined as life in nature (15 items), renewable energy resources (12 items), environmental responsibility (5 items) and the continuity of living creatures (3 items). The reliability coefficient of the primary school environmental awareness scale was found to be 0.843 and it was determined that the scale was a valid and reliable assessment tool (Yıldız and Mentiş, 2017). The maximum score that can be got from the scale is 175 and the lowest score is 35. The scale was created with the aim of assessing the awareness of primary school students about life in nature including almost all of the components of the environment, renewable energy resources, environmental responsibility and continuity of living creatures.

***Basic science process skills scale***

The Basic Skill Scale was developed by Padilla et al. (1983) and adapted to Turkish by Aydoğdu (2006). The original form of the scale comprises 36 multiple-choice questions consisting of six each question about observation, classification, inference, assessment, prediction and communication skills. In the form adapted to Turkish, totally 5 questions as 1 question in observation dimension, 1 question in classification dimension, 1 question in inference dimension, 1 question in scale dimension and 1 question in communication dimension were excluded from the scale because of the low level of distinctiveness and the scale comprised 31 questions. It was found that reliability coefficient (KR-20) of basic skill scale which consists of 31 items was 0.83, average difficulty of it was 0.55 and the scale was determined to be a valid and reliable assessment tool (Aydoğdu and Karakuş, 2015). In addition, the fact that all questions are related to environmental issues and they complete the study in terms of its relationality.

**Data collection and analysis**

The stage of collecting data for the study was launched by selecting voluntary participant students. The students were provided with necessary explanations about the scales and given an appropriate period of time.

Statistical methods were used in the analysis of the data. As the number of observations was over 30, Kolmogorov-Smirnov test was performed to determine whether the data indicated normal distribution at the first stage of the study's analysis. Significance value was calculated as 000 and therefore it was determined that the data did not indicate normal distribution. With the aim of determining the relationship between the two assessments, Spearman Test with the aim of determining whether there was a difference based on school type or not, Kruskal Wallis-H Test with the aim of paired-comparison of sub-dimension and total score average in which a significant difference was found, Mann Whitney U Test and with the aim of determining whether there was a difference about class and gender variances, Mann Whitney U Test was performed.

## RESULTS

Is there any significant difference between environmental awareness levels which are sub-problems and basic process skills of primary school students? The question which is of 1 sub-problem is shown in Table 2.

When Table 2 was examined, it was determined that the students in the study group indicated a significant difference between the total scores of the Basic Skill Scale and the primary school environmental awareness scale. A significant difference was determined between "Observation", "Classification", "Inference", "Communication", the total scores of the Basic Skill Scale and the total scores and all sub-dimensions of the Primary School Environment Awareness Scale ($p < 0.05$). In the "Prediction" sub-dimension of the Basic Skill Scale, there was not found any significant difference between the "Environmental Responsibility" and "Continuity of Living Creatures" sub-dimensions of the Primary School Environment Awareness Scale. There was not found any significant difference between the total scores and sub-dimensions of "Assessment" sub-dimension of the Basic Skill Scale and the Primary School Environment Awareness Scale ($p > 0.05$).

The findings of the question (a): “Is there any significant difference in the levels of environmental awareness among primary school students based on the variance of school type?” which is of 1 sub-problem shown in Table 3.

When Table 3 was examined, it was found that the total scores of the Primary School Students' Environmental Awareness Scale and sub-dimensions of "Life in the Nature", "Renewable Energy Resources", "Environmental Responsibility" and "Continuity of Living Creatures" indicated a significant difference based on school type ($p < 0.05$). When the Kruskal-Wallis H Test results were examined, an average of sub-dimensions and total scores in which a significant difference was found were examined through the Mann Whitney U Test paired-comparison being conducted.

Total score averages of life in nature sub-dimension of primary school environmental awareness scale were determined to indicate a significant difference ($U=3746{,}500$; $p=0.000$) between the students studying in city center public school and private school, in favor of students studying in private school; ($U=4048{,}000$; $p=0.000$) between the students studying in rural public school and in private schools in favor of students studying in private school.

Total score averages of renewable energy resources sub-dimension of primary school environmental awareness scale were determined to indicate a significant difference ($U=3208{,}500$; $p=0.000$) between the students

**Table 2.** Results of Spearman Correlation analysis on the relationship between environmental awareness levels and basic cognitive process skills of primary school students.

| Basic Skill Scale | | Primary School Environment Awareness Scale | | | | |
|---|---|---|---|---|---|---|
| | | Life in Nature | Renewable Energy Resources | Environmental Responsibility | Continuity of Living creatures | Total Score |
| Observation | r | 0.264 | 0.195 | 0.131 | 0.170 | 0.206 |
| | p | 0.000* | 0.000* | 0.017* | 0.002* | 0.000* |
| | n | 332 | 332 | 332 | 332 | 332 |
| Classification | r | 0.225 | 0.216 | 0.160 | 0.136 | 0.203 |
| | p | 0.000* | 0.000* | 0.004* | 0.013* | 0.000* |
| | n | 332 | 332 | 332 | 332 | 332 |
| Inference | r | 0.202 | 0.206 | 0.173 | 0.171 | 0.188 |
| | p | 0.000* | 0.000* | 0.002* | 0.002* | 0.001* |
| | n | 332 | 332 | 332 | 332 | 332 |
| Assessment | r | 0.004 | -0.010 | -0.031 | 0.081 | -0.034 |
| | p | 0.939 | 0.850 | 0.579 | 0.143 | 0.532 |
| | n | 332 | 332 | 332 | 332 | 332 |
| Prediction | r | 0.126 | 0.140 | 0.069 | 0.052 | 0.119 |
| | p | 0.022* | 0.011* | 0.211 | 0.341 | 0.031* |
| | n | 332 | 332 | 332 | 332 | 332 |
| Communication | r | 0.252 | 0.228 | 0.178 | 0.180 | 0.218 |
| | p | 0.000* | 0.000* | 0.001* | 0.001* | 0.000* |
| | n | 332 | 332 | 332 | 332 | 332 |
| Total Score | r | .260 | 0.227 | 0.163 | 0.188 | 0.213 |
| | p | 0.000* | 0.000* | 0.003* | 0.001* | 0.000* |
| | n | 332 | 332 | 332 | 332 | 332 |

studying in city center public school and private school in favor of students studying in private school; (U=3167,000; p=0.000) between the students studying in rural public school and in private schools in favor of students studying in private school.

Total score averages of environmental responsibility sub-dimension of primary school environmental awareness scale were determined to indicate a significant difference (U=4267,000; p=0.000) between the students studying in city center public school and private school in favor of students studying in private school; (U=4482,500; p=.001) between the students studying in rural public school rural public school and in private schools in favor of students studying in private schools.

Total score averages of environmental responsibility sub-dimension of primary school environmental awareness scale were determined to indicate a significant difference (U=3549,000; p=0.000) between the students studying in city center public school and private school in favor of students studying in private school; (U=4249,000; p=0.000) between the students studying in rural public school and in private schools in favor of students studying in private school.

Total score averages of environmental responsibility sub-dimension of primary school environmental awareness scale were determined to indicate a significant difference (U=3950,000; p=0.000) between the students studying in city center public school and private school and in favor of students studying in private school; (U=4060,000; p=000) between the students studying in rural public school and in private schools in favor of students studying in private school.

**Table 3.** Results of Kruskal Wallis-H Test about environmental awareness levels of primary school students based on school type variance.

| Primary School Environment Awareness Scale | Groups | n | $\bar{x}_{sira}$ | $x^2$ | Sd | p |
|---|---|---|---|---|---|---|
| Life in the Nature | City center public school | 111 | 144.51 | 28.986 | 2 | 0.000* |
| | Private School | 110 | 206.64 | | | |
| | Rural public | 111 | 148.71 | | | |
| Renewable Energy resources | City center public school | 111 | 139.63 | 51.421 | 2 | 0.000* |
| | Private School | 110 | 219.54 | | | |
| | Rural public school | 111 | 140.82 | | | |
| Environmental Responsibility | City center public school | 111 | 148.05 | 18.169 | 2 | 0.000* |
| | Private School | 110 | 197.96 | | | |
| | Rural public school | 111 | 153.77 | | | |
| Continuity of Living Creatures | City center public school | 111 | 137.40 | 31.532 | 2 | 0.000* |
| | Private School | 110 | 206.61 | | | |
| | Rural public school | 111 | 155.85 | | | |
| Total Score | City center public school | 111 | 147.34 | 26.052 | 2 | 0.000* |
| | Private School | 110 | 204.68 | | | |
| | Rural public school | 111 | 147.82 | | | |

The findings of the question a): “Is there any significant difference in basic science process skills of primary school students based on school type variance?” which is of 1 sub-problem shown in Table 4.

When Table 4 was examined, it was found that the total scores of the Primary School Students' Environmental Awareness Scale and sub-dimensions of "Observation", "Classification", "Inference", "Prediction" and "Communication" indicated a significant difference based on school type ($p < 0.05$). When the Kruskal-Wallis H Test results were examined, an average of sub-dimensions and total scores in which a significant difference was found were examined through the Mann Whitney U Test paired-comparison being conducted.

Score averages of observation sub-dimension of basic skill scale were determined to indicate a significant difference (U=3414,000; p=0.000) between the students studying in city center public school and private school in favor of students studying in private school; (U=2788,000; p=000) between the students studying in rural public school and in private school in favor of students studying in private school.

Score averages of classification sub-dimension of basic skill scale were determined to indicate a significant difference (U=3690,000; p=0.000) between the students studying in city center public school and private school in favor of students studying in private school; (U=3016,000; p=000) between the students studying in rural public school and in private school in favor of students studying in private school.

Score averages of inference sub-dimension of basic skill scale were determined to indicate a significant difference (U=4153,500; p=0.000) between the students studying in city center public school and private school in favor of students studying in private school; (U = 3953,500; p=0.000) between the students studying in rural public school and in private school in favor of students studying in private school.

Score averages of assessment sub-dimension of basic skill scale were determined to indicate a significant difference (U=4684,500; p=0.002) between the students studying in city center public school and private school in favor of students studying in private school; (U=4902,500; p=0.009) between the students studying in rural public school and in private school in favor of students studying in private school.

Score averages of prediction sub-dimension of basic skill scale were determined to indicate a significant difference (U=3860,000; p=0.000) between the students studying in city center public school and private school in favor of students studying in private school; (U=3496,000; p=000) between the students studying in rural public

**Table 4.** Results of Kruskal Wallis-H Test related to school type variance of basic science process skills of primary school students.

| Basic Skill Scale | Groups | n | $\bar{x}_{sira}$ | $x^2$ | Sd | p |
|---|---|---|---|---|---|---|
| | City center public school | 111 | 148.75 | 57.930 | 2 | 0.000* |
| Observation | Private School | 110 | 221.12 | | | |
| | Rural public school | 111 | 130.12 | | | |
| | City center public school | 111 | 151.56 | 50.064 | 2 | 0.000* |
| Classification | Private School | 110 | 216.54 | | | |
| | Rural public school | 111 | 131.86 | | | |
| | City center public school | 111 | 149.50 | 27.067 | 2 | 0.000* |
| Inference | Private School | 110 | 203.80 | | | |
| | Rural public school | 111 | 146.54 | | | |
| | City center public school | 111 | 152.08 | 11.093 | 2 | 0.000* |
| Assessment | Private School | 110 | 190.35 | | | |
| | Rural public school | 111 | 157.29 | | | |
| | City center public school | 111 | 151.32 | 37.671 | 2 | 0.000* |
| Prediction | Private School | 110 | 210.63 | | | |
| | Rural public school | 111 | 137.95 | | | |
| | City center public school | 111 | 152.36 | 61.684 | 2 | 0.000* |
| Communication | Private School | 110 | 222.00 | | | |
| | Rural public school | 111 | 125.63 | | | |
| | City center public school | 111 | 143.91 | 77.281 | 2 | 0.000* |
| Total Score | Private School | 110 | 231.24 | | | |
| | Rural public school | 111 | 124.93 | | | |

school and in private school in favor of students studying in private school.

Score averages of communication sub-dimension of basic skill scale were determined to indicate a significant difference (U=3461,500; p=0.000) between the students studying in city center public school and private school in favor of students studying at private school; (U=5086,000; p=0.022) between the students studying in city center public school and in rural public school in favor of students studying in city center public school; (U=2643,000; p=0.000) students studying in rural public school and in private school in favor of students studying in private school.

Score averages of basic skill scale were determined to indicate a significant difference (U=2814,000; p=0.000) between the students studying in city center public school and private school in favor of students studying in private school; (U=2274,500; p=0.000) between the students studying in rural public school and in private school in favor of students studying in private school.

The findings of the question a: “Is there any significant difference in the levels of environmental awareness among primary school students based on the variance of school type? which is of 3 sub-problem shown in Table 5.

When Table 5 was examined, according to the results of Mann-Whitney U test which was conducted in the group consisting of 332 people 137 of whom were Grade 3 and 195 of whom were Grade 4 to determine whether there was a significant difference in scores of Primary School Environmental Awareness Scale: Any significant difference was not found between the sub-dimensions and total scores of Primary School Environmental Awareness Scale (p >0.05).

The findings of the question a: “Is there any significant difference in basic science process skills of primary school students based on class level variance?” which is of 1 sub-problem shown in Table 6.

When Table 6 was examined, according to the results

**Table 5.** Results of Mann-Whitney U test of the level of environmental awareness among primary school students based on the class level.

| Primary School Environment Awareness Scale | Grade | N | Mean Rank | Rank Sum | U | z | p |
|---|---|---|---|---|---|---|---|
| Life in Nature | Grade 3 | 137 | 159.94 | 21911.50 | 12458.500 | -1.046 | 0.296 |
| | Grade 4 | 195 | 171.11 | 33366.50 | | | |
| Renewable Energy resources | Grade 3 | 137 | 162.73 | 22294.50 | 12841.500 | -0.606 | 0.544 |
| | Grade 4 | 195 | 169.15 | 32983.50 | | | |
| Environmental Responsibility | Grade 3 | 137 | 154.31 | 21141.00 | 11688.000 | -1.955 | 0.051 |
| | Grade 4 | 195 | 175.06 | 34137.00 | | | |
| Continuity of Living creatures | Grade 3 | 137 | 157.08 | 21519.50 | 12066.500 | -1.518 | 0.129 |
| | Grade 4 | 195 | 173.12 | 33758.50 | | | |
| Total Score | Grade 3 | 137 | 161.20 | 22084.00 | 12631.000 | -0.844 | 0.399 |
| | Grade 4 | 195 | 170.23 | 33194.00 | | | |

**Table 6.** Results of Mann-Whitney U Test on basic science process skills of primary students based on class level variance.

| Basic Skill Scale | Grade | N | Mean Rank | Rank Sum | U | z | p |
|---|---|---|---|---|---|---|---|
| Observation | Grade 3 | 137 | 179.11 | 24538.00 | 11630.000 | -2.052 | 0.040* |
| | Grade 4 | 195 | 157.64 | 30740.00 | | | |
| Classification | Grade 3 | 137 | 180.54 | 24734.50 | 11433.500 | -2.305 | 0.021* |
| | Grade 4 | 195 | 156.63 | 30543.50 | | | |
| Inference | Grade 3 | 137 | 173.08 | 23712.50 | 12455.500 | -1.092 | 0.275 |
| | Grade 4 | 195 | 161.87 | 31565.50 | | | |
| Assessment | Grade 3 | 137 | 190.35 | 26078.00 | 10090.000 | -3.935 | 0.000* |
| | Grade 4 | 195 | 149.74 | 29200.00 | | | |
| Prediction | Grade 3 | 137 | 177.61 | 24333.00 | 11835.000 | -1.813 | 0.070 |
| | Grade 4 | 195 | 158.69 | 30945.00 | | | |
| Communication | Grade 3 | 137 | 184.94 | 25337.00 | 10831.000 | -2.992 | 0.003* |
| | Grade 4 | 195 | 153.54 | 29941.00 | | | |
| Total Score | Grade 3 | 137 | 186.13 | 25499.50 | 10668.500 | -3.129 | 0.002* |
| | Grade 4 | 195 | 152.71 | 29778.50 | | | |

of Mann-Whitney U test which was conducted in the group consisting of 332 people 137 of whom were Grade 3 and 195 of whom were Grade 4 to determine whether there was a significant difference in scores of Basic Process Skill Scale: A significant difference was found between the total score and the scores of "Observation", "Classification", "Assessment", "Communication" sub-dimensions based on class level ($p<0.05$). When mean ranks were examined, it was determined that the difference was in favor of Grade 3 classes.

The findings of the question a: “Is there any significant difference in the levels of environmental awareness among primary school students based on gender variance?” which is of 1 sub-problem shown in Table 7.

**Table 7.** Results of Mann-Whitney U test of the level of environmental awareness among primary school students based on gender variance.

| Primary School Environment Awareness Scale | Grade | N | Mean Rank | Rank Sum | U | z | p |
|---|---|---|---|---|---|---|---|
| Life in Nature | Female | 159 | 179.45 | 28532.50 | 11694.500 | -2.361 | 0.018* |
| | Male | 173 | 154.60 | 26745.50 | | | |
| Renewable Energy resources | Female | 159 | 176.89 | 28125.00 | 12102.000 | -1.912 | 0.056 |
| | Male | 173 | 156.95 | 27153.00 | | | |
| Environmental Responsibility | Female | 159 | 173.92 | 27653.50 | 12573.500 | -1.362 | 0.173 |
| | Male | 173 | 159.68 | 27624.50 | | | |
| Continuity of Living creatures | Female | 159 | 166.42 | 26461.50 | 13741.500 | -0.014 | 0.989 |
| | Male | 173 | 166.57 | 28816.50 | | | |
| Total Score | Female | 159 | 179.10 | 28477.00 | 11750.000 | -2.294 | 0.022* |
| | Male | 173 | 154.92 | 26801.00 | | | |

When Table 7 was examined, according to the results of Mann-Whitney U test which was conducted to determine whether there was a significant difference in the level of primary school environmental awareness: A significant difference was found in the total score of Primary School Environmental Awareness Scale and the scores of "Life in the Nature" sub-dimension based on gender ($p<0.05$). When mean ranks were examined, it was determined that the difference was in favor of the female student.

The findings of the question a: “Is there any significant difference in the levels of basic process skill of primary school students based on gender variance?” which is of 3 sub-problem shown in Table 8.

When Table 8 was examined, according to the results of Mann-Whitney U test which was conducted to determine whether there was a significant difference between basic science process skills: A significant difference was found in the total score of Basic Skill Scale and the scores of "Observation" and "Classification" sub-dimensions based on gender ($p <0.05$). When mean ranks were examined, it was determined that the difference was in favor of the female student.

## DISCUSSION

When the findings of the study were examined, a significant difference was found between the levels of primary school environmental awareness and basic process skills. However, when these findings were examined in terms of sub-dimensions, any significant difference was not found between assessment which is one of the sub-dimensions of basic process skills and sub-dimensions of primary school environmental awareness scale. Assessment is described as expressing the result of observations via numbers or adjectives after any characteristic is observed (Turgut and Baykul, 2013). Based on this description, students could not express the things they had observed around via numbers or adjectives. When it comes to behaviors for which they are responsible towards environment and continuity of living creatures, students could not predict. Any significant difference was not found between prediction which is one of the sub-dimensions of basic process skills and environmental responsibility and continuity of living creatures which are sub-dimensions of primary school environmental awareness scale. In accordance with these results, it can be concluded that the better science process skills of students are, the better their environmental awareness levels are and the better their environmental awareness levels are, the better their science process skills are.

When examined in terms of the type of school, a significant difference was found between basic process skills and level of environmental awareness at primary school. The differences which were found were in favor of private schools for both scales. In the communication sub-dimension of basic process skills, a significant difference in favor of private school was found between a city center public school and private school. The fact that the difference emerged in science thinking of the students and this difference was in favor of private school could be stated as an indicator that private schools do more studies for developing science process skills. When these results were examined, the remarkable point was private school were higher than the students in the rural

**Table 8.** Results of Mann-Whitney U test of the level of basic process skills of primary school students based on gender variance.

| Basic Skill Scale | Grade | n | Mean Rank | Rank Sum | U | z | p |
|---|---|---|---|---|---|---|---|
| Observation | Female | 159 | 178.18 | 28330.50 | 11896.500 | -2.174 | 0.030* |
| | Male | 173 | 155.77 | 26947.50 | | | |
| Classification | Female | 159 | 181.94 | 28928.00 | 11299.000 | -2.898 | 0.004* |
| | Male | 173 | 152.31 | 26350.00 | | | |
| Inference | Female | 159 | 175.19 | 27855.50 | 12371.500 | -1.649 | 0.099 |
| | Male | 173 | 158.51 | 27422.50 | | | |
| Assessment | Female | 159 | 170.89 | 27171.50 | 13055.500 | -0.828 | 0.407 |
| | Male | 173 | 162.47 | 28106.50 | | | |
| Prediction | Female | 159 | 171.36 | 27246.00 | 12981.000 | -0.906 | 0.365 |
| | Male | 173 | 162.03 | 28032.00 | | | |
| Communication | Female | 159 | 176.08 | 27997.00 | 12230.000 | -1.778 | 0.075 |
| | Male | 173 | 157.69 | 27281.00 | | | |
| Total Score | Female | 159 | 179.49 | 28539.50 | 11687.500 | -2.369 | 0.018* |
| | Male | 173 | 154.56 | 26738.50 | | | |

public school who interacted with nature more. According to the scores of the research on science process skills which was conducted with grade 5 students by Çakar (2008), a significant difference was found between students studying in different schools. In the research by Beaumont-Walters and Soyibo (2001), a strong significant difference was found between school type and science process skill. In the research which was conducted with preschool students by Kuru and Akman (2017), a significant difference in scores of science process skills was found in favor of nursery classes in primary schools between the nursery classes in primary schools and preschools connected to the Ministry of National Education and private preschools. In the environmental awareness research which was conducted with 11 grade students by Alam (2018), a significant difference was found between the schools connected to the government and private schools. In the environmental awareness research which was conducted with 13-15 years old students by Indupalli et al. (2015), they found a significant difference between students in different schools. The results of this study coincide with a limited number of studies.

Any significant difference was not found between the sub-dimensions and total scores of primary school environmental awareness scale based on the class level. A significant difference was found between the basic skill scale's sub-dimensions observation, classification, assessment, communication and their total scores in favor of grade 3 classes. In the research conducted by Arslan (1995), there was a significant difference in favor of grade 5 classes when the science process skills of grade 4 and 5 students were examined. In the science process skills research which was conducted with high school students by Beaumont-Walters and Soyibo (2001), a significant difference was found based on the class level. In the environmental awareness research which was conducted with grade 8, 10 and 12 students by Mahajan and Darbari (2014), they detected a significant difference between classes and determined that the higher the class level is, the higher the environmental consciousness is. This result does not coincide with the findings of the study, but also contradicts the results of the study. The reason for this may be the selection of school types from different regions.

Between the total scores of life in nature which is one of the sub-dimensions of primary school environmental awareness and environmental awareness scale, a significant difference was found in favor of female students. Between the total scores of observation and classification which are the sub-dimensions of basic skill scale and basic skill scale, a significant difference was found in favor of female students. It could be stated that the level of environmental awareness of female students are higher and they are also more talented to use science

process skills than male students. When the studies conducted were examined, any significant difference was not generally found in science process skills based on gender. In the research conducted with secondary school students by Aydoğdu (2006), any significant difference was not found based on gender and it was concluded that arithmetical means of male students were higher. In the research conducted with preschool students by Kuru and Akman (2017), any significant difference could not be found in science process skills based on gender. In the research conducted with 5 grade students by Çakar (2008), any significant difference could not be found based on gender; but it was determined that the mean scores of female students were higher than male students. This study supported the result of the study that female students have a higher level of science process skills than male students. In the research conducted with secondary school students by Zeidan and Jayosi (2015), a significant difference in science process skills in favor of female students based on gender and this result coincided with the results of this research. In the research of attitude towards the environment conducted with teachers by Ahi and Özsoy (2015), it was determined that female teachers had a higher level of a positive attitude than male teachers. In the research of environmental awareness conducted with social service specialists by Doğan and Prutçuoğlu (2017), a difference was detected in only sub-dimension of comprehension based on gender variance in favor of female specialists. In the research of environmental awareness conducted with high school students by Alam (2018) and Badoni (2017), a significant difference between genders in favor of female students. In the research of environmental awareness conducted with 14-16 year old children by Kang and Grewak (2015), any significant difference between female and male students was not found. In the research of environmental awareness conducted with secondary school students by Altın et al. (2014), a significant difference based on gender variance in favor of female students. The results of the studies and the results of this study are similar. In the research of environmental awareness conducted with 8, 10 and 12 grade students by Mahajan and Darbari (2014), a significant difference was found based on gender in favor of male students and this result did not coincide with the results of this research.

In accordance with the results of the study, the proposals brought forward are as follows:

(1) Programs can be prepared and activities can be conducted for environmental awareness of students in state schools to be developed.
(2) Activities which attract male students can be designed for the difference based on gender to be removed and for science process skills and environmental awarenesses of male students to be developed.
(3) As it is particularly thought that accessibility to the nature of students in county schools, their environmental awarenesses can be raised and in addition, they can be provided with acquiring science process skills.
(4) In future studies, researchers may investigate the reasons why students in rural schools are less likely to learn nature awarenesses than in other schools and the reasons for gender differences.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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