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Science Literacy in Early Childhood

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Abstract: *This study was conducted to determine and compare science literacy levels of children in early childhood period in terms of various variables. Survey model was used in the study which was conducted with 211 children who attend pre-schools in Bilecik, Turkey. As data collection tool, Early Childhood Science Education Content Standards Scale (SCSS) was used and as a result of data analysis, it was found that the children participating in the study had medium level of science literacy. In terms of the variables of age, number of siblings, the education background of the parents and science materials the participants have in their houses, a statistically meaningful difference was found in the science literacy scores of the children. In terms of the variable of gender, a statistically meaningful difference was not found in the science literacy scores of the children.*
Keywords: *Science literacy, science education, early childhood*

I. Introduction

Children are born with a sense of wonder and exploration in order to make sense of the environment they live in and the world, as well. They have also a potential for learning by interacting with their environment (NRC, 2012). However, the children, besides their existing schema, gain science knowledge like preserving food for survival and some skills like drying, curing, etc. through the help of more knowledgeable adults (Mayer, 2004, NRC, 2007). The skills like observing, exploring and discovering are important and fundamental for science teaching and learning in the early childhood education. It is argued that an effective science education in the pre-school period fosters children's curiosity and enjoyment while exploring the environment and that it becomes a foundation for science education in the primary and secondary education (NSTA, 2002).

According to the National Science Teachers Association (2002, 2009), there are some key principles for pre-school teachers to consider while teaching science:

- Children have potential for engaging in scientific practices and develop understanding at a conceptual stage.
- In order for young children to learn science, adults have a very important role. Adults can engage in such a process by asking questions to children, giving explanations to the questions of children, supporting children's learning and exploratory attempts, arranging the difficulty levels of information.
- Young children are in need of various opportunities that lead them to science exploration and discovery and they learn well if they are given such opportunities to explore and experience science (Bosse, Jacobs, and Anderson, 2009; NAEYC, 2013).
- Young children can get science skills and knowledge in formal settings (in schools thorough lesson plans) and informal settings (at home).
- It takes time for young children to develop science skills and knowledge. For example, it may take several weeks for young children to understand natural events like thunders, rain, flooding, etc.
- If young children are engaged in experimental learning setting prepared by adults, they can develop their science skills and knowledge. During experiments, children can ask questions, explore new information and can build upon their previous knowledge.

When the studies are examined, it can be seen that the numbers of the studies on science literacy levels of children are quite limited. The studies are generally on the importance of science education in early childhood period (Roth, 2013; Siraj-Blatchford, 2001; Trundle, 2009; Watters et al., 2001; Hamlin and Wisneski, 2013), program development and evaluation (Broström, 2015; Hong et al., 2013; Worth, 2010), teaching methods (Saçkes et al., 2012) the opinions of teachers on science education (Yılmaztekin and Erden 2011; Yılmaztekin and Erden, 2016). It is believed that since this study aims to determine science literacy levels of children, it will support the literature in the field. In order to find solutions to some very important problems like climate changes, air pollution, global warming, wasting energy sources, environmental pollution, we should create awareness for our children and get them have high levels of science literacy. This study is believed to guide teachers, educators, program development experts, families and societies to foster science literacy levels of children in early childhood period.

1.1. Study Aim

This study was conducted to determine the science literacy levels of children in early childhood and to compare these levels based on different variables. With the aim of determining the effects of specific variables on children's science literacy, the answers to the following questions were sought:

1. What are the science literacy levels of children in early childhood (ages 4-6)?
2. Is there a meaningful difference in the science literacy levels of children in early childhood based on a) gender, b) age, c) number of siblings, d) mother's educational background, e) father's educational background and g) the presence of science materials in their homes?

II. Method

In this part of the his study, which was conducted to determine the science literacy levels of children in early childhood and to compare these levels based on different variables, the research method, study group, type and source of data, data collection tools and statistical analysis which were used in the study will be presented.

2.1. Research Model

This is a descriptive study which was conducted through the use of a screening model (survey). The screening method is a research method which aims to describe a past or a current situation exactly (Karasar, 2007; Cohen, Manion and Morrison, 2008). Children's science literacy levels and whether they differ in terms of gender, age, number of siblings, mother's educational background, father's educational background, family income and the presence of science materials in the participant children's homes were described using this method.

2.2. Study Sample/Participants

The study was conducted with 211 preschool children who voluntarily participated in the study, in Bilecik, Turkey, during the 2016-2017 academic year. Bilecik, in which the study was conducted, is located in northwestern Turkey and has a population of 57,000 people, most of whom are from middle-income families. This city generally presents limited opportunities, thus people often move elsewhere in Turkey. The demographic characteristics of the participant children are shown in Table 1. below.

Table 1. Demographic Characteristics of Participant Children

VARIABLES		**Number of Child**		**DEĞİŞKENLER**		**Number of Child**	
		f	**%**			**f**	**%**
Gender	Girl	112	53,1	Educational Background of Father	Primary	51	24,2
	Boy	99	46,9		Secondary	18	8,5
Age	4 age	67	31,8		High School	89	42,2
	5 age	70	33,2		Graduate	36	17,1
	6 age	74	35,1		Master	17	8,1
Number of Siblings	No Sibling	48	22,7	Family Income	1000-1500 ₺*	18	8,5
	1 sibling	82	38,9		1500-2000 ₺	38	18,0
	2 siblings	43	20,4		2000-2500 ₺	51	24,2
	3 siblings	22	10,4		2500-3000 ₺	50	23,7
	4 siblings and more	16	7,6		3000-3500 ₺	40	19,0
Educational Background of Mother	Primary	63	29,9		3500 ₺ and more	14	6,6
	Secondary	32	15,2	The Presence of Science Materials in Their Homes	Quite a lot	39	18,5
	High School	81	38,4		Adequate	75	35,5
	Graduate	26	12,3		Inadequate	51	24,2
	Master	9	4,3		None	46	21,8
Total		211	100	**Total**		211	100

As seen in Table 1., 53.1% (n=112) of the participant children were girls, and 46.9% (n=99) were boys. Among the sample, 31.8% (n=67) were at the age of four; 33.2% (n=70) were at the age of five, and 35.1% (n=74) were at the age of six. In terms of number of siblings of the children, 22.7% (n=70) do not have any siblings; 38.9% (n=82) have one sibling; 20.4% (n=43) have two siblings; 10.4% (n=22) have three siblings, and 7.6% have four siblings. Regarding their mothers' educational backgrounds, 29.9% (n=63) had a primary school degree; 15.2% (n=32) had a secondary school degree; 38.4% (n=81) had a high school degree; 12.3% (n=26) had a graduate degree, and 4.3% (n=9) had a master's degree. Regarding their fathers' educational backgrounds, 24.2% (n=51) had a primary school degree; 8.5% (n=18) had a secondary school degree; 42.2% (n=89) had a high school degree; 17.1% (n=36) had a graduate degree, and 8.1% (n=17) had a master's degree.

* *Turkish lira symbol*

To the family income of the participant children, 8.5% (n=18) of the children's families earn 1000-1500 ₺ per month; 18% (n=38) earn 1500-2000 ₺ per month; 24.2% (n=51) earn 2000-2500 ₺ per month; 23.7% (n=50) earn 2500-3000 ₺ per month; 19% (n=40) earn 3000-3500 ₺ per month and 6.6% (n=14) earn 3500 ₺ or more per month. In a review of the variable reflecting the presence of science materials in the children's homes, it was found that 18.5% (n=39) of the children possessed quite a lot of science materials; 35.5% (n=75) possessed sufficient science materials; 24.2% (n=51) possessed insufficient science materials, and 21.8% (n=46) possessed no science materials in their homes.

2.3. Data Collection Tools

In the study, the Early Childhood Science Education Content Standards Scale (SCSS) which was developed by Taştepe and Temel (2013) and a personal information form, which was developed by the researcher with the aim of collecting necessary information about the participant children were used. The scale includes gains related to science and measures children's science literacy levels. Some of the items in the scale are presented in Table 2. below.

Table 2. Sample Items from Early Childhood Science Education Content Standards Scale

Item Number in the Scale	Scale Item
2	S/he differentiates right/wrong actions towards living things such as watering/not watering plants etc.
7	S/he can distinguish the detrimental effects of situations on living things such as gum which is flung to ground can be supposed as a food by birds, harmful food/drink can influence people' health etc.
12	S/he forecasts meteorological situations such as rainy, sunny or snowy, on the basis of his/her experiences.
17	S/he searches natural laws such as throwing something to ground many times so as to observe the law of gravity and makes generalizations for every item.
23	S/he identifies similarities and differences between natural objects like cotton, feather, stone, wood etc. and man-made objects like plastic, Styrofoam, paper etc.
28	S/he identifies the characteristics of sound such that if it is used in different situations like empty space, microphone etc., it can sound high, low, deep, sharp etc.
31	S/he talks about her/his observations related to day and night.

Totally possessing 31 items, the Early Childhood Science Education Content Standards Scale (SCSS) consists of three sub dimensions: life sciences, physical sciences and world and space sciences. The general Cronbach Alpha reliability coefficient of the scale was measured as .94. The scale rates children's science literacy proficiencies as always (5), often (4), sometimes (3), rarely (2) and never (1) (Taştepe & Temel, 2013). The scale items were completed by children's teachers, families or with the researcher through taking children's proficiencies in the related item into consideration. As seen in Table 2., there were scientific gains in the scale which are expected to be shown by children in early childhood. The lowest score that can be obtained in the scale is 31 while the highest is 155. The children who score 120 or above are acknowledged as excellent in terms of science literacy.

2.4. Data Analysis

The data obtained from Early Childhood Science Education Content Standards Scale (SCSS), which was applied so as to determine children's science literacy levels in early childhood period, was analyzed via frequency (f), percent (%), average ($\bar{X}$), standard deviation (*sd*), t-test an one-way ANOVA, and through the use of SPSS packet program. In the case the ANOVA results were significant, the Scheffe test, which is one of the post-hoc multi comparison tests, was used in order to determine the source of the difference.

III. Findings

In this part of the paper, the findings which were revealed following the analysis and different interpretations related to these findings are presented. First, the science literacy levels of the participant children in early childhood period were determined and the results are given in Table 3. below.

Table 3. Science Literacy Levels of Children in Early Childhood

Early Childhood Science Education Content Standards Scale (SCSS)	*n*	$\bar{X}$	$\bar{X}$ / *k*	*Sd*
Life Sciences	211	37.12	3.09	.77
Physical Sciences	211	26.89	2.98	.97
World and Space Sciences	211	32.24	3.22	.79
General	211	96.26	3.17	.80

In a review of Table 3., the children were found to score $\bar{x}$ =37.12 ($\bar{x}$ /k=3.09) in the life sciences sub dimension; $\bar{x}$ =26.89 ($\bar{x}$ /k=2.98) in physical sciences sub dimension, and $\bar{x}$ =32.24 ($\bar{x}$ /k=3.22) from the world and space sciences sub dimension of Early Childhood Science Education Content Standards Scale (SCSS). And, the children were found to score $\bar{x}$ =96.26 ($\bar{x}$ /k=3.17) in the scale in general. According to these findings, children's behaviors related to science are in the level of "sometimes" (3). Considering the total score the children obtained from the general scale ($\bar{x}$ =96.26), it can be said that the children have a medium level of science literacy. The children's science literacy scores based on gender are demonstrated in Table 4. below.

Table 4. The Comparison of Children's Science Literacy Scores based on Gender

Early Childhood Science Education Content Standards Scale (SCSS)	*Gender*	*n*	$\bar{x}$	*sd*	*df*	*t*	*p*
Life Sciences	Girl	112	36.63	9.146	209	-.816	.416
	Boy	99	37.68	9.595			
Physical Sciences	Girl	112	27.18	8.640	209	.514	.608
	Boy	99	26.56	8.902			
World and Space Sciences	Girl	112	32.66	7.618	209	.833	.406
	Boy	99	31.75	8.280			

According to *t* test result shown in Table 4., there were found no significant differences in early childhood period children's science literacy scores from the "life sciences" sub dimension based on gender [$t_{(209)}$= -.816, p>.05]. Additionally, the differences seen in the "physical sciences" sub dimension were not significant [$t_{(209)}$= -.514, p>.05]. And similarly, no significant differences were found in the "world and space sciences" sub dimension [$t_{(209)}$= -.833, p>.05]. From these findings it can be inferred that children's science literacy levels do not show any difference in terms of gender. The arithmetic averages and standard deviation values related to children's science literacy level scores on the basis of gender are presented in Table 5. below. Also, the findings related to F test results, which was conducted to test whether the differences in children's science literacy levels average scores are statistically meaningful, are presented in the table.

Table 5. The Comparison of Children's Science Literacy Scores on the basis of Age

Early Childhood Science Education Content Standards Scale (SCSS)	Age	*n*	$\bar{x}$	*sd*	Source of Variance	Sum of Squares	*df*	Mean Square	F	*p*
Life Sciences	4 age	67	2.81	.835	Between Groups	8.359	2	4.180	7.294	.001*
	5 age	70	3.16	.731	Within Groups	119.193	208	.573		
	6 age	74	3.28	.704	Total	127.552	210			
Physical Sciences	4 age	67	2.74	1.035	Between Groups	6.734	2	3.367	3.653	.028*
	5 age	70	3.02	.936	Within Groups	191.707	208	.922		
	6 age	74	3.17	.909	Total	198.441	210			
World and Space Sciences	4 age	67	3.12	.865	Between Groups	1.245	2	.622	.989	.374
	5 age	70	3.22	.770	Within Groups	130.822	208	.629		
	6 age	74	3.31	.744	Total	132.067	210			

* *p<.05*

According to the one-way ANOVA results conducted for children's science literacy scores on the basis of age, there were statistically meaningful differences found in the "life sciences" sub dimension [$F_{(2-208)}$=7.294, p<.05] and in the "physical sciences" sub dimension [$F_{(2-208)}$=3.653, p<.05]. However, no statistically significant results were found in the "World and space sciences" sub dimension of the scale [$F_{(2-208)}$=.989, p<.05]. The Scheffe test, which is one of the post-hoc multi variable comparison tests, was applied to determine the source of this difference found in the "life sciences" and "physical sciences" sub dimensions on the basis of age, and the data related to the Scheffe test results is show in Table 6. below.

Table 6. Scheffe Test Results of the Differences among Children's Science Literacy Scores on the basis of Age

Early Childhood Science Education Content Standards Scale (SCSS)	*n*	$\overline{X}$	*sd*	Age	4 age	5 age	6 age
Life Sciences	67	2.81	.835	4 age		*	*
	70	3.16	.731	5 age	*		
	74	3.28	.704	6 age	*		
Physical Sciences	67	2.74	1.035	4 age			*
	70	3.02	.936	5 age			
	74	3.17	.909	6 age	*		

According to the results of the Scheffe test, the meaningful difference in the "life sciences" sub dimension was found to be between children ages four, five and six. In a review of arithmetic averages of both children ages four and five, the five-year-old children's arithmetic scores ($\overline{X}$ = 3.16) were revealed to be higher than those of the four-year old's average scores ($\overline{X}$ = 2.81). Similarly, the six-year old children's arithmetic scores ($\overline{X}$ = 3.28) were found to be higher than the four-year-old's average scores ($\overline{X}$ = 2.81). In this sense, it can be claimed that in the "life sciences" sub dimension, five and six-year-old children possess higher levels of science literacy than four-year-olds. In Table 7, the arithmetic averages and standard deviation values related to children's science literacy level scores based on number siblings are presented. And again, Table 7. shows the results of the F test, which was conducted to reveal whether the differences found in children's science literacy scores were significant.

Table 7. The Comparison of Children's Science Literacy Scores on the basis of Number of Siblings

Early Childhood Science Education Content Standards Scale (SCSS)	*Number of Siblings*	*n*	$\overline{X}$	*sd*	Source of Variance	Sum of Squares	*df*	Mean Square	F	*p*
Life Sciences	No	48	3.15	.727	Between Groups	12,065	4	3.016	5.380	.000*
	1 siblings	82	3.26	.787						
	2 siblings	43	3.03	.664	Within Groups	115,488	206	.561		
	3 siblings	22	2.98	.800						
	4 or more	16	2.34	.746	Total	127,552	210			
Physical Sciences	No	48	3.23	.888	Between Groups	18,255	4	4.564	5.217	.001*
	1 siblings	82	3.09	.969						
	2 siblings	43	2.81	.900	Within Groups	180,186	206	.875		
	3 siblings	22	3.03	1.016						
	4 or more	16	2.08	.864	Total	198,441	210			
World and Space Sciences	No	48	3.31	.719	Between Groups	6,878	4	1.719	2.829	.026*
	1 siblings	82	3.36	.780						
	2 siblings	43	3.08	.838	Within Groups	125,189	206	.608		
	3 siblings	22	3.14	.765						
	4 or more	16	2.72	.801	Total	132,067	210			

* *p<.05*

In terms of number of siblings, to the one-way ANOVA results, there were found statistically meaningful differences in the "life sciences" sub scale [$F_{(4-206)}$=5.380, p<.05]; in the "physical sciences" sub dimension [$F_{(4-206)}$=5.217, p<.05] and in the "world and space sciences" sub dimension [$F_{(4-206)}$=2.829, p<.05]. With the aim of determining the source of the significant differences found in all sub dimensions, the Scheffe test was applied, and the data related to the test results are given in Table 8.

Tablo 8. Scheffe Test Results of the Differences among Children's Science Literacy Scores on the basis of Number of Siblings

Early Childhood Science Education Content Standards Scale (SCSS)	*n*	$\overline{X}$	*sd*	*Number of Siblings*	No siblings	1 siblings	2 siblings	3 siblings	4 or more siblings
Life Sciences	48	3.15	.727	No siblings					*
	82	3.26	.787	1 siblings					*
	43	3.03	.664	2 siblings					*
	22	2.98	.800	3 siblings					
	16	2.34	.746	4 or more siblings	*	*	*		

Physical Sciences	48	3.23	.888	No siblings					*
	82	3.09	.969	1 siblings					*
	43	2.81	.900	2 siblings					
	22	3.03	1.016	3 siblings					
	16	2.08	.864	4 or more siblings	*	*			
World and Space Sciences	48	3.31	.719	No siblings					*
	82	3.36	.780	1 siblings					*
	43	3.08	.838	2 siblings					
	22	3.14	.765	3 siblings					
	16	2.72	.801	4 or more siblings	*	*			

According to the Scheffe test results, the meaningful differences found in the “life sciences” sub dimension were between the children with four or more siblings, and the children with no siblings, or the children with one or two siblings. Considering the average scores of the children with no siblings ($\bar{x}$ = 3.15), it was revealed that it was higher than the average scores of the children with four or more siblings ($\bar{x}$ = 2.34). The average scores of the children with one sibling ($\bar{x}$ = 3.26) were higher than the ones with four or more siblings ($\bar{x}$ = 2.34). Similarly, the average scores of the children with two siblings ($\bar{x}$ = 3.03) were found to be higher than the ones with four or more siblings ($\bar{x}$ = 2.34). In the light of these findings, the children with four or more siblings can be said to be less science literate in the “life sciences” sub dimension than the ones without siblings, or the ones with one or two siblings.

Following the Scheffe test, it was revealed that the meaningful difference found in the “physical sciences” sub dimension were between the children with four or more siblings, and the ones with no siblings, and the ones with one sibling. The average scores of the ones with no siblings ($\bar{x}$ = 3.23) were found to be higher than the average scores of the children with four or more siblings ($\bar{x}$ = 2.08). The average scores of the ones with one sibling ($\bar{x}$ = 3.09) were found to be higher than the average scores of the children with four or more siblings ($\bar{x}$ = 2.08). Hence, the children with four or more siblings can be said to be less science literate in the “physical sciences” sub dimension than the ones with no siblings, or the ones with one sibling.

The meaningful differences found in the “world and space sciences” sub dimension were between the children with four or more siblings, and the children with no siblings, and the ones with one sibling. Considering the average scores of the children with no siblings ($\bar{x}$ = 3.31), they were found to have higher scores than the ones with four or more siblings ($\bar{x}$ = 2.72). Additionally, the average scores of the children with one sibling ($\bar{x}$ = 3.36) were revealed to be higher than the ones with four or more siblings ($\bar{x}$ = 2.72). In light of these findings, the children with four or more siblings can be said to be less science literate in the “world and physical sciences” sub dimension than the ones with no sibling, or the ones with one sibling. The arithmetic averages and standard deviation values related to children’s science literacy scores on the basis of their mothers’ educational backgrounds are demonstrated in Table 9. The table also shows the F test results which were applied to see whether the differences in the scores were meaningful.

Table 9. The Comparison of Children’s Science Literacy Scores on the basis of Mother’s Educational Background

Early Childhood Science Education Content Standards Scale (SCSS)	*Mother’s Educational Background*	*n*	$\bar{x}$	*sd*	Source of Variance	Sum of Squares	*df*	Mean Square	F	*p*
Life Sciences	Primary	63	3.05	.829	Between Groups	3.121	4	.780	1.292	.274
	Secondary	32	3.01	.800						
	High School	81	3.04	.721	Within Groups	124.432	206	.604		
	Graduate	26	3.33	.825						
	Master	9	3.44	.634	Total	127.552	210			
Physical Sciences	Primary	63	2.67	1.064	Between Groups	11.197	4	2.799	3.080	.017*
	Secondary	32	3.01	.977						
	High School	81	3.07	.879	Within Groups	187.244	206	.909		
	Graduate	26	3.23	.944						
	Master	9	3.55	.645	Total	198.441	210			
World and Space Sciences	Primary	63	2.93	.869	Between Groups	9.517	4	2.379	3.999	.004*
	Secondary	32	3.22	.706						
	High School	81	3.32	.759	Within Groups	122.550	206	.595		
	Graduate	26	3.52	.709						
	Master	9	3.55	.424	Total	132.067	210			

* *p<.05*

According to the results of the one-way ANOVA which was conducted on the basis of number of siblings variable, there was no statistically meaningful difference in the "life sciences" sub dimension [$F_{(4-206)}$=1.292, p>.05] while there were found meaningful differences in the sub dimensions of "physical sciences" [$F_{(4-206)}$=3.080, p<.05] and "world and space sciences" [$F_{(4-206)}$=3.999, p<.05].

In order to determine the source of the meaningful difference found between "physical sciences" and "world and space sciences" sub dimensions, the Schffe test was applied, and the related findings are shown in Table 10 below.

Table 10. Scheffe Test Results for the Children's Science Literacy Scores on the basis of Mothers' Educational Background

Early Childhood Science Education Content Standards Scale (SCSS)	*n*	$\bar{x}$	*sd*	*Mother's Educational Background*	Primary	Secondary	High School	Graduate	Master
Physical Sciences	63	2.67	1.064	Primary				*	*
	32	3.01	.977	Secondary					
	81	3.07	.879	High School					
	26	3.23	.944	Graduate	*				
	9	3.55	.645	Master	*				
World and Space Sciences	63	2.93	.869	Primary				*	*
	32	3.22	.706	Secondary					
	81	3.32	.759	High School					
	26	3.52	.709	Graduate	*				
	9	3.55	.424	Master	*				

According to the results of the Scheffe test, the meaningful differences found in the "physical sciences" sub dimension were between the children whose mothers have a primary school degree, and the children whose mothers have graduate and master's degrees. The average scores of the children whose mothers have graduate and a master's degrees ($\bar{x}$ = 3.55) were found to be higher than the children whose mothers have a primary degree ($\bar{x}$ = 2.67). Similarly, the average scores of the children whose mothers have a graduate degree ($\bar{x}$ = 3.23) were found to be higher than the ones whose mothers have primary degrees ($\bar{x}$ = 2.67). In this context, the children whose mothers have graduate or master's degrees can be said to be more science literate in the "physical sciences" sub dimension than the children whose mothers have a primary school degree.

The difference found in the "world and space sciences" sub dimension was between the children whose mothers have a primary school degree and the ones whose mothers have a graduate or master's degree. The average scores of the children whose mothers have master's degrees ($\bar{x}$ = 3.55) were found to be higher than the children whose mothers have primary school degrees ($\bar{x}$ = 2.93). Similarly, the average scores of the children whose mothers have a graduate degree ($\bar{x}$ = 3.52) were found to be higher than the children whose mothers have a primary school degree ($\bar{x}$ = 2.93). Thus, the children whose mothers have a graduate or master's degree can be said to be more science literate in the "world and space sciences" sub dimension than the children whose mothers have a primary school degree. Table 11. presents the arithmetic averages and standard deviation values related to children's science literacy scores on the basis of father's educational background. The table also reflects the results of the F test which was applied to test whether the differences in scores were meaningful.

Table 11. The Comparison of Children's Science Literacy Scores on the basis of Father's Educational Background

Early Childhood Science Education Content Standards Scale (SCSS)	*Father's Educational Background*	*n*	$\bar{x}$	*sd*	Source of Variance	Sum of Squares	*df*	Mean Square	F	*p*
Life Sciences	Primary	51	2.81	.764	Between Groups	18.376	4	4.594	8.668	.000*
	Secondary	18	2.76	.672						
	High School	89	3.08	.805	Within Groups	109.176	206	.530		
	Graduate	36	3.28	.544						
	Master	17	3.90	.542	Total	127.552	210			
Physical Sciences	Primary	51	2.73	.894	Between Groups	20.679	4	5.170	5.991	.000*
	Secondary	18	2.75	.982						
	High School	89	2.93	.939	Within Groups	177.762	206	.863		
	Graduate	36	3.14	1.043						
	Master	17	3.93	.586	Total	198.441	210			

World and Space Sciences	Primary	51	3.01	.747	Between Groups	12.275	4	3.069	5.277	.000*
	Secondary	18	2.96	.856						
	High School	89	3.17	.778	Within Groups	119.792	206	.582		
	Graduate	36	3.46	.759						
	Master	17	3.84	.605	Total	18.376	4	4.594		

** p<.05*

According to the results of the one-way ANOVA which was conducted on the basis of father's educational background, there were found statistically meaningful differences in the "life sciences" sub dimension [$F_{(4\text{-}206)}$=8.668, p<.05], in the "physical sciences" sub dimension [$F_{(4\text{-}206)}$=5.991, p<.05] and in the "world and space sciences" sub dimension [$F_{(4\text{-}206)}$=5.277, p<.05]. With the aim of determining the source of the meaningful differences in all sub dimensions, the Schffe test was applied, and the related findings are shown in Table 12. below.

Tablo 12. Scheffe Test Results for the Children's Science Literacy Scores on the basis of Fathers' Educational Background

Early Childhood Science Education Content Standards Scale (SCSS)	*n*	$\overline{X}$	*sd*	*Father's Educational Background*	Primary	Secondary	High School	Graduate	Master
Life Sciences	51	2.81	.764	Primary					*
	18	2.76	.672	Secondary					*
	89	3.08	.805	High School					*
	36	3.28	.544	Graduate					
	17	3.90	.542	Master	*	*	*		
Physical Sciences	51	2.73	.894	Primary					*
	18	2.75	.982	Secondary					*
	89	2.93	.939	High School					*
	36	3.14	1.043	Graduate					
	17	3.93	.586	Master	*	*	*		
World and Space Sciences	51	3.01	.747	Primary					*
	18	2.96	.856	Secondary					*
	89	3.17	.778	High School					*
	36	3.46	.759	Graduate					
	17	3.84	.605	Master	*	*	*		

To the Scheffe test results, the difference found in the "life sciences" sub dimension was between the children whose fathers have a master's degree and the ones whose fathers have primary, secondary or high school degrees. The average scores of the children whose fathers have a master's degree ($\overline{X}$ = 3.90) were found to be higher than the children whose fathers have a primary school degree ($\overline{X}$ = 2.81). The average scores of the children whose fathers have a master's degree ($\overline{X}$ = 3.90) were found to be higher than the children whose fathers have a a secondary school degree ($\overline{X}$ = 2.76). The average scores of the children whose fathers have a master's degree ($\overline{X}$ = 3.90), were found to be higher than the children whose fathers have a high school degree ($\overline{X}$ = 3.08). Hence, the children whose fathers have a master's degree can be said to be more science literate in the "life sciences" sub dimension than the children whose fathers have primary, secondary or high school degrees.

The meaningful difference found in the "physical sciences" sub dimension was between the children whose fathers have a master's degree and the ones whose fathers have primary, secondary or high school degrees. The average scores of the children whose fathers have a master's degree ($\overline{X}$ = 3.93) were found to be higher than the children whose fathers have a primary school degree ($\overline{X}$ = 2.73). The average scores of the children whose fathers have a master's degree ($\overline{X}$ = 3.93) were found to be higher than the children whose fathers have a secondary school degree ($\overline{X}$ = 2.75). The average scores of the children whose fathers have a master's degree ($\overline{X}$ = 3.93) were found to be higher than the children whose fathers have a high school degree ($\overline{X}$ = 2.93). In this sense, the children whose fathers have a master's degree can be said to be more science literate in the "physical sciences" sub dimension than the children whose fathers have primary, secondary or high school degrees.

The meaningful difference found in the "world and space sciences" sub dimension was again between the children whose fathers have a master's degree and the ones whose fathers have primary, secondary or high school degrees. The average scores of the children whose fathers have a master's degree ($\bar{x}$ = 3.84) were found to be higher than the children whose fathers have primary degree ($\bar{x}$ = 3.01). The average scores of the children whose fathers have a master's degree ($\bar{x}$ = 3.84) were found to be higher than the children whose fathers have a secondary school degree ($\bar{x}$ = 2.96). The average scores of the children whose fathers have a master's degree ($\bar{x}$ = 3.84) were found to be higher than the children whose fathers have a high school degree ($\bar{x}$ = 3.17). In light of these findings, the children whose fathers have a master's degree can be said to be more science literate in the "world and space sciences" sub dimension than the children whose fathers have primary, secondary or high school degrees. Table 13. shows the arithmetic averages and standard deviation values related to children's science literacy scores based on the presence of science material in their homes. The table also demonstrates the results of the F test which was applied to test whether the differences in scores were meaningful.

Tablo 13. The Comparison of Children's Science Literacy Scores on the basis on the Presence of Science Material in Their Homes

Early Childhood Science Education Content Standards Scale (SCSS)	*Presence of Science Material in Their Homes*	*n*	$\bar{x}$	*sd*	Source of Variance	Sum of Squares	*df*	Mean Square	F	*p*
Life Sciences	Quite a lot	39	3.80	.380	Between	53.513	3	17.838	49.870	.000*
	Sufficient	75	3.17	.659	Within	74.040	207	.358		
	Insufficient	51	3.19	.673	Total	127.552	210			
	No material	46	2.25	.550						
Physical Sciences	Quite a lot	39	3.93	.389	Between	114.320	3	38.107	93.771	.000*
	Sufficient	75	3.22	.744	Within	84.121	207	.406		
	Insufficient	51	3.07	.758	Total	198.441	210			
	No material	46	1.71	.436						
World and Space Sciences	Quite a lot	39	3.92	.325	Between	68.624	3	22.875	74.634	.000*
	Sufficient	75	3.39	.632	Within	63.443	207	.306		
	Insufficient	51	3.34	.615	Total	132.067	210			
	No material	46	2.21	.491						

** p<.05*

According to the results of the one-way ANOVA, which was conducted on the basis of the presence of science material at children's homes, there were found statistically meaningful differences in "life sciences" sub dimension [$F_{(3-207)}$= 49.870, p<.05], in the "physical sciences" sub dimension [$F_{(3-207)}$= 93.771, p<.05] and in the "world and space sciences" sub dimension [$F_{(3-207)}$= 74.634, p<.05]. With the aim of determining the source of the meaningful differences in all sub dimensions, the Schffe test was applied, and the related findings are shown in Table 14. below.

Tablo 14. Scheffe Test Results for the Children's Science Literacy Scores on the basis on the Presence of Science Material in Their Homes

Early Childhood Science Education Content Standards Scale (SCSS)	*n*	$\bar{x}$	*sd*	*Presence of Science Material in Their Homes*	Quite a lot of	Sufficient	Insufficient	No material
Life Sciences	39	3.80	.380	Quite a lot of		*	*	*
	75	3.17	.659	Sufficient				
	51	3.19	.673	Insufficient				
	46	2.25	.550	No material	*	*	*	
Physical Sciences	39	3.93	.389	Quite a lot of		*	*	*
	75	3.22	.744	Sufficient				
	51	3.07	.758	Insufficient				
	46	1.71	.436	No material	*	*	*	
World and Space Sciences	39	3.92	.325	Quite a lot of		*	*	*
	75	3.39	.632	Sufficient				
	51	3.34	.615	Insufficient				
	46	2.21	.491	No material	*	*	*	

According to the Scheffe test results, the difference found in the "life sciences" sub dimension was between the children possessing quite a lot of science materials in their homes and the ones possessing sufficient, insufficient science materials and the ones possessing no science materials in their homes. Also, there were found meaningful differences in science literacy scores of the children who have sufficient science materials at home and the ones who do not have any science materials at home. The average scores of the children who have quite a lot of science materials at their homes ($\bar{X}$ = 3.80) were found to be higher than the children who have sufficient ($\bar{X}$ = 3.17), insufficient ($\bar{X}$ = 3.19) and no science materials at their homes ($\bar{X}$ = 2.25). In light of these findings, the children who have quite a lot of science materials at their homes can be said to be more science literate in "life sciences" sub dimension than the children who have sufficient, insufficient and no science materials at their homes. Additionally, the average scores of the children who have no science materials at their homes ($\bar{X}$ = 2.25) were found to be lower than the average scores of the ones who have quite a lot of science materials at their homes ($\bar{X}$ = 3.80), who have sufficient science materials at their homes ($\bar{X}$ = 3.17), and who have insufficient science materials at their homes ($\bar{X}$ = 3.19). In this sense, the children who don't have any science materials at their homes can be said to be less science literate than the children who have quite a lot of, sufficient and insufficient science materials at their homes.

The meaningful difference found in "physical sciences" sub dimension was between the children who have quite a lot of science materials at their homes, and the ones who have sufficient, insufficient and no science materials at their homes. There were also found meaningful differences in science literacy scores of the children who have sufficient science materials at home and those who do not have any science materials at home. The average scores of the children who have quite a lot of science materials at their homes ($\bar{X}$ = 3.93), were found to be higher than the children who have sufficient ($\bar{X}$ = 3.22), insufficient ($\bar{X}$ = 3.07) and no science materials at their homes ($\bar{X}$ = 1.71). In this sense, the children who have quite a lot of science materials at their homes can be said to be more science literate in "physical sciences" sub dimension than the children who have sufficient, insufficient and no science materials at their homes. Besides, the average scores of the children who have no science materials at their homes ($\bar{X}$ = 1.71) were found to be lower than the average scores of the ones who have quite a lot of science materials at their homes ($\bar{X}$ = 3.93), who have sufficient science materials at their homes ($\bar{X}$ = 3.22), and who have insufficient science materials at their homes ($\bar{X}$ = 3.07). Hence, the children who do not have any science materials at their homes can be said to be less science literate in "physical sciences" sub dimension than the children who have quite a lot of, sufficient and insufficient science materials at their homes.

The significant difference found in the "world and space sciences" sub dimension was between the children, who have quite a lot of science materials at their homes, and the ones who have sufficient, insufficient and no science materials at their homes. There were also found meaningful differences in science literacy scores of the children who have sufficient science materials at home and the ones who do not have any science materials at home. The average scores of the children who have quite a lot of science materials at their homes ($\bar{X}$ = 3.92), were found to be higher than the children who have sufficient ($\bar{X}$ = 3.39), insufficient ($\bar{X}$ = 3.34) and no science materials at their homes ($\bar{X}$ = 2.21). In this context, the children who have quite a lot of science materials at their homes can be said to be more science literate in "world and space sciences" sub dimension than the children who have sufficient, insufficient and no science materials at their homes. Again, the average scores of the children who have no science materials at their homes ($\bar{X}$ = 2.21) were found to be lower than the average scores of the ones who have quite a lot of science materials at their homes ($\bar{X}$ = 3.92), who have sufficient science materials at their homes ($\bar{X}$ = 3.39), and who have insufficient science materials at their homes ($\bar{X}$ = 3.34). Thus, the children who don't have any science materials at their homes can be said to be less science literate in "world and space sciences" sub dimension than the children who have quite a lot of, sufficient and insufficient science materials at their homes.

IV. Discussion and Conclusion

This study was conducted to determine the science literacy levels of children in early childhood stage and to compare these levels based on different variables. To the analysis results, the science literacy level scores of the participant children were found to be $\bar{X}$ =96.26 ($\bar{X}$ /k=3.17). In this sense, the participant children can be said to have a medium level of science literacy. In the related literature, the number of studies concerning the determination of children's science literacy levels, especially the ones in early childhood stage, is quite inadequate. Especially in Turkey, although there have been adequate studies regarding teachers' opinions towards science education for children, teaching methods in science education, materials in this field etc. there seems to be almost no studies related to children's science literacy. Thus, this study is expected to significantly contribute to the related literature.

To the t test results, no meaningful difference was found in children's science literacy level scores on the basis of gender. In terms of age, one-way variance analysis results indicate statistically significant differences in the "life sciences" and "physical sciences" sub dimensions. The study findings suggest that the children at the age of five and six can be accepted as more science literate than those at the age of four. As a result of the fact that as the age rises, the mental development and developments at other sides improve, children interact with their surroundings more, which might in turn be said to influence their science literacy levels.

Regarding the number of siblings variable, one-way variance analysis results indicate statistically meaningful differences in children's science literacy level scores. In this sense, the scores of the children with four or more siblings were lower than other children's science literacy scores, which might stem from the fact that the high number of siblings results in lack of care and interest given to a child, financial opportunities provided, the increase in child's responsibility towards his siblings etc. In a review of the science literacy scores, the highest scores were found to belong to the children with no siblings or with one sibling, which might stem from the fact that these families can spare more time and financial opportunities for their children, that thee children are more free to act on the basis of their exploring senses, that they can make use of materials at home and in their environments more etc.

Regarding parents' educational background, the one-way variance analysis results demonstrate statistically meaningful differences in children's science literacy scores. The children whose fathers or mother have a graduate or a master's degree are seen to be more science literate than the others. Indeed, the high educational background of parents can signify that children can be provided various opportunities to experience science by their parents, which can be agreed to contribute positively to children's science literacy. Lastly, based on the presence of science materials in home, the one-way variance analysis results suggest statistically meaningful differences in children's science literacy scores. In this sense, the scores of the children who have quite a lot of science materials at their homes were higher than other children's scores. Thus, it can be said that these children are more science literate than the children who possess less science materials at their homes. Also, the opposite situation can be said for the children who do not have any science materials at their homes.

V. Recommendations

In early childhood, children are having a deep sense of curiosity and exploring. They want know and investigate the environment so they attempt to do various things. They try to satisfy their curiosity through tinkering with objects, tools, equipment, machines, drawers, cupboards, toys etc. in their homes or surroundings. Many families prefer to hinder these actions of children for fear that they would harm themselves or their surroundings. However, these attempts comprise the foundation of scientific thought. Children's sense of curiosity and exploring should not be hindered, they should be encouraged to do so, they should be provided with opportunities, experiences related materials and experiment settings, all of which would considerably contribute to their science literacy and to their scientific process skills.

During the implementation of the study, the researcher also found the chance to observe at schools, and to learn about scientific studies there. According to the observations of the researcher, there were no science materials at some schools or classrooms, or at some of them they were not adequate. Also, in many classes, science education was limited to specific corners in classes. However, science is everywhere. Scientific studies can be conducted anywhere. Even without buying any materials, scientific studies can be conducted. Scientific studies can be done through making use of waste materials, wood, paper, wax, fiber and numerous materials that we can count here now. Natural trips, camps, visits to zoos and botanic gardens, observations, practices made with water, mud, sand, clay and stone, and various similar studies can be conducted, and these activities can be maintained both at home and at school.

The places which provide children with experiences related to science have increased in Turkey recently. The number of the observation sides at playgrounds, small zoos, hobby gardens, and science houses including scientific materials, and science centers for children has risen. However, these opportunities are provided in big cities generally, thus it is of importance to establish these facilities even in small cities and rural areas. It is thought that providing children with opportunities in which they can work in the science field considerably contributes to their science literacy levels. The studies in literature proved that children who experience various things in a specific field are disposed to be more successful at that field. Through providing schools and families with necessary support, all children can be raised to be equipped with 21st century skills, to possess scientific thought and as individuals who contribute to their country and humanity through his or her discoveries and inventions.

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