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STUDENT LEARNING, CHILDHOOD & VOICES | RESEARCH ARTICLE

Kindergarten students' levels of understanding some science concepts and scientific inquiry processes according to demographic variables (the sampling of Kilis Province in Turkey)

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Abstract: The purpose of this study is to identify the kindergarten students' levels of understanding some science concepts (LUSSC) and scientific inquiry processes (SIP) and compare their LUSSC and SIP in terms of some demographic variables. Also, another purpose of this study is to identify the predictive power of those demographic variables over the kindergarten students' LUSSC and SIP. This study was conducted according to quantitative research design. The study group consisted of 335 kindergarten students from 20 different rural and urban schools. In the study, the scale for "Turkish Kindergarten Students' Understandings of Scientific Concepts and Scientific Inquiry Processes" was used. According to some variables (such as mother's education level and family structure), there was a statistically significant difference between students' mean scores for LUSSC and between students' mean scores for SIP. Within the scope of this study, it was found that among the predictor variables (age, family's income level, and number of brother/sister) were significant predictors for LUSSC, and number of brother/sister was a significant predictor for SIP.

Subjects: Early Childhood; Science Education; Teaching & Learning

Keywords: demographic variables; kindergarten students; science concepts; scientific inquiry processes

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PUBLIC INTEREST STATEMENT

The first six years of life is a time of rapid growth and development for children. In this paper, we identify the kindergarten students' levels of understanding some science concepts (LUSSC) and scientific inquiry processes (SIP) and compare in terms of different variables. The study group consisted of 335 kindergarten students (54–72 month) from 20 different rural and urban schools.

According to some variables, such as mother's education level and family structure, there was a statistically significant difference between students' mean scores for LUSSC and between students' mean scores for SIP. Within the scope of this study, it was found that among the predictor variables, age, family's income level, and number of brother/sister were significant predictors for LUSSC, and number of brother/sister was a significant predictor for SIP.

1. Introduction

Children are born with a sense of curiosity and inquiry. They get numerous opportunities for perception, learning, and understanding the world with the help of their daily life experiences. Through to those opportunities, they carry on their natural tendencies such as discovering and learning by trying to form new knowledge through using their existing knowledge and, when necessary, by trying to structure new knowledge through changing their existing knowledge (Uyanik-Balat, 2011).

The first six years of life are a time of rapid growth and development of children. The process starting as of the age of three in this period of rapid growth and development covers the preschool education period. This process constitutes the first stage of the systematic education (Ayvacı, Devecioglu, & Yigit, 2002). The goals of the education given to children in this period in Turkey are: to provide the physical, mental, and emotional development of children; to make them gain behaviors: to prepare them for primary school; to establish a common raising environment for children coming from unfavorable families and settings; and to ensure that they speak Turkish language well and accurately (Ministry of National Education [MNE], 2013). In order to be able to achieve those goals, preschool education program, which is child-centered, flexible, cyclical, eclectic, balanced, and game-based, has been developed. In this program, inquiry learning has priority, the development of creativity is in the forefront, and the use of daily life experiences and immediate surrounding opportunities for education purposes is promoted (MNE, 2013). Moreover, in this program, learning centers in the classroom are important, cultural and universal values are taken into account, family education and participation are essential, and the assessment process is versatile.

Within the scope of the preschool education program, which has been updated in 2013, learning centers in the classroom have been arranged as "interest corners" in preschools in order to meet children's need for playing free games. One of those learning centers in schools has to be a science center. The use of science centers and scientific activities in preschools is expected to help the preschoolers particularly in using and developing scientific process (MNE, 2013). The aim of preschool science education is to provide children with the basic knowledge on the occurrence of phenomena and events in nature and help them understand themselves and their environment (Sahin, 1997). The science education to be given to children in this period should be directed toward satisfying the curiosity of children, rather than providing information on scientific concepts (Kefi, Çeliköz, & Erişen, 2013). Science education where the science concepts are merely recited to students or which is based on memorization does not contribute much to the mental development of children. Consequently, the learned information accumulates irregularly and gets forgotten in a short time. In science education, where activities are performed and students are active, on the other hand, children who are introduced to science activities will refrain from scientific works in the following years unless they get sufficient support from their teachers and if they have negative experiences (Simpson & Oliver, 1990).

According to Kamay and Kaşker (2006), children start to learn and use the basic concepts of mathematics and science education in the preschool period. According to Kefi and Çeliköz (2014), this period is full of experiences in which children acquire basic concepts and scientific process skills. It is important to include activities in which children can use or develop scientific process skills along with the basic knowledge, understanding, attitude, and values regarding science (Boyuk, Tanik, & Saracoglu, 2011). Children should be introduced to such skills in the preschool period so that they can use the scientific process skills effectively in future years (Kefi et al., 2013).

Scientific process skills are essential skills that every individual should have in order to become a science literate. The best time to introduce children to science is the preschool period when they start to get curious about the world surrounding them. When children have the ability to use their scientific process skills, it is easier for them to reach new knowledge through concrete experiences and gain such knowledge (Harlen & Qualter, 2004).

According to Cepni et al. (2006), those skills are divided into three groups: basic skills, causal skills, and experimental skills. Among those skills, basic scientific process skills are gained since birth. The most frequently repeated basic scientific process skills are observation, estimation, classification, using numbers, communication, measurement, data recording, problem-solving, and reasoning skills (Howe & Jones, 1998). Hypothesizing, defining hypothesis, and data checking skills are more advanced level scientific process skills that develop after preschool periods (Lind, 2000). According to Kefi et al. (2013), it is not possible to gain the scientific process skills, which are expected to be gained in further ages, effectively without developing the basic scientific process skills.

Although the importance attached to preschool education has increased in Turkey in recent years, there is no consensus about the science education that should be given to children in that age group (Senocak, Samarapungavan, Aksoy, & Tosun, 2013). When most of the studies in literature are analyzed, we see studies that recommend starting science education in the early years of childhood (Eshach, 2011; Eshach & Fried, 2005; French, 2004; Watters, Diezmann, Grieshaber, & Davis, 2000). When the studies on preschool education period in Turkey are analyzed, we see that most of them focus on identifying the perceptions of the preschool teachers/prospective preschool teachers (Durmusoglu, 2008; Kabadayi, 2010; Secer, 2010). The literature includes some studies focusing on how preschoolers learn science (Ayvaci, 2010; Sackes, Flevares, & Trundle, 2010).

A number of researchers have investigated preschooler children's conceptions, such as children's knowledge of the Moon (Venville, Louisell, & Wilhelm, 2012), children's understandings of the Earth (Tao, Oliver, & Venville, 2013), and children's conceptions of the mechanism of rainfall (Sackes et al., 2010). Demographic variables such as gender and socioeconomic status are important for academic achievement (Cheng Lee & Al Otaiba, 2015). But there are little studies about demographic influences on children's understanding of science concepts. Venville et al. (2012) investigated how rich social and cultural environments impact children's ideas about the Moon. They explained that children's ideas were influenced by observation of physical factors in their environment and by social interaction or cultural activities.

Learning environment outside school is important for developing kindergarten students. Kindergarten students' understanding of scientific concepts and scientific inquiry processes (SIP) can be improved in the learning environment outside school, such as parent's occupational status and education level, inhabitation (rural and urban), and number of brother/sister. On the other hand, the types of kindergartens are important in improving the students' understanding of scientific concepts and SIP. In Turkey, there are three types of kindergartens for children: private kindergartens, state kindergartens, and state kindergartens classroom of primary/elementary schools. Private kindergartens use the same curriculum whereas can carry out different activities in Turkey.

In addition, the literature includes studies on developing scales by performing validity and reliability studies for measuring the preschoolers' levels of understanding some science concepts (LUSSC) and SIP (Senocak et al., 2013). However, the literature does not include many studies, which compare the preschoolers' LUSSC and SIP in terms of different variables and which use scales developed by doing validity and reliability works while doing the comparison. This has been identified as a problem to be addressed in this study.

1.1. Aim of the study

The aim of this study is to identify the kindergarten students' LUSSC and SIP and compare their LUSSC and SIP in terms of different variables. The other aim of this study is to identify the predictive power of those variables in terms of the kindergarten students' LUSSC and SIP. Within the framework of those general objectives, answers were sought to the following research questions.

1.2. Research questions

(1) Do the kindergarten students' LUSSC and SIP indicate a significant difference according to:
   (a) gender,
   (b) years of kindergarten attendance,
   (c) mother's occupational status,
   (d) father's occupational status,
   (e) family structure,
   (f) inhabitation,
   (g) type of school,
   (h) mother's education level,
   (i) father's education level,
   (j) family's income level,
   (k) age, and/or
   (l) number of brother/sister?

(2) What is the predictive power of the above-mentioned variables over the kindergarten students' LUSSC and SIP?

2. Method

This study used the survey method, which is one of the non-experimental quantitative research methods. Since the survey studies are versatile, efficient, and generalizable, they are quite popular for education studies (McMillan & Schumacher, 2010, p. 233).

2.1. Study group

The study sampling was determined according to the random sampling method (McMillan & Schumacher, 2010, p. 235). According to the information gathered from Directorate of Education in 2014, a total of 1599 kindergarten students from 47 different schools (urban center = 29, rural schools = 18) were enrolled in the province of the Kilis in Turkey. In Turkey, there are three types of kindergartens (state kindergarten class of primary/elementary schools, state kindergarten students, and private kindergarten students). Kindergarten students in rural schools are state kindergartens class of primary/elementary schools'. The study group consisted of 335 kindergarten students from urban schools (N = 211) and rural schools (N = 124) in Kilis and its districts, in Turkey in the fall semester of the school year of 2013–2014. The study was conducted in 20 different schools affiliated to the MNE with 335 kindergarten students. The study group consisted of 124 students (37.0%) of state kindergartens class of primary/elementary schools, 148 state kindergarten students (44.2%), and 63 private kindergarten students (18.8%). One hundred and seventy-four students (51.9%) were female; 161 students (48.1%) were male. In terms of age, 177 students were (52.9%) 54–60 months old; 32 students were (9.6%) 61–66 months old; and 125 students were (37.3%) 67–72 months old. One student (.3%) did not specify age. Table 1 provides more detailed information regarding the study group.

2.2. Data collection tool

The study used the scale "Turkish Kindergarten Students' Understandings of Scientific Concepts and Scientific Inquiry Processes" developed by Senocak et al. (2013) along with the scale measuring the demographic information of kindergarten students. Permission was received to use the scale created by Senocak et al. (2013).

Items of scale were constructed according to Turkish Preschool Program. This program has a set of indicators addressing some science concepts and SIP. The items of the scale were reviewed by experts in the area of science learning in preschool education.

Table 1. Demographic information

		Frequency (*f*)	Percentage (%)
Mother's education level	Primary school	123	36.7
	Secondary school	93	27.8
	High school	62	18.5
	University	53	15.8
	Unspecified	4	1.2
Father's education level	Primary school	50	14.9
	Secondary school	96	28.7
	High school	100	29.9
	University	87	26.0
	Unspecified	2	.6
Father's occupational status	Minimum wage	75	22.4
	Small business owner (grocer, baker, barber, etc.)	129	38.5
	Teacher	44	13.1
	Doctor, engineer, police, soldier	25	7.5
	Civil servant	25	7.5
	Farmer and others	37	11.0
Mother's occupational status	Housewife, not working	268	80.0
	Mothers working outside the home	67	20.0
Number of brother/sister	0 (None)	38	11.3
	1	126	37.6
	2	84	25.1
	3 and more	87	26.0
Year of kindergarten attendance	1	257	76.7
	2	78	23.3
Type of kindergarten	Private kindergartens	63	18.8
	State kindergartens	148	44.2
	State kindergartens class of primary/elementary schools	124	37.0
Family structure	Core family (parents and children)	292	87.2
	Extended family (grandparents, etc.)	43	12.8
Inhabitation	Urban area (city center)	211	63.0
	Rural area (village)	124	37.0
Family's income level Turkish Lira (TL)	0–1000	80	23.9
	1000–2000	151	45.1
	2000–3000	43	12.8
	3000-above	61	18.2

Items with three choices were written and pictured for the science concepts (living things, properties of the objects, heat and temperature, sound, and day and night) and SIP which are presented as follow: (i) "Understand science as a process of inquiry is based on asking questions and making predictions about the natural world;" (ii) "Understand the empirical basis of science: Scientific ideas are evaluated by their correspondence or fit to empirical evidence;" and (iii) "Understand simple tools used to gather, record, analyze, and share data." Items of SIP with three choices were written and pictured in accordance with the Scientific Inquiry Subtest developed by Samarapungavan, Mantzicopoulos, Patrick, and French (2009). This scale contained 16 questions in 2 domains. The first

domain covered 10 questions (questions 1–10) prepared to identify the kindergarten students' LUSSC. The second domain covered six questions (questions 11–16) prepared to identify the kindergarten students' SIP. The questions had three choices, in which there was one correct answer and two false answers. While developing the scale, 12 subject area specialists and 7 Turkish language specialists provided opinions. In order to determine the construct validity of the scale, difficulty (Average difficulty = .63) and discrimination (Average discrimination = .44) indexes were calculated for each question and also, confirmatory factor analysis was performed for the scale structure including the two domains. The scale items had two factor structures and acceptable reliabilities.

Cronbach's alpha reliability coefficient of the scale was calculated as .67 (Senocak et al., 2013). The used scale was suitable in terms of its scope for measuring the concepts mentioned in science activities and the gains of scientific process skills identified in the preschool teaching program of the MNE in 2013. For example, the preschool teaching program updated in 2013 included a gain "He/she sorts the objects/creatures according to their length, size, amount, and weight and color tone" (MNE, 2013; Gain 9). The scale included the following questions regarding the concepts included in this gain (Figure 1).

> Question 4. One of them is heavier than the others. Which one? (Show the pictures: apple, balloon and bubble).

The scale included the following question in order to identify the kindergarten students' SIP (Figure 2).

> Question 14. In the first picture, Ali's mother gathers the spilled needles with the help of a magnet easily (show the pictures). In the second picture, Ali tries to gather the spilled beans with the help of a magnet. However, he cannot manage it. Here are three children saying something (show the pictures). Now I will tell you what each child is saying. Now think again about what Ali and his mother did, and tell me which one of those children are talking about the result of what Ali and his mother did?

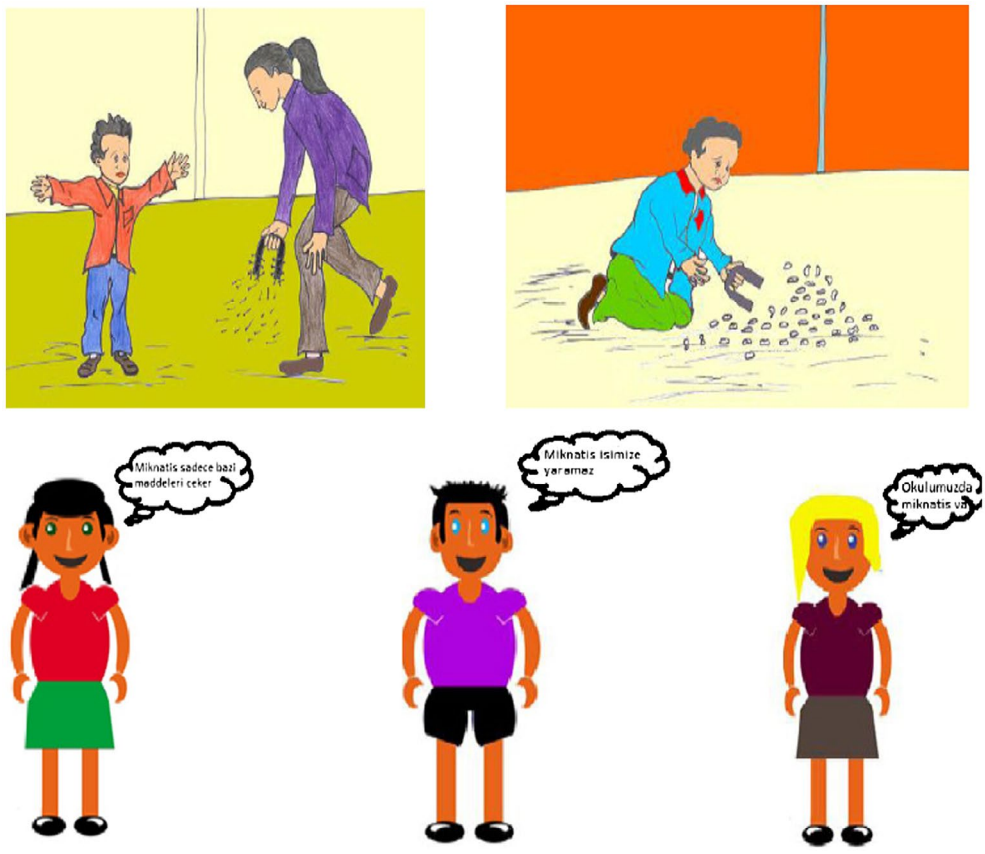
The fourth question in the scale tried to identify whether children can distinguish the concepts of heavy and light. The 14th question was about SIP, namely estimation and reasoning skills. This question tried to identify children's SIP.

2.3. Data collection

Official permissions for kindergarten students were obtained from educational directorates of the region. While collecting data from the kindergarten students in the study, assistance was received from the prospective teachers who were in the final year of the preschool teacher training program. The scale was performed by one-on-one meetings. Different methods were used while applying the scale to the kindergarten students. Sometimes kindergarten students were asked the questions that were prepared in PowerPoint on computer, through which data were collected. Sometimes, color printouts were taken for the questions and choices, then they were pressed, and then each question

Figure 1. An example of the questions for LUSSC.

Figure 2. An example of the questions for SIP.



and its choices were put in an envelope; this way, we tried to raise the curiosity of the responding children and prevent them from getting bored, and thus data were collected. There was no time limitation in the application of the scales.

2.4. Data analysis

The data obtained were analyzed using the SPSS 18 package program. Descriptive statistical techniques were used while classifying the study group according to some variables. Parametric tests were used for data analysis; independent-samples *t*-test was used for variables with two groups; and one-way analysis of variance (ANOVA) was used for the variables with more than two groups. In addition, multiple linear regression analysis was performed to determine the predictive power of the said variables over the kindergarten students' levels of understanding science concepts and SIP.

3. Results

3.1. Results regarding the kindergarten LUSSC and SIP

Accordingly, the highest score for LUSSC was 10, and the highest score for SIP was 6. In line with the answers of the participating 335 kindergarten students, the mean score of LUSSC was 6.23 (SD = 1.93), and the mean score of SIP was 3.64 (SD = 1.50). Descriptive data were presented in order to determine difficulty of the questions in the LUCSS and SIP (Table 2). Correct answer ratios were identified for each question in the scale. Table 2 indicates that in the first 10 questions included in LUSSC, the 8th question had the lowest ratio of correct answer (50.1%) and the 10th question has the highest ratio of correct answer (71.9%). On the other hand, in the six questions included in the measuring SIP, the 11th question had the lowest ratio of correct answer (46.3%) and the 15th question has the highest ratio of correct answer (77.3%).

Table 2. Correct answer ratios of the questions included in the scale

			Correct answer		Wrong answer	
Question	**Questions and related science concepts**	**Correct answer**	***f***	**%**	***f***	**%**
1	One of them is lifeless	Doll	230	68.7	105	31.3
2	Human life cycle	Old woman	224	66.9	111	33.1
3	Plant's parts	Some plants have flowers	195	58.2	140	41.8
4	One of them is heavier than the others	Apple	236	70.4	99	29.6
5	What material are those nails made of?	Iron	232	69.3	103	30.7
6	The object that clings to Mehmet's magnet	Paperclip	191	57.0	144	43.0
7	Here is the picture of a hot tea	I pour cold water	182	54.3	153	45.7
8	Here are three children who want to play a game	Ears are closed	168	50.1	167	49.9
9	Here is the picture of three people	A young man	191	57.0	144	43.0
10	Selim and his sister/brother	Wake up, it is morning	241	71.9	94	28.1
11	Here is the picture of a butterfly	Does the butterfly have a mouth?	155	46.3	180	53.7
12	Here is the picture of a balloon	This balloon might explode	168	50.1	167	49.9
13	Here is Ece's room	Ice melts when heated	214	63.9	121	36.1
14	Ali's mother	Magnet attracts some materials	231	69.0	104	31.0
15	Some tools we use when researching	Scales	259	77.3	76	22.7
16	Here are three children doing something	Murat explains his drawing to his friend	176	52.5	158	47.2

3.2. Evaluating the LUSSC according to different variables

We examined whether the mean score received for the kindergarten students' LUSSC in the scale was a statistically significant difference according to some variables. Independent-samples *t*-test was used in order to identify whether there was a difference between the kindergarten students' LUSSC according to the variables with two groups (gender, mother's occupational status, family structure, inhabitation, and year of kindergarten attendance) (Table 3).

Table 3 indicates that according to gender [$t_{(331.675)} = 1.112$; $p > .05$] and year of kindergarten attendance [$t_{(122.660)} = -1.725$; $p > .05$], there was no statistically significant difference between students' mean scores for LUSSC. However, according to the variables of mother's occupational status [$t_{(108.969)} = -3.091$; $p < .05$], family structure [$t_{(333)} = 2.232$; $p < .05$], and inhabitation [$t_{(250.901)} = 4.387$; $p < .05$], there was a statistically significant difference between students' mean scores for LUSSC.

According to the mother's occupational status, children whose mothers were housewives had lower LUSSC ($M = 6.08$) than children whose mothers were working ($M = 6.85$); therefore, there was a significant difference in favor of children whose mothers were working.

Table 3. Results of independent-samples *t*-test regarding LUSSC

Variables		N	Mean	SD	df	t	p
Gender	Female	174	6.12	2.05	331.675	1.112	.267
	Male	161	6.36	1.78			
Year of kindergarten attendance	1 year	257	6.13	1.90	122.660	−1.725	.087
	2 year	78	6.57	1.99			
Mother's occupational status	Housewife/not working	268	6.08	1.94	108.969	−3.091	.003*
	Working	67	6.85	1.77			
Family structure	Core family	292	6.32	1.84	333	2.232	.026*
	Extended family	43	5.62	2.37			
Inhabitation	Urban area	211	6.58	1.85	250.901	4.387	.000*
	Rural area	124	5.64	1.92			

*There is a significant difference at the level of .05.

According to family structure, children living in core families had higher LUSSC (M = 6.32) than children living in extended families (M = 5.62); therefore, significant difference was in favor of children living in core families.

According to inhabitation, children living in urban areas had higher LUSSC (M = 6.58) than children living in rural areas (M = 5.64); therefore, there was a significant difference in favor of children living urban areas.

One-way ANOVA was performed according to the variables with more than two groups such as the type of school, mother's education level, father's education level, family's income level, father's occupational status, age, and number of sister/brother in order to identify whether there was a statistically significant difference between kindergarten students' mean scores for LUSSC (Table 4).

The results of the variance analysis indicated that the variables, namely: the type of school, mother's education level, father's education level, family's income level, father's occupational status, age, and number of sister/brother, had a significant effect on the kindergarten students' LUSSC, at the importance level of .05. Post hoc test results were used to examine among which groups this differentiation was formed.

According to this, among the students going to private kindergartens (M = 6.80) and state kindergartens class of primary/elementary schools (M = 6.00), there was a significant difference [$F_{(2-332)}$ = 3.736; p < .05] in favor of the students going to private kindergartens.

According to the mother's education level, among children whose mothers graduated from high schools (M = 7.00), children whose mothers graduated from universities (M = 6.98), and children whose mothers graduated from primary schools (M = 5.82), there was a significant difference [$F_{(3-327)}$ = 9.378; p < .05] in favor of children whose mothers graduated from high schools and universities. Among children whose mothers graduated from secondary schools (M = 5.87), children whose mothers graduated from high schools (M = 7.00), and children whose mothers graduated from universities (M = 6.98), there was a significant difference in favor of children whose mothers graduated from high schools and universities.

According to the father's education level, among children whose fathers graduated from primary schools (M = 5.70), children whose fathers graduated from secondary schools (M = 5.96), children whose fathers graduated from high schools (M = 6.12), and children whose fathers graduated from universities (M = 6.98), there was a significant difference [$F_{(3-329)}$ = 6.693; p < .05] in favor of children whose fathers graduated from universities.

Table 4. Results of the ANOVA regarding LUSSC according to different variables

	Source of variance	Sum of squares	df	Mean square	*F*	*p*	Difference
Type of school	Between groups	27.487	2	13.743	3.736	.025	State kindergartens class of primary/elementary schools–private kindergarten (p = .020)
	Within groups	1221.409	332	3.679			
	Total	1248.896	334				
Mother's education level	Between groups	98.331	3	32.777	9.378	.000	Primary school–High school (p = .000)
	Within groups	1142.847	327	3.495			Primary school–University (p = .001)
	Total	1241.178	330				Secondary school–High school (p = .002)
							Secondary school–University (p = .004)
Father's education level	Between groups	71.826	3	23.942	6.693	.000	Primary school–University (p = .001)
	Within groups	1176.955	329	3.577			Secondary school–University (p = .002)
	Total	1248.781	332				High school–University (p = .010)
Family's income level	Between groups	104.434	3	34.811	10.068	.000	0–1000/2000–3000 (p = .001)
	Within groups	1144.461	331	3.458			0–1000/3000-over (p = .000)
	Total	1248.896	334				1000–2000/2000–3000 (p = .012)
							1000–2000/3000-over (p = .001)
Father's occupational status	Between groups	117.477	5	23.495	6.832	.000	Minimum wage–small business owner (p = .010)
	Within groups	1131.419	329	3.439			Minimum wage–teacher (p = .000)
	Total	1248.896	334				Minimum wage/doctor–engineer–police–soldier (p = .027)
							Teacher–farmer and others (p = .001)
Age	Between groups	64.075	2	32.037	8.955	.000	54–60/61–66 (p = .024)
	Within groups	1184.239	331	3.578			54–60/67–72 (p = .000)
	Total	1248.314	333				
Number of sister/brother	Between groups	56.415	3	18.805	5.220	.002	1/3-above (p = .001)
	Within groups	1192.481	331	3.603			
	Total	1248.896	335				

According to the family's income level, among children from families with an income of 2000–3000 TL and 3000-over TL, children from families with an income of 0–1000 TL (M = 5.62), and children from families with an income of 1000–2000 TL (M = 6.01), there was a significant difference [$F_{(3-331)}$ = 10.068; p < .05] in favor of children from families with an income of 2000–3000 TL ($\bar{X}$ = 7.00) and children from families with an income of 3000-over TL (M = 7.06) separately.

According to the father's occupational status, among children whose fathers were small business owners, teachers, doctors, engineers, soldiers, or police, and children whose fathers were minimum wage earners (M = 5.48), there was a significant difference [$F_{(5-329)}$ = 6.832; p < .05] in favor of children

Table 5. *Results of* independent-sample *t-test regarding* SIP

		N	Mean	SD	df	*t*	*p*
Gender	Female	171	3.59	1.51	326.862	.612	.541
	Male	159	3.69	1.49			
Year of kindergarten attendance	1	252	3.55	1.47	122.721	−1.987	.049*
	2	78	3.94	1.56			
Mother's occupational status	Housewife/not working	264	3.51	1.48	99.425	−3.173	.002*
	Working	66	4.16	1.49			
Family structure	Core family	288	3.71	1.52	328	2.332	.020*
	Extended family	42	3.14	1.24			
Inhabitation	Urban area	208	3.88	1.54	328	3.847	.000*
	Rural area	122	3.23	1.34			

*There is a significant difference at the level of.05.

whose fathers were small business owners (M = 6.39), teachers (M = 7.29), and doctors, engineers, soldiers, or police (M = 6.80) separately. In addition, among children whose fathers were teachers and children whose fathers were farmers or other professionals (M = 5.62), there was a significant difference in favor of children whose fathers were teachers (M = 7.29).

According to the ages of the kindergarten students, among the 61–66-month-old students, 67–72-month-old students, and 54–60-month-old students (M = 5.82), there was a significant difference [$F_{(2-331)}$ = 8.955; p < .05] in favor of the 61–66-month-old students (M = 6.78) and 67–72-month-old students (M = 6.68) separately in terms of the mean scores of LUSSC.

According to the number of sister/brother, among the students who had one sister/brother and the students who had three and more sister/brother (M = 5.59), there was a significant difference in favor of the students who had one sister/brother (M = 6.61).

3.3. Evaluating the kindergarten students' levels of understanding SIP according to different variables

We evaluated whether the participating kindergarten students' SIP indicated a statistically significant difference according to demographic variables. For this purpose, independent-samples t-test was used in order to identify whether there was a difference between groups with two variables (gender, mother's occupational status, family structure, inhabitation, and year of kindergarten attendance) in terms of students' SIP, and the results are given in Table 5.

Table 5 indicates that according to gender [$t_{(326.862)}$ = .612; p > .05], there was no statistically significant difference among the students' SIP. However, according to variables such as the year of kindergarten attendance [$t_{(122.721)}$ = −1.987; p < .05], mother's occupational status [$t_{(99.425)}$ = −3.173; p < .05], family structure [$t_{(328)}$ = 2.332; p < .05], and inhabitation [$t_{(328)}$ = 3.847; p < .05], there was a statistically significant difference among the students' SIP. According to the year of kindergarten attendance, children attending kindergarten for two years (M = 3.94) had higher SIP than children attending kindergarten for one year (M = 3.55); therefore, there was a significant difference in favor of children attending kindergarten for two years. According to the mother's occupational status, children whose mothers were housewives (M = 3.51) had lower SIP than children whose mothers were working (M = 4.16); therefore, there was a significant difference in favor of children whose mothers were working. According to the family structure, children living in core families (M = 3.71) had higher SIP than children living in extended families (M = 3.14); therefore, there was a significant difference in favor of children living in core families. On the other hand, according to the inhabitation, children living in urban areas (M = 3.88) had higher SIP than children living in rural areas (M = 3.23); therefore, there was a significant difference in favor of children living in urban areas.

Table 6. Results of ANOVA regarding SIP according to different variables

	Source of variance	Sum of squares	df	Mean square	*F*	*p*	Difference
Type of school	Between groups	22.638	2	11.319	5.120	.006	State kindergartens class of primary/elementary schools–Private kindergarten (p = .035)
	Within groups	722.880	327	2.211			State kindergarten–Private kindergarten (p = .005)
	Total	745.518	329				
Mother's education level	Between groups	50.337	3	16.779	8.041	.000	Primary school–High school (p = .003)
	Within groups	673.993	323	2.087			Primary school–University (p = .000)
	Total	724.330	326				Secondary school–University (p = .015)
Father's education level	Between groups	60.690	3	20.230	9.676	.000	Primary school–University (p = .001)
	Within groups	677.380	324	2.091			Secondary school–High school (p = .011)
	Total	738.070	327				Secondary school–University (p = .000)
Family's income level	Between groups	65.897	3	21.966	10.536	.000	0–1000/2000–3000 (p = .000)
	Within groups	679.621	326	2.085			0–1000/3000-over (p = .003)
	Total	745.518	329				1000–2000/2000–3000 (p = .000)
							1000–2000/3000-over (p = .001)
Father's occupational status	Between groups	48.056	5	9.611	4.465	.001	Minimum wage/teacher (p = .001)
	Within groups	697.462	324	2.153			Small business owner/teacher (p = .006)
	Total	745.518	329				Teacher/farmer and others (p = .045)
Age	Between groups	25.698	2	12.849	5.876	.003	54–60/61–66 (p = .006)
	Within groups	712.801	326	2.187			
	Total	738.498	328				
Number of sister/brother	Between groups	31.122	3	10.374	4.734	.003	None/3-over (p = .039)
	Within groups	714.397	326	2.191			1/3-over (p = .005)
	Total	745.518	329				

On the other hand, one-way ANOVA was performed in order to identify whether there was a difference among groups with more than two variables (type of school, age, mother's education level, father's education level, number of sister/brother, and family's income level) in terms of students' SIP, and the results are given in Table 6.

The results of ANOVA indicated that variables, namely: the type of school, mother's education level, father's education level, family's income level, father's occupational status, age, and number of sister/brother, affected the kindergarten students' SIP. Post hoc test results were used to examine among which groups this differentiation was formed.

According to this, among the students attending private kindergartens, state kindergarten students class of primary/elementary schools (M = 3.59), and students attending state kindergartens (M = 3.46), there was a significant difference [$F_{(2-327)}$ = 5.120; $p < .05$] in favor of the students attending private kindergartens (M = 4.18).

According to the mother's education level, among children whose mothers graduated from high school, children whose mothers graduated from universities, and children whose mothers graduated from primary schools (M = 3.28), there was a significant difference [$F_{(3-323)}$ = 8.041; $p < .05$] in favor of children whose mothers graduated from high schools (M = 4.06) and children whose mothers graduated from universities (M = 4.30) separately. Moreover, among children whose mothers

graduated from universities, and children whose mothers graduated from secondary schools (M = 3.55), there was a significant difference in favor of children whose mothers graduated from universities (M = 4.30).

According to the father's education level, among children whose fathers graduated from universities, children whose fathers graduated from primary schools (M = 3.21), and children whose fathers graduated from secondary schools (M = 3.18), there was a significant difference [$F_{(3-324)}$ = 9.676; p < .05] in favor of children whose fathers graduated from universities (M = 4.22). In addition, among children whose fathers graduated from high schools and children whose fathers graduated from secondary schools (M = 3.18), there was a significant difference in favor of children whose fathers graduated from high schools (M = 3.82).

On the other hand, according to the family's income level, among children from families with an income of 2000–3000 TL and 3000-over TL, children from families with an income of 0–1000 TL (M = 3.32), and children from families with an income of 1000–2000 TL (M = 3.36), there was a significant difference [$F_{(3-326)}$ = 10.536; p < .05] in favor of children from families with an income of 2000–3000 TL (M = 4.44) and children from families with an income of 3000-over TL (M = 4.20) separately.

According to the father's occupational status, among children whose fathers were teachers, children whose fathers were minimum wage earners (M = 3.26), children whose fathers were small business owners (M = 3.50), and children whose fathers were farmers or other professionals (M = 3.45), there was a significant difference [$F_{(5-324)}$ = 4.465; p < .05] in favor of children whose fathers were teachers (M = 4.40).

According to the kindergarten students' age, among the 61–66-month-old students and 54–60-month-old students (M = 3.42), there was a significant difference [$F_{(2-326)}$ = 5.876; p < .05] in favor of 61–66-month-old students (M = 4.34) in terms of the mean scores of SIP.

According to the number of sister/brother, among the students who had no sister, the students who had one sister/brother, and the students who had three and more sister/brother (M = 3.22), there was a significant difference in favor of the students who had no sister/brother (M = 4.00), and the students who had one sister (M = 3.92).

3.4. Predictive power of variables over the kindergarten students' LUSSC

Multiple linear regression analysis was performed in order to identify the predictive power of variables, namely: gender, mother's occupational status, family structure, inhabitation, year of kindergarten attendance, type of school, age, mother's education level, father's education level, father's occupational status, number of sister/brother, and family's income level, over the kindergarten students' LUSSC (see Table 7). The results of the analysis indicated that the said variables altogether presented a significant relation (R = .401; R^2 = .161) with the kindergarten students' LUSSC ($F_{(12-316)}$ = 5.059; p < .01). The said 12 variables altogether explained 16.1% of the difference in the kindergarten students' LUSSC. According to standardized regression coefficients, the relative importance order of predictor variables in terms of LUSSC was as follows: family's income level (β = .307), age (β = .179), mother's occupational status (β = −.130), number of sister/brother (β = −.109), father's education level (β = −.102), inhabitation (β = −.098), mother's education level (β = .082), family structure (β = −.069), father's occupational status (β = −.066), gender (β = −.051), year of kindergarten attendance (β = .043), and type of school (β = .011). The significance tests of regression coefficients indicated that, among the predictor variables, the variables of age (p < .01), family's income level (p < .01), and number of sister/brother (p < .05) were significant predictors for LUSSC.

3.5. Predictive power of variables over the kindergarten students' SIP

Multiple linear regression analysis was performed in order to identify the predictive power of variables such as gender, mother's occupational status, family structure, inhabitation, year of

Table 7. Multiple regression analysis for identifying the predictive power of the variables over LUSSC

Variable	*B*	Standard error	*β*	*t*	*p*	Zero-order *r*	Partial *r*
Constant	6.813	.880		7.739	.000		
Type of school	.030	.150	.011	.200	.841	.135	.011
Age	.370	.110	.179	3.351	.001	.212	.185
Gender	−.196	.203	−.051	−.970	.333	−.067	−.054
Number of sister/brother	−.216	.109	−.109	−1.982	.048	−.198	−.111
Year of kindergarten attendance	.198	.250	.043	.793	.428	.105	.045
Family structure	−.397	.312	−.069	−1.274	.204	−.123	−.071
Inhabitation	−.395	.237	−.098	−1.665	.097	−.230	−.093
Family's income level	.587	.197	.307	2.982	.003	.279	.165
Father's occupational status	−.080	.068	−.066	−1.188	.236	.030	−.067
Mother's occupational status	−.629	.407	−.130	−1.547	.123	.157	−.087
Mother's education level	.146	.198	.082	.737	.462	.253	.041
Father's education level	−.195	.185	−.102	−1.056	.292	.222	−.059

Notes: $R = .401$; $R^2 = .161$.

$F_{(12-316)} = p = .000$.

kindergarten attendance, type of school, age, mother's education level, father's education level, father's occupational status, number of sister/brother, and family's income level, over the kindergarten students' SIP (see Table 8). The results of the analysis indicated that the said variables altogether presented a significant relation ($R = .349$; $R^2 = .122$) with the kindergarten students' SIP ($F_{(12-312)} = 3.597$; $p < .01$). The said 12 variables altogether explained 12.2% of the difference in the kindergarten students' SIP. According to standardized regression coefficients, the relative importance order of predictor variables in terms of SIP is as follows: family structure ($\beta = -.349$), inhabitation ($\beta = -.294$), year of kindergarten students' attendance ($\beta = .257$), mother's occupational status ($\beta = -.244$), number of sister/brother ($\beta = -.184$), mother's education level ($\beta = .136$), age ($\beta = .120$), gender ($\beta = -.108$), father's education level ($\beta = .097$), family's income level ($\beta = .061$), father's occupational status ($\beta = .039$), and type of school ($\beta = -.004$). The significance tests of regression

Table 8. Multiple regression analysis for identifying the predictive power of the variables over SIP

Variable	*B*	Standard error	*β*	*t*	*p*	Zero-order *r*	Partial *r*
Constant	3.670	.694		5.285	.000		
Type of school	−.004	.119	−.002	−.032	.975	.107	−.002
Age	.120	.087	.076	1.389	.166	.124	.078
Gender	−.108	.160	−.036	−.674	.501	−.037	−.038
Number of sister/brother	−.184	.086	−.122	−2.141	.033	−.197	−.120
Year of kindergarten attendance	.257	.196	.073	1.313	.190	.129	.074
Family structure	−.349	.246	−.079	−1.419	.157	−.139	−.080
Inhabitation	−.294	.186	−.096	−1.579	.115	−.217	−.089
Family's income level	.061	.155	.042	.394	.694	.239	.022
Father's occupational status	.039	.053	.042	.742	.459	.104	.042
Mother's occupational status	−.244	.319	−.066	−.764	.445	.165	−.043
Mother's education level	.136	.155	.099	.873	.383	.256	.049
Father's education level	.097	.146	.066	.667	.506	.255	.038

Notes: $R = .349$; $R^2 = .122$.

$F_{(12-312)} = p = .000$.

coefficients indicated that, among the predictor variables, only the number of sister/brother ($p < .05$) was a significant predictor for SIP.

4. Discussion and conclusion

This study identified the kindergarten students' LUSSC and SIP in Kilis sampling in Turkey and compared their LUSSC and SIP according to different variables (some demographic features). In addition, this study identified the predictive power of the said variables over the kindergarten students' LUSSC and SIP.

The study results indicated that the kindergarten students whose mothers worked had better LUSSC and SIP. The kindergarten students' LUSSC and SIP increased as the education level of their parents increased. This situation can be interpreted as an indication that the parents who had increased levels of education helped their children more in their way to success. One of the study's results was that the kindergarten students' LUSSC and SIP increased as their parents' income level increased. In addition, children who lived in core families, who lived in urban areas (city centers), and who went to private kindergartens had better LUSSC and SIP. According to Ginsgburg and Papas (2004), having computers and educational toys at home, being able to get private lessons, and begin able to go to a more qualified school were directly associated with the socioeconomic status and had an impact on increasing academic performance. Private kindergartens use the same curriculum whereas can carry out different activities in Turkey (MNE, 2013). A study by Uyanik-Balat (2011) showed that kindergarten students' science process skills had differences according to the type of kindergartens.

Another study result was that children whose fathers were teachers had better LUSSC and SIP than children whose fathers worked in other professions. Attending the kindergarten for two years and having one sister/brother were also reported in this study as factors that had a positive effect on LUSSC and SIP. Moreover, 61–66 and 67–72-month-old children had better LUSSC and SIP than 54–60-month-old children. This situation was in good agreement with the results of studies by Yesil-Daglı and Jones (2012), which reported that children who went to preschool on time or with delay had better mathematical success than children who went to preschool early. Some studies reported that the young children attending preschool could not exhibit an academic performance as good as the older ones (e.g. Stipek & Byler, 2001; West, Denton, & Germino-Hausken, 2000).

The second question, which this study sought to answer, was how many variables, such as gender, mother's occupational status, family structure, inhabitation, year of kindergarten attendance, type of school, age, mother's education level, father's education level, father's occupational status, number of sister/brother, and family's income level, predicted the kindergarten students' LUSSC and SIP. This study indicated that among the predictor variables, the variables of age, family income level, and number of sister/brother were predictive over LUSSC. It was also found that the number of sister/brother was a significant predictor for SIP. The study by Sackes, Trundle, and Bell (2013) stated that the opportunities of learning science provided in kindergarten were not significant predictors for the development in the performance exhibited by children in science class between the third and eighth grades.

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