Ilkogretim Online - Elementary Education Online, 2020; 19 (4): pp. 2227-2236
http://ilkogretim-online.org.tr
doi:10.17051/ilkonline.2020.763874

Investigation of the relationship between attention skills and science process skills in children regarding external elements[1]

Gülçin Güven, *Marmara University,* Turkey, *gulcinm@marmara.edu.tr* ORCID: 0000-0002-9638-025X
Elif Yılmaz, *Karamanoğlu Mehmetbey University,* Turkey, *elifyilmaz@kmu.edu.tr* ORCID: 0000-0002-1364-6359

Abstract. In this research, it is aimed to examine the relationship between the attention skills of children regarding auditory and visual elements and their science process skills. In addition, these skills were examined in terms of gender and socio-economic level variables. The research is designed in survey model and the study group is consisted of randomly selected 156 children aged 60-72 months attending preschool education institutions in the 2018-2019 academic year in Istanbul. Four data collection tools as Demographic Information Form, Preschool Science Process Skills Scale for 60-72 Months Old Children, Listening Test and Concentration Test for 5-Year-Old Children were used in the research. As the result of the research, it is found a positive significant relationship between the visual and auditory attention skills of the preschool children and science process skills. It was found that the science process skills and auditory attention skills of preschool children did not differ significantly with gender. However, visual attention skills differed with gender of the children and this difference was in favor of the girls. Additionally, attention skills and scientific process skills differed with socio-economic level of the children and this difference was in favor of the upper socio-economic level.

Keywords: Preschool, attention skill, science process skill

Received: 14.08.2019	Accepted: 29.11.2019	Published: 15.09.2020

INTRODUCTION

Scientific process skills which forms the basis of analytical thinking are a lifelong learning process that we use in creating knowledge and problem solving through the principle of learning by doing, (Dönmez & Azizoğlu, 2010; Hazır & Türkmen, 2008; Tan & Temiz, 2003). When the appropriate environment is provided, children carry out their work with a higher motivation in the learning process by testing their thoughts. Therefore, children need scientific process skills to explain, explore, and comprehend the relationships between various variables (Myers, 2006).

Conceptual classifications related to scientific process skills vary. They are classified by Mohd-Saat (2004) as basic skills and high level skills; by Lind (2005) as basic process skills, intermediate process skills and advanced process skills; by Keily, Haney, and Zoffel (2009) as basic process skills and integrated process skills. A comparison between them indicates that basic process skills which include observation, comparison, classification, communication, measurement, estimation and inference can be seen as a common step (Brewer, 2007; Morrison, 2012). In this context, the basic process skills as the skills of observation, classification, measurement and communication, making predictions and inferences are the initial steps of the scientific processes that the preschool children are expected to have (Özkan & Önder, 2016). In a general manner, these skills can be defined as the actions that children take when they learn about the world (Lindblom & White, 2011).

Although each of the scientific process skills expected to have children in the preschool period is considered as independent skills, it can be stated that observation is the precursor of the other skills. Scientific knowledge is also acquired by making observations through senses or materials (Myers, 2006). Lind (1998) states that children, from the moment they born, have learned the scientific concepts by looking at their environment in a curious way, in other words, making observation. The role of attention skill on observation skill of children that they use to investigate their environment, arouses curiosity. Considering that everything is remarkable for

[1] This study was presented at the V. TURKCESS International Congress on Education and Social Sciences, which was held between 27-29 June 2019 at Yildiz Technical University.

young children, it can be said that they use most of the scientific process skills naturally (Morrison, 2012).

Human being is an entity that tries to adapt to her environment, reacts to the events she encounters, perceives stimuli and makes systematic choices among them, and interprets her choices with her own consciousness. The systematic acceptance of stimuli to perceptual consciousness is expressed by the concept of "attention" (Amado, 1996). Like scientific process skills, there are different classifications of attention development and attention skills in the literature. Posner and Petersen (1990) have made a classification as anterior attention and posterior attention, according to the brain areas where the nerve density is higher. Accordingly, anterior attention is related to motor skills and language skills while posterior attention is to visual elements. In addition, according to their relationship with the target there are selective attention, sustained attention and divided attention; according to the transfer of the acquired information to consciousness or short-term memory there are active attention (determined by individual causes and behavior) and passive attention (automatically settled into consciousness) (Pashler, 1998: cited in Doğutepe-Dinçer & Karakaş, 2008).

However the different classifications exist, attention can be defined commonly as being aware of the stimulus. These stimuli can be internal as in thoughts and memories, or external as in images and sounds. While most of the stimuli in the external world are captured by sensory organs, some are perceived selectively. Individuals have limited capacity and cannot deal with all stimuli at the same time (Karaduman, 2004). In this study, listening skills are examined as a separate element in order to test attention skills in terms of sounds in addition to the image. Listening is defined as paying attention to what people say and understanding what they say (Melanlıoğlu, 2012). Listening skills, as expressed in this definition, can be considered as an important indicator of attention. In the research, attention skills related to external elements were limited to visual and auditory ones.

The aim of this research is to examine the relationship between the attention skills of the 60-72-month-old children who have received preschool education and their skills of scientific process. In addition to this general purpose, it is also aimed to examine the visual and auditory attention skills and scientific process skills of preschool children in terms of gender and socio-economic level variables.

METHODS

Research Model

The research was designed in a relational survey model in which the relationship between the attention skills of the 60-72 months old children who received preschool education and their skills of scientific process was examined. Relational studies are models designed to explain and predict the relationship between variables (Christensen, Johnson & Turner, 2015).

Study Group

The study group of the research was consisted of 156 children (85 female, 71 male) who were 60-72 months old and who accepted to participate the research, attending randomly selected three independent kindergartens and four primary schools in 2018-2019 academic year in Kadıköy and Ataşehir districts on the Anatolian side of Istanbul. Demographic characteristics of the study group are presented in Table 1.

Table 1 shows that, 27.6% of the mothers of the children in the study group are primary, 19.2% are secondary and 53.2% are higher education graduates; 27.6% of their fathers are primary, 30.1% are secondary and 42.3% are higher education graduates. 39.8% of the children are single child, 47.4% have one sibling, 12.8% have two or more siblings. Duration of their preschool education distributes as, 52.6% of the students received education for one year, 44.9% for two years, 2.6% for three years and longer. Finally, as stated by the parents of the children in the study group, 9% of the families were at the lower, 68.6% were at the middle and 22.4% were at the upper socio-economic level.

Table 1. *Demographic characteristics of the study group*

Demographic characteristics		n	%
Mother's Level of Education	Primary School	43	27.6
	Secondary School	30	19.2
	High School	83	53.2
Father's Level of Education	Primary School	43	27.6
	Secondary School	47	30.1
	High School	66	42.3
Number of siblings	Single child	62	39.8
	One	74	47.4
	Two and more	20	12.8
Duration of Preschool Education	One Year	82	52.6
	Two Years	70	44.9
	Three Years or More	4	2.6
Socio-Economic Level	Lower	14	9.0
	Middle	107	68.6
	Upper	35	22.4

Data Collection Tools

In the study, four data collection tool is used, as Demographic Information Form, Preschool Scientific Process Skills Scale for 60-72 Months Old Children, Listening Test for measuring their auditory and visual attention skills and Concentration Test for 5 Years Old Children (FTF-K: Frankfurter Tests Für Fünfjahrige-Konzentration).

Demographic Information Form

The demographic information form developed by the researchers provided information on sex, socio-economic level perception, parental education levels, number of siblings, and duration of preschool education of the children in the study group.

Preschool Scientific Process Skills Scale for 60-72 Months Old Children

Preschool Scientific Process Skills Scale for 60-72 Months Old Children, developed by Özkan and Önder (2016), consists of 31 items and four sub-dimensions, as, 1. prediction-inference-scientific communication, 2. measurement, 3. classification and 4. observation. Materials such as leaves, stones, beads, legos, number bars, paper, pieces of wood as well as pictures for graphic creation and observation were used for the scale. The scale is evaluated by applying one to one with the child. Each child receives 1 point for each correct answer and 0 points for the wrong answer. The lowest score that can be obtained from the scale is zero and the highest score is 31.

In the validity-reliability analysis conducted by Özkan and Önder (2016), the scale explained 52.95% of the variance of the four factors identified in the exploratory factor analysis. The Kuder-Richardson 20 coefficients were calculated for reliability; it is observed that the subscales ranged from .75 to .90 and the scale was found to provide test-retest reliability. In this study, reliability coefficients were re-calculated. The reliability coefficients ranged between .73 and .87, while the reliability coefficient for the total score of the scale was found to be .82.

Listening Test (The Map Task)

Listening Test was developed by Doherty-Sneddon and Kent (1996). Its Turkish adaptation was made by Ergin (2004). Listening Test requires drawing the route on a map to the specified locations according to the verbal instructions. The test can score one point for each route and a total of nine points. On the map, there are pictures (lake, birds, house, forest, cows, caravan, sea, ship, tree, hut, etc.) placed in different locations. Children are asked to reach the route dictated by the researchers on the map through listening. Ergin (2004) determined that it provided coverage validity by taking expert opinions for the validity of the test. Test-retest and Cronbach Alpha reliability coefficient (.71) were calculated to determine its reliability. In addition, it was stated

that there should be a meaningful relationship between two tests that measure the same feature within the scope of reliability analyzes. Comparison of the "Listening Test" with "Facial Expression Recognition Test", "Eye Contact Establishment Test", "Emotion Recognition Test" and "Emotion Expression Test" indicated a significant relationship. In this study, Cronbach's alpha reliability coefficient of the test was calculated as .72.

Concentration Test for 5 Years Old Children (FTF-K: Frankfurter Tests Für Fünfjahrige-Konzentration)

It was developed by Raatz and Möhling (1971) to test children's attention skills. In the test, the children are asked to mark the pear pictures from the form containing apple and pear pictures within 90 seconds. The test is applied to each child individually. In the test, the pears marked by the child within 90 seconds constitute the raw score. The test is evaluated by adding the corresponding score from the adjusted score table according to the calendar age and sex of the child to the raw score (Gözalan-Alkan & Koçak, 2018). The validity-reliability analysis of the test was conducted by Gözüm and Kandır (2018) and the form in which the scope and appearance validity of the test was provided by Raatz and Möhling (1971) was used intact. The reliability of the test was performed using the test-retest method and the test-retest reliability coefficient was calculated as .85 at three-week intervals. Since the structural properties of the test were not changed, the validity-reliability analyzes were not repeated in this study.

Data Collection and Analysis

After the research permissions obtained from the Provincial Directorate of National Education, three independent kindergartens and four preschool classes of separate primary schools in Kadıköy and Ataşehir districts on the Anatolian side of Istanbul were visited. Written communication was established with the families of 60-72 months old children with the approval of school administrators and teachers. Parents who accepted their children to participate in the study were asked to complete the demographic information form. A total of 158 forms returned. An empty space / classroom was used in the school for individual assessments with each child. The study group consisted of 156 children. Each child was evaluated on two separate days. The first day the Preschool Scientific Process Skills Scale for 60-72 Months Old Children was applied. Listening Test and Concentration Test for 5 Years Old Children were applied together the next day. After a total of 25-30 minutes of application, the data were recorded in the database.

Statistical package program was used for data analysis. Since the Kolmogorov-Smirnov test showed that the data is not normally distributed, Spearman Correlation Analysis was used to evaluate the data. Predictability could not be tested since the data did not show normal distribution. In this research, children's scientific process skills and attention skills towards external elements are analyzed by using Mann Whitney U Test for sex variable and Kruskal-Wallis H Test for socio-economic level variable.

RESULTS

In this section where the data and findings obtained in the study are presented, firstly, the relationship between the auditory and visual attention skills of children and their scientific process skills is examined and the findings are presented in Table 2.

Table 2 shows that "Measurement" (r = .244), "Classification" (r = .287), "Observation" (r = .408) subscales and total mean scores (r = .280) of Preschool Scientific Process Skills Scale for 60-72 Months Old Children and the Concentration Test for 5 Years Old Children scores that test their visual attention skills have a positively significant relationship (p< .05). However, no significant relationship was found between the "Prediction-Inference-Scientific Communication" subscale mean scores of the Preschool Scientific Process Skills Scale for 60-72 Months Old Children and the mean scores of Concentration Test for 5-Year-Old Children. In addition, A positively significant relationship between the Listening Test mean scores and the "Estimation-Inference-Scientific Communication" (r = .269), "Measurement" (r = .493), "Classification" (r = .518),

"Observation" (r = .403) subscales and total mean scores (r = .547) of the Preschool Scientific Process Skills Scale for 60-72 Months Old Children is found (p< .05).

Table 2. *The results of Spearman Correlation Analysis on the relationship between scientific process skills of preschool children and their attention skills related to external elements*

		Preschool Scientific Process Skills Scale for 60-72 Months Old Children				
		Prediction-Inference-Scientific Communication	Measurement	Classification	Observation	Total score
Concentration Test for 5 Year-Old Children	r	,075	,244	,287	,408	,280
	p	,354	,002*	,000*	,000*	,000*
	n	156	156	156	156	156
Listening Test	r	,269	,493	,518	,403	,547
	p	,001*	,000*	,000*	,000*	,000*
	n	156	156	156	156	156

*p<.05

The analysis of whether the scientific process skills of preschool children differ by sex is presented in Table 3.

Table 3. *Mann Whitney U Test results of children's scientific process skills mean scores by variable of sex*

Subscale	Sex	n	Average of Rows	Total of Rows	U	z	p
Prediction-Inference-Scientific Communication	Female	85	81.91	6962.00	2728.000	-1.039	,299
	Male	71	74.42	5284.00			
Measurement	Female	85	82.64	7024.50	2665.500	-1.291	,197
	Male	71	73.54	5221.50			
Classification	Female	85	79.06	6720.00	2970.000	-.171	,864
	Male	71	77.83	5526.00			
Observation	Female	85	79.48	6756.00	2934.000	-.312	,755
	Male	71	77.32	5490.00			
Total score	Female	85	80.38	6832.00	2858.000	-.569	,570
	Male	71	76.25	5414.00			

According to Table 3, it was found that the subscale and total score averages of the Preschool Scientific Process Skills Scale for 60-72 Months Old Children did not show a significant difference by variable of sex (p> .05).

Table 4 presents the analysis of whether the auditory and visual attention skills of children differ by variable of sex.

Table 4. *Mann Whitney U Test results of children's attention skills related to external elements by variable of sex*

Scale	Sex	n	Average of Rows	Total of Rows	U	z	p
Concentration Test for 5 Year-Old Children	Female	85	90.57	7698.50	1991.500	-3.657	,000*
	Male	71	64.05	4547.50			
Listening Test	Female	85	84.43	7176.50	2513.500	-1.822	,068
	Male	71	71.40	5069.50			

*p<.05

Table 4 shows that the mean scores of the Concentration Test for 5 Years Old Children differ significantly by sex (U = 1991,500, p< .05). Average row score of the girls was 90.57 and the boys was 64.05. Accordingly, it was found that visual attention skills differ significantly in favor of girls. It was found that the Listening Test mean scores did not show significant difference by sex (p> .05).

The analysis of whether the scientific process skills of the children participating in the study differ by the socio-economic level variable is presented in Table 5.

Table 5. *Kruskal Wallis-H Test results of children's scientific process skill score means by the socio-economic level*

Subscale	Groups	n	$\overline{X}_{sira}$	*x*	Sd	p
Prediction-Inference-Scientific Communication	Lower	14	42.46	27.778	2	,000*
	Middle	107	72.98			
	Upper	35	109.79			
Measurement	Lower	14	39.18	37.401	2	,000*
	Middle	107	71.86			
	Upper	35	114.54			
Classification	Lower	14	55.75	32.961	2	,000*
	Middle	107	69.21			
	Upper	35	116.01			
Observation	Lower	14	35.68	35.397	2	,000*
	Middle	107	73.47			
	Upper	35	111.00			
Total score	Lower	14	38.25	51.302	2	,000*
	Middle	107	68.94			
	Upper	35	123.81			

*p<.05

In Table 5, "Estimation-Inference-Scientific Communication" (x^2 = 27,778), "Measurement" (x^2 = 37,401), "Classification" (x^2 = 32,961), "Observation" (x^2 = 35,397) subscales and total mean scores (x^2 = 51,302) of the Preschool Scientific Process Skills Scale of the children participating in the research differed significantly by the socio-economic level variable (sd = 2; p< .05). The paired comparisons made using Mann Whitney U Test in order to determine the meaningful differences indicate a significant difference between the lower and upper socio-economic level as well as between the middle and upper socio-economic level in favor of children at the upper socio-economic level in all subscales. In addition, a significant difference was found between the lower and middle socio-economic level in all subscales except the "Classification" subscale and the total score average between the lower and middle socio-economic level in favor of the children at the middle socio-economic level.

Finally, the analysis of whether the attention skills regarding the external elements, i.e. sound and image, differ by the variable of sex is presented in Table 6.

Table 6. *Results of Kruskal Wallis-H Test of children's attention skills regarding external elements by socio-economic level variable*

Scale	Groups	n	$\overline{X}_{sira}$	*x*	Sd	p
Concentration Test for 5 Year-Old Children	Lower	14	71.75	25.641	2	,000*
	Middle	107	68.28			
	Upper	35	112.46			
Listening Test	Lower	14	62.07	38.410	2	,000*
	Middle	107	67.26			
	Upper	35	119.44			

*p<.05

Table 6 shows that the difference between the mean scores of the socio-economic level variable of the Concentration Test for 5 Years Old Children scores and the raw averages of socio-economic level variable is significant (x^2 = 25,641; sd = 2; p< .05). Similarly, the difference between the average of the children's Listening Test scores and socio-economic level variable is significant (x^2 = 38,410; sd = 2; p< .05). The paired comparisons made using Mann Whitney U Test in order to determine the meaningful differences shows that the auditory and visual attention skills of the children differs significantly for lower and upper socio-economic level children and middle and upper socio-economic level children in favor of children at upper socio-economic level. In addition, no significant difference was found between lower and middle socio-economic levels in both scales.

DISCUSSION and CONCLUSIONS

The findings obtained as a result of the research which examined the relationship between attention skills and scientific process skills of the 60-72 months old children receiving preschool education show a positive significant relationship between their visual attention skills and their measurement, classification, observation subclasses of the scientific process skills. Similarly, there was a positive correlation between auditory attention skills and subclasses of scientific process skills, such as prediction-inference-scientific communication, measurement, classification and observation skills. Nikolaeva (2008) stated that children can establish cause-and-effect relationships by using their scientific process skills and recognize their environment. It can be stated that attention skills related to external elements play an important role for observation skills that come to the fore in the recognition of the environment (Myers, 2006). However, no similar study was found to this research where a significant positive relationship is found between attention skills regarding external elements and scientific process skills. When the literature is examined, it is seen that the objective of the studies on visual attention at first is to evaluate cognitive skills such as information processing speed and recall (Colombo, 2002). Baddeley (1996), Cowan (1993) and Engle (2002) have conducted research on the relationship between attention and memory. However, today, attention is considered to be a brain activity based on the interaction of perceptual, cognitive, and motor behaviors, as opposed to conceptualization of the attention aiming to explain memory or learning processes (Kieling, Roman, Doyle, Hutz, & Rohde, 2006; Spaulding, Plante & Vance, 2008). Programs with such a broad concept of attention aim to support preschool children's various skills such as attention (Gözüm & Kandır, 2019), language (Gözalan & Koçak, 2014), thinking skills (Seçer & Kaymak-Özmen, 2015) and cognitive tempo (Kayılı & Kuşçu, 2018).

In this study, preschool children's scientific process skills and attention skills regarding external elements were examined in terms of sex and socio-economic level variables. As a result of the first analysis, it was found that the scientific process skills of the children did not differ according to the sex variable. The experimental study conducted by Alabay (2013) with preschool children found no significant difference between the average scores of the children in the experimental and control groups for the Science Process Observation Form which includes sex as an independent variable and the scientific process skills (observation, classification, communication, measurement, estimation and total science processes). Similarly, in the study conducted by Akman, Üstün and Güler (2003), no significant difference was found between the sex and the use of scientific processes of six-year-old children attending different preschool education institutions. In addition to the results that support this finding in various studies conducted at primary and secondary school levels (Kulal, Kanlı & Tan, 2010), the studies conducted by Aydınlı (2007), Çakar (2008) and Hazır & Türkmen (2008) found that the scientific process skills scores of girls are higher.

When attention skills regarding external elements are examined by sex; children's auditory attention skills did not show any significant differences by sex, but visual attention skills differed by sex of the children and this difference was in favor of girls. In the study conducted by Karaduman (2004), it was found that attention skills did not differ by sex. Similarly, Kaymak (2003) conducted a study with 2nd and 3rd grade students in primary education and found that

children's attention skills did not show any significant differences by sex. In the study conducted by Pişkin (2015) in order to support the attention skills of 2nd grade students, not any significant difference by sex was found. Therefore, it is seen that the significant difference found in this research in visual attention skills in favor of girls is not supported by the literature.

It was found that the scientific process skills of children differs significantly by the socio-economic level and this difference is in favor of the children at the upper socio-economic level. There is no study that examines the scientific process skills of preschool children in terms of socio-economic level variable. However, in a study conducted by Aydınlı (2007) with 6th, 7th and 8th grade students, it was found that the scientific process skills of children differ in favor of children at the upper socio-economic level. Similarly, in the study conducted by Hazır and Türkmen (2008) with 5th grade students in primary education, as a result of the evaluation based on the socio-economic environment of the schools, it is found that the scientific process skill levels of children in the schools with higher socio-economic level differed significantly from other schools. These results may be interpreted as the opportunities offered to children and the rich stimulating environment is important in terms of scientific process skills.

As the last variable of the study, when attention skills regarding external factors were examined in terms of socio-economic level variable; it is also found that visual and auditory attention skills differed significantly according to socio-economic level variable. As a result of the paired comparisons, it was found that attention skills regarding external elements showed a significant difference in favor of children at upper socio-economic level. Clearfield and Jedd (2012) examined the attention skills of infants in terms of socio-economic level variables in the sixth, ninth and twelfth months. It is found that infants at higher socio-economic level have more attention in general and their attention skills increase when more complex stimuli are presented. While, infants at lower socio-economic level received lower scores from their peers at higher socio-economic level in terms of their attention skills in all three age groups. In a study conducted by Güneş (1997) with elementary school students, similar results were reached and it is found that children with higher socio-economic levels have higher attention levels. Barkley (1995) found that one out of four children in the lower socio-economic regions have attention deficit and stated that it is associated with factors such as malnutrition and inadequate stimulation (Cited in Karaduman, 2004). From this point of view, it is accepted that the stimulus presented to children is related to the income level of the families and that the socio-economic level is an important variable in attention skills.

When the literature is examined, it is seen that scientific process skills for preschool children are mostly handled together with science education (Alabay, 2013; Büyüktaşkapu, Çeliköz & Akman, 2012). However, it is seen that there is limited research on the relationship between scientific process skills and different teaching fields and variables other than science education. In addition, it can be said that research on attention skills in preschool era is limited. Therefore, considering the relationship between various skills and variables and attention skills, intervention programs can be designed to support these skills.

REFERENCES

Akman, B., Üstün, E., & Güler, T. (2003). 6 yaş çocuklarının bilim süreçlerini kullanma yetenekleri. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 24*, 11-14. [Online]: https://dergipark.org.tr/download/article-file/87823 Retrieved: June 12, 2019.

Alabay, E. (2013). SCIENCESTART!™ destekli fen eğitim programının 60-72 aylık çocukların bilimsel süreç becerilerine ve bilimsel tutuma güvenme ve yönelime etkisi. Unpublished dissertation, Selçuk Üniversitesi Sosyal Bilimler Enstitüsü, Konya.

Amado, S. (1996). Farklı dikkat düzeylerinin örtük ve açık bellek üzerindeki etkileri. Unpublished dissertation, Ege Üniversitesi Sosyal Bilimler Enstitüsü, İzmir.

Aydınlı, E. (2007). İlköğretim 6, 7 ve 8. sınıf öğrencilerinin bilimsel süreç becerilerine ilişkin performanslarının değerlendirilmesi. Unpublished M.A. thesis, Gazi Üniversitesi Eğitim Bilimleri Enstitüsü, Ankara.

Baddeley, A. (1996). Exploring the central executive. *The Quarterly Journal of Experimental Psychology Section A, 49*(1), 5-28. Doi: https://doi.org/10.1080/713755608

Brewer, J. A. (2007). Introduction to early childhood education: Preschool through primary grades. Sixth edition. USA: Pearson Education.

Büyüktaşkapu, S., Çeliköz, N., & Akman, B. (2012). Yapılandırmacı bilim eğitimi programı'nın 6 yaş çocuklarının bilimsel süreç becerilerine etkisi. Eğitim ve Bilim, 37(165), 275-292. [Online]: http://egitimvebilim.ted.org.tr/index.php/EB/article/view/1296/428 Retrieved: June 18, 2019.

Christensen, L. B., Johnson, R. B., & Turner, L. A. (2015). Araştırma yöntemleri desen ve analiz. (Trans. Ed. A. Aypay). 2nd Edition. Ankara: Anı Yayıncılık.

Clearfield, M. W., & Jedd, K. E. (2012). The effects of socio-economic status on infant attention. *Infant and Child Development, 22*(1), 53–67. Doi: https://doi.org/10.1002/icd.1770

Colombo, J. (2002). Infant attention grows up: The emergence of a developmental cognitive neuroscience perspective. *Current Directions in Psychological Science, 11*(6), 196–200. Doi: https://doi.org/10.1111/1467-8721.00199

Cowan, N. (1993). Activation, attention, and short-term memory. *Memory & Cognition, 21*(2), 162-167. Doi: https://doi.org/10.3758/BF03202728 [Online]: https://link.springer.com/content/pdf/10.3758%2FBF03202728.pdf Retrieved: June 18, 2019.

Çakar, E. (2008). 5. sınıf fen ve teknoloji programının bilimsel süreç becerileri kazanımlarının gerçekleşme düzeylerinin belirlenmesi. Unpublished M.A. thesis, Süleyman Demirel Üniversitesi Sosyal Bilimler Enstitüsü, Isparta.

Doğutepe-Dinçer, E., & Karakaş, S. (2008). Nöropsikolojik dikkat testleri arasındaki ilişkilerin modellenmesi. *Klinik Psikofarmakoloji Bülteni, 18*(1), 31-40. [Online]: http://www.psikofarmakoloji.org/pdf/18_1_4.pdf Retrieved: June 16, 2019.

Doherty-Sneddon, G., & Kent, G. (1996). Visual signals and the communication abilities of children. *Journal of Child Psychology and Psychiatry, 37*(8), 949-959. doi: https://doi.org/10.1111/j.1469-7610.1996.tb01492.x

Dönmez, F., & Azizoğlu, N. (2010). Meslek liselerindeki öğrencilerin bilimsel süreç beceri düzeylerinin incelenmesi: Balıkesir örneği. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi, 4* (2), 79-109. [Online]: http://www.nef.balikesir.edu.tr/~dergi/makaleler/yayinda/9/EFMED_KME121.doc Retrieved: June 12, 2019

Engle, R. W. (2002). Working memory capacity as executive attention. Current directions in psychological science, 11(1), 19-23. Doi: https://doi.org/10.1111/1467-8721.00160

Ergin, H. (2004). Okul öncesi dönem çocukları için iletişim becerileri ölçeklerinin geçerlik, güvenirlik ve norm çalışması. *Hasan Ali Yücel Eğitim Fakültesi Dergisi, 1*(2), 181-199. [Online]: https://dergipark.org.tr/download/article-file/93001 Retrieved: May 21, 2019.

Gözalan-Alkan, E., & Koçak, N. (2018). Oyun temelli dikkat eğitim programının 5-6 yaş çocukların dikkat toplama beceri düzeylerine etkisinin incelenmesi. *Uluslararası Eğitim Bilimleri ve Öğrenme Teknolojileri Dergisi, 1*(1), 9-15. doi: https://doi.org/10.18493/kmusekad.12328

Gözalan, E., & Koçak, N. (2014). Oyun temelli dikkat eğitim programının 5-6 yaş çocukların kelime bilgi düzeylerine etkisinin incelenmesi. *Karamanoğlu Mehmetbey Üniversitesi Sosyal ve Ekonomik Araştırmalar Dergisi, 16*(11), 115-121. [Online]: https://dergipark.org.tr/download/article-file/107175 Retrieved: June 15, 2019.

Gözüm, A. İ. C., & Kandır, A. (2018). Beş yaş çocuklar için Frankfurter Konsantrasyon Testi'nin (Frankfurter Test für Funjahrige Konzentration FTF-K) güvenirlik çalışması, in (Ed. S. Dinçer) Değişen Dünyada Eğitim, (s. 57-66) Ankara: Pegem Akademi Yayıncılık. doi: http://dx.doi.org/10.14527/9786052412480.04

Gözüm, A. İ. C., & Kandır, A. (2019). Attention skill development program's effects on children in terms of attention skill acquisition during preschool term. *Pegem Eğitim ve Öğretim Dergisi, 9*(2) 547-584. Doi: https://doi.org/10.14527/pegegog.2019.018

Güneş, M. (1997). İlkokul öğrencilerinin okuma düzeyleri ve dikkat özelliklerinin bazı değişkenler açısından İncelenmesi (Ankara ilinde bir araştırma). Unpublished M.A. thesis, Gazi Üniversitesi Sosyal Bilimler Enstitüsü, Ankara.

Hazır, A., & Türkmen, L. (2008). İlköğretim 5. sınıf öğrencilerinin bilimsel süreç beceri düzeyleri. *Selçuk Üniversitesi Ahmet Keleşoğlu Eğitim Fakültesi Dergisi, 26*, 81-96. [Online]: https://docplayer.biz.tr/258779-Ilkogretim-5-sinif-ogrencilerinin-bilimsel-surec-beceri-duzeyleri.html Retrieved: June 12, 2019.

Karaduman, B. D. (2004). Dikkat toplama eğitim programının ilköğretim 4. ve 5. sınıf öğrencilerinin dikkat toplama düzeyi, benlik algısı ve başarı düzeylerine etkisi. Unpublished dissertation, Ankara Üniversitesi Eğitim Bilimleri Enstitüsü, Ankara.

Kayılı, G., & Kuşçu, Ö. (2018). The effects of Orff-based attention-enhancing music education programme on impulsive preschool children's cognitive tempo. *Early Child Development and Care*, 1-10. Doi: https://doi.org/10.1080/03004430.2018.1475367

Kaymak, S. (2003). Dikkat toplama eğitimi programının ilköğretim 2. ve 3. sınıf öğrencilerinin dikkat toplama becerilerinin geliştirilmesine etkisi. Unpublished dissertation, Ankara Üniversitesi Sosyal Bilimler Enstitüsü, Ankara.

Keil, C., Haney, J., & Zoffel, J. (2009). Improvements in student achievement and science process skills using environmental health science problem-based learning curricula. *Electronic Journal of Science Education, 13*(1), 1-18. [Online]: http://ejse.southwestern.edu/article/view/7782 Retrieved: June 15, 2019.

Kieling, C., Roman, T., Doyle, A. E., Hutz, M. H. ve Rohde, L. A. (2006). Association between DRD4 gene and performance of children with ADHD in a test of sustained attention. *Biological Psychiatry, 60*(10), 1163-1165. Doi: https://doi.org/10.1016/j.biopsych.2006.04.027

Kulal, G., Kanlı, U., & Tan. M. (2010). 9. 10. ve 11. sınıf öğrencilerinin okul öncesi eğitim alma durumları ile bilimsel süreç becerileri arasındaki ilişki. IX. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi Özet Kitapçığı, Dokuz Eylül Üniversitesi Buca Eğitim Fakültesi, İzmir.

Lind, K. K. (1998). Science in early childhood: Developing and acquiring fundemental concepts and skills. Paper Presented at the Forum Early Childhood Science, Mathematics and Technology Education. Washigton, DC, February 6-8. [Online]: https://files.eric.ed.gov/fulltext/ED418777.pdf Retrieved: June 15, 2019.

Lindblom, S., & White, M. (2011). Let's explore science. Arkansas Department of Human Services Division of Child Care and Early Childhood Education. Arkansas Children's Week, April, 10-16. [Online]: http://asuchildhoodservices.org/docs/Lets_Explore_Science_2011.pdf Retrieved: June 15, 2019.

Melanlıoğlu, D. (2012). Dinleme becerisinin geliştirilmesinde ailenin rolü. *Sosyal Politika Çalışmaları, 12*(7), 65-77. [Online]: https://dergipark.org.tr/download/article-file/197918 Retrieved: June 12, 2019.

Mohd-Saat, R. (2004). The acquisition of integrated science process skills in a web-based learning environment. *Research in Science & Technological Education, 22*(1), 23-40. Doi: https://doi.org/10.1080/0263514042000187520

Morrison, K. (2012). Integrate science and arts process skills in the early childhood curriculum. *Dimensions of Early Childhood, 40*(1), 31-38. [Online]: http://www.imagineeducation.com.au/files/CHCECE018022/7.pdf Retrieved: June 16, 2019.

Myers, S.P. (2006). A personal study of science process skills in a general physics classroom. Degree of Masters, Natural Sciences/Environmental Education, Hamline University, Minnesota.

Nikolaeva, S. N. (2008). The ecological education of preschool children. *Russian Education & Society, 50*(3), 64-72. Doi: https://doi.org/10.2753/RES1060-9393500306

Özkan, B., & Önder, A. (2016). 60-72 aylık çocuklar için bilimsel süreç becerileri ölçeğinin geçerlik güvenirlik çalışması. *Uluslararası Eğitim Bilimleri Dergisi, 3*(8), 214-223. doi: http://dx.doi.org/10.16991/INESJOURNAL.279

Pişkin, A. (2015). Dikkat toplama eğitimi programının ilkokul 2. sınıf öğrencilerinin dikkat toplama becerilerinin gelişimine etkisi. Unpublished M.A. thesis, Erciyes Üniversitesi Eğitim Bilimleri Enstitüsü, Kayseri.

Posner, M. I., & Petersen, S. E. (1990). The attention system of the human brain. *Annual Review of Neuroscience, 13*(1), 25–42. doi:10.1146/annurev.ne.13.030190.0003

Raatz, U., & Möhling, R. (1971). Frankfurter Tests für Fünfjährige-Konzentration: FTF-K. Weinheim: Beltz.

Seçer, Z., & Kaymak-Özmen, S. (2015). Dikkat toplamayı geliştirici etkinliklerin içtepisel okul öncesi çocukların düşünme ve dikkat toplama becerilerine etkisi. *Kastamonu Eğitim Dergisi, 23*(4), 1803-1816. [Online]: https://dergipark.org.tr/download/article-file/209808 Retrieved: June 12, 2019.

Spaulding, T. J., Plante, E., & Vance, R. (2008). Sustained selective attention skills of preschool children with specific language impairment: Evidence for separate attentional capacities. *Journal of Speech, Language, and Hearing Research, 51*(1), 16-34. Doi: https://doi.org/10.1044/1092-4388(2008/002)

Tan, M., & Temiz, M.K. (2003). Fen öğretiminde bilimsel süreç becerilerinin yeri ve önemi. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi, 1*(13), 89-101. [Online]: https://dergipark.org.tr/pauefd/issue/11130/133117 Retrieved: June 12, 2019.