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Examining the Science Process Skills of Preschoolers with Regards To Teachers' and Children' Variables *

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Abstract

The aim of this research is defining whether the science skills preschool children who are receiving early childhood education differ from children's age, gender, school type, status of getting early childhood education before and its duration, their parents' educational level, teacher's duration of implementing science activity, their period of service, department of graduation. The sample of the research contains 250 children and 50 early childhood educators in these children's classroom. In this study, Science Observation Form and Personal Information Form are used as data collection tool. The collected data was analyzed with SPSS 16.0 package program. It was reached that while the independent variables which are children's age, school type, status of getting early childhood education before are determinant of children's science skills, the children's gender, teacher's duration of implementing science activity and their period of service are not determinant of children's science skills.

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Introduction

Children in early years engage in many formal and informal scientific experiences. While science education in pre-school period is conducted within a certain program according to children's curiosities and experiences, students also engage in many scientific activities in daily life and learn certain scientific contents. Eliason and Jenkins (2003) accept science as part of everyday life and state that it should be associated with real life through integration of daily life into curriculum. Driver and Bell (1986) exemplified the association of science with daily life with the following example: by putting the blocks on the top of the other, the child watches as the blocks gradually progress and also has the opportunity to observe the motion of the blocks on the ground through this real life experience. Most of the children like experiencing in nature, collecting stones, and finding worms by digging the soil. By observing their environment actively, kids perform basic comprehensions by observing their environment and engaging in experiences (Trundle, 2010). Informal learning which is triggered by natural learning experiences in children is generally initiated by an adult. The role of the adult in informal learning is to offer an interesting and rich environment to the child. The environment should have things which can be touched, tasted, heard, smelt, and observed by the child while the adult is

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there monitoring the child (Charlesworth & Lind, 2010; Ünal & Akman, 2006). In this sense, the importance and role of teachers for science activities in pre-school education institutions cannot be ignored in early childhood period. The teachers' attitudes, beliefs, and knowledge about science have an influence on their approach to scientific activities (Faulkner-Schneider, 2005). Teachers are determiners for what children know and are interested in (Gilson & Cherry, 2004). In the activities, the teacher should place the child, instead of himself or concepts, at the center of the activities. Akman (2010) states that the interests of pre-school children in science change depending on their ages. Therefore, a teacher should take into account the ages of children while planning an activity. For instance, the teacher should base the activities on more concrete events and concepts with preoperational period children. In addition, he should encourage their active participation in the activities. Thus, he will be able to improve children's interests and eagerness about science as well as their learning.

Science activities in pre-school period should support children's curiosity, enable them to engage in natural research and examination, and let them ask questions and know their environment (Landry & Foreman, 2001; Cho, Kim, & Choi, 2003; Ünal & Akman, 2006; Trundle, 2015).

Science education, which is formally given for the first time in pre-school period, improves children's scientific process skills (observation, classification, communication, measurement, and comparison), and makes them acquire affective and psychomotor skills, helps them understand their selves and environment, enhances their independent thinking skills, equips them with curiosity, open-mindedness, truthfulness, determination, perseverance, and skepticism, progresses their hypothesizing skills, enables them to discover problems, helps them to have a democratic personality, makes them understand that the earth is worth to analyze, research, and learn, and develops positive attitudes and motivation towards science (Akman, Üstün, & Güler, 2003; Murpy & Smith; 2014; Conzeio & French, 2002; Saçkes, Akman, & Trundle, 2012; Aktaş Arnas, 2002).

The acquisition of science process skills in early childhood is critical; This study examined according to the variety, the kindergarten is located in Ankara, special kindergartens, Ministry of Education and the independent and dependent children who attend pre-school children to institutions is limited to the points of Science Process Observation Form.

The literature review of research done previously made; teachers / teachers of science and nature proficiency in activities, attitudes and determine their beliefs, scientific process skills imparted in preschool to determine the effects on science achievement in children's later stages, the actions of the gain scientific process skills of or home environment, pre-school education, or an applied science education program it was found to be research oriented to the effectiveness on children (Afacan & Selimhocaoğlu, 2012; Ayvacı, Devecioğlu, & Yigit, 2002; Büyüktaşkapu, Çeliköz, & Akman, 2012; Cho et al., 2003; Ekinci Vural & Hamurcu, 2008; Erden & Sönmez, 2011; Garbett, 2003; Kıldan & Pektaş, 2009; Melhuis et al., 2008; Olgan, Güner Alpaslan, & Öztekin, 2014; Olgan, 2015; Özbey & Alisinanoğlu, 2009; Saçkes, 2014; Sarıtaş, 2010; Sönmez, 2007; Ünal & Akman, 2006).

This research is the factors thought to be related to both teacher (science activity duration, length of service) is important to have a study that evaluated both located in class with the children and the teachers. the work has been previously seen to contain results for more teachers and student teachers. In the study of children's science process skills this is the first study conducted in this regard with the evaluation factors can be considered both for the child due to the teacher. Research; the acquisition of science process skills in early childhood is critical; age, sex, receiving pre-school education level, type of school children continued, while science activities and teachers' length of service is done by the

teachers, with the aim to determine the relationship between variables. To achieve this objective in the study sought to answer the following research questions:

1. Science process skills of children in pre-school age, gender, pre-school education before receiving state, is it being differentiated by the type of pre-school education institutions continue?
2. Science process skills of children in pre-school, pre-school teacher and the duration of the effectiveness of science Does the professional services differentiated according to time?

Method

Research Design

Survey method was employed in this study. The data of the study were collected from the teachers and children via demographic data form developed by the researchers and the Science Observation Form whose language, scope, and construct validity was also examined by the researchers.

Study Group

Study group is comprised of 50 teachers, selected via convenience sampling, and 250 children, selected via random sampling, from 6 nursery classes affiliated with primary schools, 5 official kindergartens, 4 private kindergartens, and 5 kindergartens of specific institutions, which makes a total of 20 pre-school education institutions. These institutions are located in the district centers of Ankara province. 19.6% of the children are 4 years old; 57.6% are 5 years old; and 22.8% are 5.5 years old. 52.4% of the children are females while 47.6% are males. 20% of the children attend nursery classes; 32% attend official kindergartens affiliated with MoNE; 26% attend private kindergartens; and 22% attend kindergartens of specific institutions. 60.8% of the children have received pre-school education previously while 39.2% have not.

Of the teachers constituting the study group, 22% work in nursery classes; 32% work in official kindergartens; 26% work in private kindergartens; and 20% work in kindergartens of specific institutions. 52% of the teachers have less than ten years of experience while 48% have more than ten years of experience. 24% of the teachers perform science activities once a week; 68% perform twice a week; and 8% perform three times a week.

Data Collection Tool

"Science Observation Form" was employed to reveal children's scientific process skills. Science Observation Form is comprised of 3 sub-dimensions (Science Check List, Problem Solving Check List, and Scientific Attitude Observation Inventory) and 22 items. It is a three-point Likert-type scale (always, sometimes, never).

The language, scope and construct validity of the scale was examined by the researchers based on expert academicians' view. Cronbach's alpha coefficient and split half correlation were calculated and found 0.93 and 0.87 respectively. For the construct validity of the scale, the practices conducted over 370 pre-school children were analyzed. Whether the three-factor construct of the original scale was confirmed by the data collected from 48 to 66 months old children in the Turkish culture was checked by confirmatory factor analysis (CFA). According to the CFA results, chi-square value calculated for model-data fit was significant (X^2=1784.35; $p<0.01$). Some fit statistics calculated via the same analysis are as follows: RMSEA=0.04, RMR=0.02, StRMR=0.03, GFI=0.95, AGFI=0.94, CFI=0.98, and NFI=0.97. Taking the analysis results into account, it is possible to say that the Turkish version of Science Observation Form has a three-factor construct just like its original version.

In addition, the t values concerning the differences between the item scores obtained from the bottom and top 27% groups, which were determined based on the total scores, were examined to analyze item validity (discrimination). The items whose t values were high and significant at 0.01 level were included in the scale. At the end of the analysis, it was seen that the t values concerning the differences between the item scores obtained from the bottom and top 27% groups, which were determined based on the total scores, were significant at .001 level. The t values obtained from this test

change within the range of 4.91 to 10.07. Moreover, the t test results between bottom and top groups yielding significant results at .00 level for all items is an evidence of the internal consistency of the scale.

In addition, Participant Information Form was prepared by the researchers to collect demographic data from children and teachers. The forms were distributed to willing teachers and parents, who consented participating in the study, with an explanation specifying the purpose and importance of the study.

Data Collection Process

Hacettepe University Senate Ethics Commission was consulted for the purpose of examining the research in line with the ethical principles and rules before proceeding to the data collection phase of the research. After the application approval from Hacettepe University Senate Ethics Committee, the schools which have received permission from the Ministry of National Education and volunteered to participate in the research have been determined. In these schools, interviews were made with 250 children selected by appropriate sampling method and 50 teachers, working in the classes of these children, before the research applications, day and hour when the teachers were suitable. Teachers were introduced to the teachers' scale after giving information about the objectives and importance of research. The study also involved researchers in the role of the teacher is to scale practice before each item is explained in detail. In each classroom, five children were selected from the families who filled the form and gave the permission of their children' attendance to the study. Children's science process skills; Located within the triple-point Likert scale was evaluated by teachers substances. Also fill in the information form with all teachers and science activities while the service time per week they were asked.

Data Analysis

The normality of distribution and the homogeneity of variance (i.e. parametric test assumptions) were statistically tested for the data that were obtained from the Science Observation Form, which were employed to measure participant children's scientific process skills. Whether the data obtained from the groups had a normal distribution or not was tested based on the coefficients of skewness and kurtosis and "Kolmogorov-Smirnov test" while the homogeneity of variance was checked via "Levene's Test of Equality of Error Variances". Graphics were also examined to test normality.

Since the p values based on the results obtained from Kolmogorov-Smirnov and Levene's tests were lower than 0.05, it is possible to say that the distribution of the data was not normal, and the variances were not homogeneous.

"Kruskal Wallis H-test", which is a non-parametric test and tests whether more than two unrelated sample means significantly differ from one another, was used to see whether age, pre-school institution attended, the duration of science activities, and teacher's service period were influential on the scores children got from the Science Observation Form. In addition, Mann Whitney U test was employed to reveal whether gender and attending pre-school education previously were influential on the scores children got from the Science Observation Form. Data analysis was performed via SPSS 16.0 package. To check Type I error in data analysis, Bonferroni correction was made. Type I error: may be 0.05 or 0.01. keeping 0.05 level means to make 95% confidence decision. Bonferroni correction is determined through the formula of significance level/the number of groups (Vialatte & Cichocki, 2008). In addition, the r = z score / √n formula was used to calculate the magnitude of the effect of the Mann Whitney U test (Pallant, 2011). Mann-Whitney U test was used for the post-hoc test among the groups with significant difference after the Kruskal-Wallis test.

Results

The scientific process of the children of the study; Sex, age, ongoing school type, and attendance to the pre-school education institution were found in Tables 1, 2, 3 and 4; Findings regarding the variables of teachers' science activity duration and service duration are given in Table 5 and Table 6.

Table 1. Mann-Whitney-U Test Results Concerning the Children's Mean Scores Obtained from the Science Observation Form by Gender

	Gender	*n*	*Mean rank*	*Rank sum*	*U*	*p*
Scientific Process	Kız	131	129,75	16997,50	7237,50	0,34
Skills	Erkek	119	120,82	14377,50		

p<0,025

Table 1 shows that the children's mean scores obtained from the Science Observation Form (U=7237.50; p>0.025) do not show a significant difference by gender. This indicates that gender is not a significant variable having an influence on scientific process skills in pre-school period.

Table 2. Findings Regarding Whether Children's Mean Scores Obtained from the Science Observation Form Differ by Age

	Age	*n*	*Mean rank*	*Sd*	χ^2	*p*	*Significant difference*	*Effect Size (r)*
Scientific	Age 4	49	99,13	2	12,063	0,001*	1-2	r(1-2)=0,15
Process	Age 5	144	125,63				1-3, 2-3	r(1-3)=0,33
Skills	Age 5,5	57	147,85					r(2-3)=0,13

* p<0,016

Table 2 shows that children's mean scores obtained from the Science Observation Form (X2 (2)=12.063; p<0.016) significantly differ by gender. This indicates that children's ages are an important variable having an influence on scientific process skills in pre-school period. Based on the mean ranks of the groups, it can be said that the highest mean belongs to the children aged 5.5. Mann-Whitney U test was performed to see which groups are different from each other, thereby finding the source of the difference. The results indicated that the children aged 5 had higher mean scores that the children aged 4, and the children aged 5.5 had higher mean scores than the children aged 4 and 5.

Table 3. Kruskal-Wallis H-test Results Concerning the Children's Mean Scores Obtained from the Science Observation Form by the Type of School Attended

	Type of school	*n*	*Mean Rank*	*Sd*	χ^2	*p*	*Significant difference*	*Effect Size (r)*
Scientific Process Skills	MoNE affiliated nursery class	50	132,11	3	23,99	0,001*	1-2	r(1-2)=0,24
	MoNE affiliated Kindergarten	80	95,67				2-3, 2-4	r(2-3)=0,25
	Private Pre-Kindergarten	65	132,09					r(2-4)=0,40
	Kindergarten of a Specific Institution	55	155,09					

* p<0,012

Table 3 shows that the children's mean scores obtained from the Science Observation Form (X2 (3)=29.99; p<0.012) (X2 (3)=30.26; p<0.012) significantly differ by the type of school attended. This indicates that the type of school children attend is an important variable having an influence on scientific process skills in pre-school period. Mann-Whitney U test was performed to see which groups are different from each other, thereby finding the source of difference. The results indicated that the children attending the kindergartens of specific institutions got higher mean scores from the Science Observation Form compared to the children attending nursery classes of primary schools affiliated with MoNE, private kindergartens, and independent kindergartens affiliated with MoNE.

Table 4. Mann Whitney U-test Results of Children's Perceptions of Pre-School Education Levels of Obtained Point Scores of Science Process Observation Forms

	PPSEDB	*n*	*Mean rank*	*Rank sum*	*U*	*p*	*Effect Size (r)*
Scientific Process Skills	Yes	152	143,73	21847,00	4677,00	0,001*	r=0,31
	No	98	97,22	9528,00			

* p<0,012 PPSEDB: Previous pre-school education backgrounds

Table 4 shows that the children's mean scores obtained from the Science Observation Form (U=4677; p<0.025) significantly differ by previous pre-school education background. This indicates that previous pre-school education background is an important variable having an influence on scientific process skills in pre-school period. Based on the mean ranks of the groups, it can be said that the children who had received pre-school education previously had higher scores than those who did not.

Table 5. Kruskal-Wallis H-test Results Concerning the Children's Mean Scores Obtained from the Science Observation Form by the Duration of Scientific Activities Provided by Teacher

Science activity duration provided by teacher	*n*	*Mean rank*	*Sd*	χ^2	*p*
Once a week	60	118,25	2	1,17	0,56
Twice a week	170	128,88			
Three or more times a week	20	118,52			

p<0,016

Table 5 shows that the children's mean scores obtained from the Science Observation Form do not show a significant difference by the duration of science activities provided by teacher. This indicates that the duration of the science activities provided by teachers is not a significant variable having an influence on scientific process skills in pre-school period.

Table 6. Kruskal-Wallis H-test Results Concerning the Children's Mean Scores Obtained from the Science Observation Form by the Service Period of Teacher

	Service period	*n*	*Mean rank*	*Rank sum*	*U*	*p*
Scientific	10 years and less than 10 years	26	120,83	15707,50	7192,50	0,28
Process Skills	More than 10 years	24	130,56	15667,50		

p<0,025

Table 6 shows that the children's mean scores obtained from the Science Observation Form (U=7192.50; p>0.025) do not show a significant difference by teacher's service period.

Discussion and Conclusion

This study deals with the scientific process skills of preschool children attending pre-school education and their analysis in relation to various variables. According to the research findings, children's scientific process skills have statistically significant relationships with the variables of age, the type of school attended, and previous pre-school education background whereas there is no statistically significant relationship between their scientific process skills and gender, the duration of scientific activities provided by teacher, and service period of teacher.

According to Piaget, who emphasizes the importance of age factor in cognitive development and considers learning as an age-dependent process, every learning period should involve the acquisitions of previous periods and children's cognitive development should go on in this way (Hudson, 2011). The research findings are consistent with the findings of Şimşek and Tezcan (2008) and Olkun, Fidan, and Babacan Özer (2013). This finding suggests that children's scientific process skills increase with age The present study deals with scientific process skills of preschool The results of this study also indicate that children's scientific process skills differ by age. It is possible to say that age is an important factor influential on the quality and quantity of the scientific knowledge acquired by children.

Ramazan and Demir (2011) analyzed cognitive development levels of kids aged 36 to 48 months. They revealed that there is no significant difference between children's cognitive development levels by gender. Gibson and Chase (2002), and Saunders, Cavallo, and Abraham (2000) studied the relationship between students' epistemological beliefs towards science, learning experience types, and gender. It was seen that there are no significant differences between students' epistemological beliefs towards science and gender. Literature review and the results of the present study indicate that children's scientific process skills and interests in engaging in scientific activities and activities having a scientific content are not influenced by gender.

That children attending the kindergartens of specific institutions have higher scientific process skills compared to the children attending other types of schools, which is one of the results of this study, may be because the period these children receive pre-school education is longer; the physical environment of the kindergartens of specific institutions is advantageous (i.e. generally they are located on larger areas and are richer in material); teachers perform more effective activities to contribute to children's scientific process. Akman et al. (2003) conducted a study to reveal to what extent children aged 6 use their scientific process skills. He revealed a significant difference between children's scientific process skills and the type of school attended. It was also determined that this difference is on behalf of the kindergartens of specific institutions.

Yazıcı (2002) analyzed the difference between children aged 6 in terms of school maturity on the basis of receiving pre-school education or not. It was seen that pre-school education has an influence on school maturity, and children who have received pre-school education have higher scores than those who have not. Barnett (2008) states that pre-school education curricula have positive influences on children's development and learning. He added that a well-designed pre-school education curriculum promotes future academic achievement. Guo, Piasta, and Bowles (2015) evaluated the scientific

knowledge of children both in fall and in spring terms. They revealed that children acquire a great deal of scientific information throughout the year in pre-school education period. The results of previous studies are consistent with another result of this study indicating that the scientific process skills of children who have previously received pre-school education are higher than those who have not.

Another result of this study is that there is no relationship between children's scientific process skills and teachers' professional service period and the duration of scientific activities provided by them. Study results suggest that pre-school teachers have certain problems in planning and practicing science activities, are not able to develop authentic materials, and have no idea of which methods and techniques they are to use while teaching the activities (Ayvacı et al., 2002; Özbey, 2006). Afacan and Selimhocaoğlu (2012) and Özbey (2006) conducted studies on pre-school teachers' competencies regarding science education and analyzed these competencies according to certain variables. They revealed that there is no significant relationship between pre-school teachers' service periods and science competencies. The results obtained in this study are consistent with the results of the previous studies. That pre-school teachers feel incompetent about science education and do not know how to teach abstract science concepts to children prevent them from creating an effective science activity. Thus, even if science activity duration and service period change, activities may be inefficient since appropriate methods and techniques are not employed for these activities; they are not associated with the daily life; and children are not encouraged to actively participate in learning by doing process, preventing children from developing scientific process skills.

Suggestions

In our country can be considered as yet caused determined in preschool education national standards and be differentiated according to the scientific process, type of institution they attend the skills of children and lack of program partnership and to make efforts to eliminate the differentiation resulting from these factors is important. How to participate in in-service training and seminars for teachers of science should be given in pre-school education, the interests and needs of children are recommended to take into account when planning for science activities. Research has found that children in pre-school education is higher than the scientific process skills. These findings by starting from the families of children must submit their pre-school education institutions should be provided, as well as the activities of teachers and parents should allow their learning through experiences of children will relate to real life, children, to give the opportunity to make observations in different areas should be provided.

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