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# Examination of the Executive Function Skills of 5-Year-Old Children Receiving Pre-School Education According to Some Variables

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## Abstract

*The aim of this study is to examine the executive function skills of 5-year-old children receiving pre-school education in terms of gender, duration of pre-school education, parental education and age status, maternal employment status, children's digital game playing status and digital game playing frequency variables. The study was carried out through the descriptive survey model, which is among the quantitative research methods, and the convenience sampling method, which is among the non-random sampling methods. The population of the study consists of 5-year-old children receiving pre-school education and the sample group consists of 332 children in the 5-year-old group who attend independent kindergartens affiliated to the Ministry of National Education in Ağrı and who are allowed by their parents to participate in the research. 'The Childhood Executive Function Inventory (CHEXI)-Teacher Form' and the Child Information Form prepared by the researchers were used within the context of the study. As a result of the study, no significant difference was found in CHEXI-Teacher Form scores in terms of the variables of duration of preschool education, parent education and age status, and maternal employment status. However, it was observed that CHEXI-Teacher Form scores were significantly higher for boys compared to girls, for children who play digital games compared to those who do not, and for children who play digital games more than once a day compared to children who play less frequently.*

**Keywords:** *Executive Functions, Pre-School, Digital Game, Game.*

## Öz

*Bu çalışmanın amacı, okul öncesi eğitim alan 5 yaş grubu çocukların yürütücü işlev becerilerinin cinsiyet, okul öncesi eğitime devam etme süresi, anne-baba eğitim ve yaş durumu, anne çalışma durumu, çocukların dijital oyun oynama durumu ve dijital oyun oynama sıklığı değişkenleri açısından incelenmesidir. Çalışma nicel araştırma yöntemlerinden betimsel tarama modeli ve seçkisiz olmayan örnekleme yöntemlerinden uygun örnekleme yöntemiyle yürütülmüştür. Çalışmanın evrenini 5 yaş grubu okul öncesi eğitimi alan çocuklar oluşturmakla birlikte örneklemi, Ağrı ili MEB'e bağlı resmi bağımsız anaokullarına devam eden ve ebeveynleri tarafından araştırmaya katılımına izin verilen 5 yaş grubu 332 çocuk oluşturmaktadır. Çalışma kapsamında 'Çocukluk Dönemi Yürütücü İşlevler Envanteri (ÇDYİE)-Öğretmen Formu' ve araştırmacılar tarafından hazırlanmış olan Çocuk Bilgi Formu kullanılmıştır. Çalışmanın sonucunda Çocukluk Dönemi Yürütücü İşlevler Envanteri (ÇDYİE)-Öğretmen Formu puanlarında okul öncesi eğitime devam etme süresi, anne-baba eğitim ve yaş durumu, anne çalışma durumu değişkenlerine göre anlamlı farklılık bulunmamıştır. Bununla birlikte erkek çocukların kız çocuklarına göre, dijital oyun oyanayan çocukların oynamayanlara göre ve günde bir kereden fazla dijital oyun oynayan çocukların daha az sıklıkta oynayan çocuklara göre Çocukluk Dönemi Yürütücü İşlevler Envanteri (ÇDYİE)-Öğretmen Formu puanlarının anlamlı derecede yüksek olduğu görülmüştür.*

**Anahtar Kelimeler**: *Yürütücü Işlevler, Okul Öncesi, Dijital Oyun, Oyun.*

**Introduction**

The pre-school period, which covers the first six years of life from the birth, is a period in which development and growth are effective and rapid as well as interaction with the environment occurs at most. In the preschool period, children develop their skills by gaining basic habits, socialize by gaining different experiences, and improve their cognitive skills (Barnett, 1992; Oktay, 2010).

Executive function skills, which are also expressed as cognitive skills in the preschool period, are skills that are associated with many developmental areas and their development is important. The first five years have a critical importance in the development of cognitive skills. Besides, the fastest growing age group is stated as 5-8 years old (Barkley & Murphy, 2010; Garon et al., 2008; Taş & Deniz, 2018). Within this context, this study was carried out with 5 years old children in the preschool period who are in the critical age group in order to support the development of executive function skills which are also expressed as cognitive skills (Best & Millor, 2010; Dawson & Guare, 2010; Diamond, 2002; Karakaş & Karakaş, 2000).

Executive functions are cognitive skills which prevent stimuli that are not suitable for the purpose in order to plan thoughts and behaviors in accordance with the purpose and to maintain these plans. These cognitive skills allow keeping the processed information active, directing attention, and shifting between information (Diamond, 2002).

Comprising sub-dimensions of working memory, cognitive flexibility, inhibitory control, planning-organization and directing attention; executive function skills cover all education levels including the pre-school period (Barkley & Murphy, 2010; Garon et al., 2008; Taş & Deniz, 2018). Additionally, with the arrangements configured as part of a project, it was revealed that the sub-dimensions of executive function skills are working memory, obstructive control, and cognitive flexibility (Bailey et al., 2018). The executive function model developed by Miyake et al. (2000) also consists of a triple structure in the form of working memory, obstructive control, and cognitive flexibility. In addition, this triple structure is separate from yet correlates with each other. This situation indicates that besides this trilateral structure is not completely independent of each other, it has common characteristics.

Working memory refers to the ability to keep the information in mind in a short time and to take action regarding this information. Attention is an important element for this purpose. This skill develops with the age of 2 in children and this development accelerates during the preschool period. Working memory has an effect on keeping information in mind temporarily and then turning it into appropriate reactions when applicable situations (Baddeley, 2012; Garon et al., 2008). Inhibitory control (Inhibition) is the individual's showing the appropriate reaction in a controlled manner instead of giving the dominant response. In order not to realize the dominant response, the inhibitory control is consciously activated. Along with increasing age, inhibition skill also develops. It is seen that this development is greater especially after the preschool period (Barkley, 1997; Fuster, 2008; Tregay et al., 2009). Cognitive flexibility is the ability to consciously switch from one task to another and to control attention during these transitions. It is effective in individual's showing problem solving behavior along with tasks that s/he is not accustomed to. Cognitive flexibility, which supports adaptation to changing conditions, is seen in children from the age of 3 and continues until after the preschool period (Canas et al., 2006; Diamond et al., 2005).

Children's executive function skills are more sensitive to environmental effects due to their rapid development and formability in preschool years (Zelazo & Carlson, 2012). In addition, the objectives of the education given in the pre-school period include enabling children realize their potential by providing rich stimulating environments, developing their thinking capacities, and preparing children for advanced academic experience and life. One of the most important steps that can be followed to achieve these goals is to support these cognitive skills of children with rich stimulating environments in the preschool period, when the rate of cognitive development and thus the establishment of

synaptic connections are the highest and executive function skills develop in the fastest way (Oakley, 2004; Türkoğlu & Uslu, 2016). It is stated that rich stimulating environments to be provided in order to support the cognitive development of children can also be achieved through play (Dönmez, 1992; Oktay, 2010).

Plays have effects on children such as making evaluations by thinking rationally, making a judgment, and improving information processing skills (Armory et al., 1999; Jonassen et al., 1999). Today, it is observed that digital games have an important place in children's lives due to technological developments and the widespread use and easy access of mobile devices (Bilgi Teknolojileri ve İletişim Kurumu, 2020) and that the play preferences of preschool children are increasing from traditional plays to digital games (Sapsağlam, 2018).

The positive effects of digital games have an undeniable reality in terms of enabling 21st-century learning skills such as critical thinking, creating a synthesis, collaborating, communication, and approaching events from different perspectives (Binkley et al., 2012). In the studies, besides the results that digital games have different levels of effects on learning success, it has been observed that they have potential effectiveness in achieving cognitive attainment, gaining positive attitudes towards the learning process, and improving executive function skills (Anguera et al., 2013; Homer et al., 2018). Considering the fact that there are many studies stating that executive function skills affect academic achievement, adaptation to primary school, and showing appropriate behavior in the classroom (Anderson, 2002; Harris, 2016; Riggs et al., 2003; St Clair-Thompson & Gathercole, 2006; Vitiello & Greenfield, 2017; Zelazo et al., 2003), this study is of importance in terms of shedding light on the studies to be done on the subject and contributing to the literature by revealing the executive function skills of children and the factors affecting them. In this context, in terms of executive function skills that are important to be gained in preschool, it is aimed to determine to what extent variables such as gender, duration of preschool education, parental education status, parental age status, maternal employment status, digital game playing situation, and frequency of digital playing are effective on children's development in these skills.

The early childhood years offer unique opportunities to support executive function skills. One of those who will create this unique opportunity are those who work with children, namely teachers. Meltzer (2010) stated that teachers' opinions about children's experiences of certain difficulties are very important when evaluating children, and he mentioned teachers as informal diagnostic experts depending on observation and classroom-based assessment methods. Evaluation methods are important for teachers to understand the executive function processes of children and to determine how to support children in this process. Accordingly, examining the executive function skills of 5-year-old children receiving pre-school education depending upon the 'The Childhood Executive Functions Inventory (CHEXI)-Teacher Form' constitutes the main problem of this research.

The problem statement of the research has been determined as "What are the factors affecting the executive function skills of 5-year-old children receiving pre-school education?". The sub-problems of the research are as follows:

1. What are the executive function skills levels of 5-year-old children?
2. Do the executive function skills of 5-year-old children show a significant difference related to gender?
3. Do the executive function skills of 5-year-olds differ significantly according to the duration of pre-school education?
4. Do the executive function skills of 5-year-olds differ significantly according to the parental education status?
5. Do the executive function skills of 5-year-olds differ significantly according to the parental age status?
6. Do the executive function skills of 5-year-olds differ significantly according to the maternal employment status?
7. Do the executive function skills of 5-year-olds differ significantly depending on the state of digital game playing?
8. Do the executive function skills of 5-year-olds differ significantly according to the frequency of digital game playing?

## Method

The method of the research is the descriptive survey model, which is one of the quantitative research methods. This model is the scanning arrangements on the entire population or the sample to be taken from the population in order to make a general judgment about the population when there is a large number of members in the population (Karasar, 2012). Scanning models are research approaches aimed at describing a past or present situation as it exists (Karasar, 2012).

## Study group

The population of the research consists of children who receive pre-school education in the 5-year-old group and the sample group consists of 332 children in the 5-year-old group, who attend official independent kindergartens affiliated to the Ministry of National Education in Ağrı and are allowed to participate in the study by their parents.

While determining the study group, convenience sampling method, which is one of the non-random sampling methods, was used. Convenience sampling method is expressed as a method that aims to prevent the loss of time and workforce of the researcher (Büyüköztürk et. al., 2015).

The demographic profile of the children comprising the study group is included in Table 1.

***Table 1. The demographic profile of the children comprising the study group***

| | Variables | N | % |
|---|---|---|---|
| Gender | Girl | 176 | 53.01 |
| | Boy | 156 | 46.99 |
| Duration of pre-school education | 12-24 months | 146 | 43.98 |
| | 25-36 months | 186 | 56.02 |
| Mother's educational background | illiterate | 31 | 9.34 |
| | Primary School | 84 | 25.3 |
| | Secondary School | 51 | 15.36 |
| | High School | 81 | 24.4 |
| | Undergraduate and higher | 85 | 25.6 |
| Father's educational background | illiterate | 7 | 2.1 |
| | Primary School | 63 | 18.98 |
| | Secondary School | 41 | 12.35 |
| | High School | 82 | 24.7 |
| | Undergraduate and higher | 139 | 41.87 |
| Mother's age status | Aged 20-30 | 154 | 46.38 |
| | Aged 31-40 | 155 | 46.69 |
| | Aged 40 and older | 23 | 6.93 |
| Father's age status | Aged 20-30 | 51 | 15.36 |
| | Aged 31-40 | 231 | 69.58 |
| | Aged 40 and older | 50 | 15.06 |
| Maternal employment status | Unemployed | 298 | 89.76 |
| | Employed | 34 | 10.24 |
| Digital game playing status | Yes | 272 | 81.93 |
| | No | 60 | 18.07 |
| Digital game playing frequency | Rarely | 58 | 21.32 |
| | A few times a week | 59 | 21.69 |
| | Once a day | 76 | 27.94 |
| | More than once a day | 79 | 29.05 |

## Data Collection Tools

***Form Child Information Form:*** This form which was developed by the researchers includes information about children's gender, duration of pre-school education, parental education status, parental age status, maternal employment status, digital gaming status, and frequency of digital game playing.

***The Childhood Executive Functions Inventory (CHEXI)-Teacher:*** Developed by Thorell and Nyberg (2008) regarding the executive functioning skills of children aged 4-12 and based on Barkley's (1997) model, The Childhood Executive Functioning Inventory (CHEXI) consists of teacher and parental inventories. The teacher inventory of the scale has been adapted to Turkish by Çiftçi et al. (2020) by carrying out validity and reliability studies for children between 48-72 months of age.

Developed by Thorell and Nyberg (2008), CHEXI was primarily handled as 4 sub-dimensions and 26 items. It was designed as

working memory (11 items), planning (4 items), inhibiton (6 items) and regulation (5 items). However, in the factor analysis, it was concluded that the best adjustment was achieved with the sub-dimensions of working memory and inhibiton. As the factors were examined, it was seen that the first factor included items related to working memory and planning sub-dimensions, and the second factor included items related to inhibiton and regulation sub-dimensions. The scale was organized as a total of 24 items, 13 of which were in working memory and 11 were in inhibiton.

The 5-point Likert-type inventory (1: Definitely not true, 5: Definitely true) is filled by the teacher and takes 5-10 minutes on average (Thorell & Catale, 2014; Thorell & Nyberg, 2008).

While high scores in the original of the scale showed that the child had difficulties in executive function skills, this situation was replaced by reverse coding in the Turkish version. In this case, high scores mean that the child demonstrates high executive function skills. (Çiftçi et al., 2020; Thorell & Nyberg, 2008).

In confirmatory factor analysis, factor loading values were found to vary between 0.47 and 0.85 and supported the original structure with two factors (working memory and inhibiton) ($\chi 2$ (544) = 1113891, CFI= 0.93, RMSEA= 0.06 [90% CI 06, 07], SRMR = 0.04). Cronbach's alpha coefficients were 0.95 for the Working Memory subscale and 0.91 for the Inhibiton sub-scale. In the test-retest reliability coefficient calculation, Working Memory was found to be 0.89 and Inhibiton was 0.85. Corrected item-total score correlations range from 0.46 to 0.83. The results have shown that the Turkish version of the CHEXI is a valid and reliable measurement tool in assessing executive function skills for 48-72 months old children.

**Data Collection Process**

In order to carry out the research, first of all, utilization permissions were obtained from the owners of the measurement tools to be used within the scope of the research. Afterwards, Ethics Committee of Ağrı İbrahim Çeçen University was applied to obtain the necessary permissions. After obtaining the ethics committee permission, from the Ağrı Provincial Directorate of National Education, necessary permission was obtained for the application.

For the study, the principals, assistant principals and teachers of 5 independent kindergartens affiliated with the Agri Province center were interviewed and informed about the study and the 'Child Information Form' and 'The Childhood Executive Functions Inventory (CHEXI)-Teacher Form' were distributed to the teachers who participated voluntarily. By the teachers, the parents of 507 children were delivered the 'Volunteers' Informed Consent Form-Parent' and 'Child Information Form', which states that they approved their children to participate in the study. Of the forms delivered, 378 were returned. Of the returned forms, 46 of which were filled incompletely were removed and 332 of them were evaluated

**Analysis of the Data**

First of all, data of 332 5-year-olds collected from five independent kindergartens were transferred to the SPSS 21 program. The normality of the scores obtained from the 'The Childhood Executive Functions Inventory (CHEXI)-Teacher Form' was evaluated by examining the coefficients of kurtosis and skewness for each category of both the general total and the independent variables and it was observed that these coefficients remained between ±1.5. In the case that the coefficients of kurtosis and skewness are within the ±1.5 limit, the distribution of the data set is considered normal (Pituch & Stevens, 2016). The homogeneity of the group variances was checked with Levene's test and the degree of freedom were recalculated for the variables whose Levene test was significant. Since it was observed that the data were normally distributed in all independent variables, while the differences between the group means for the two-category independent variables were analyzed with t-test, the mean differences, between the groups for the three or more category independent variables were analyzed with ANOVA. Upon the significant F statistics results of ANOVA, in order to define the source of the group differences, Scheffer test was used if the group variances were homogeneous and Tamhane's T2

test was used if not homogeneous. For the results of the difference between group averages that were significant at 0.05 alpha level, the effect of the independent variable on the dependent variable was examined with eta-squared (η2) statistics. η2, also called the effect size, shows how much the independent variable explains the total variance in the dependent variable and it varies between 0,00-1,00. This coefficient is interpreted as small effect size for η2=0.01, medium for η2=0.06, and large effect size for η2=0.14 (Büyüköztürk, 2011).

**Ethical Notification**

This study was carried out within the scope of the permission obtained from the Scientific Researches Ethics Committee of Ağrı İbrahim Çeçen University (dated November 25, 2021, decision no. 322).

**Findings**

***Regarding the first sub-problem of the study: the state of executive functions:*** The answer to this sub-problem was sought by examining the mean and standard deviation values of the answers given to 'The Childhood Executive Functions Inventory (CHEXI)-Teacher Form'. The results regarding the distribution of executive function skills scores obtained from the inventory are summarized in Table 2.

***Table 2. Average of the executive function skills scores***

| N | Minimum | Maximum | Mean | Standard Deviation |
|---|---|---|---|---|
| 332 | 42 | 118 | 74,44 | 16,72 |

When Table 2 is examined, it is seen that the average of the executive function skills scores of the children participating in the study is 74.44. Accordingly, children's executive function skills are at a medium-level.

***Regarding the second sub-problem of the study: the state of gender:*** An independent samples t-test was used to answer this sub-problem and the results are summarized in Table 3.

***Table 3. The t-test results of the executive function skills scores by gender.***

| Gender | N | Mean | Standard Deviation | t | sd[a] | p | η2 |
|---|---|---|---|---|---|---|---|
| Boy | 176 | 77.60 | 17.68 | 3.76 | 329.01 | 0.00* | 0.04 |
| Girl | 156 | 70.88 | 14.82 | | | | |

**p<0,05; a: Levene's test (F=4,56; p=0,04)*

When Table 3 is examined, it is seen that while the average of the executive function skills scores of boys is 77.60, it is 70.88 for girls. The differences observed between the averages were statistically significant (t=3.76; p<0.05). In addition, gender explains 4% of the variability in executive function scores (η2=0.04).

***Regarding the third sub-problem of the study: the state of duration of pre-school education:*** The answer to this sub-problem was sought through one-way variance analysis (ANOVA) for independent samples and the results were summarized in Table 4.

***Table 4. T test result of executive function skills scores according to the status of duration of preschool education.***

| The state of duration of preschool education | N | Mean | Standard Deviation | t | sd | p |
|---|---|---|---|---|---|---|
| 12-24 months | 146 | 76.31 | 19.20 | 0,74 | 330 | 0,50 |
| 25-36 months | 186 | 74.20 | 16.38 | | | |

When Table 4 is examined, it is seen that the average executive function skills scores of children with a duration of 12-24 months are 76.31, while the average of children with a duration of 25-36 months is 74.20. The differences observed between the averages were not found statistically significant (t=0.74; p>0.05).

***Regarding the 4th sub-problem of the study: educational status of parents:*** The answer to this sub-problem for independent samples was sought through one-way variance analysis (ANOVA) and the results were summarized in Tables 5 and 6.

*Table 5. The distribution of executive function skills according to parental educational status*

| Educational Status | Mother | | | Father | | |
|---|---|---|---|---|---|---|
| | N | Mean | Standard Deviation | N | Mean | Standard Deviation |
| illiterate | 31 | 75,87 | 18,58 | 7 | 75,29 | 17,07 |
| Primary School | 84 | 73,11 | 17,09 | 63 | 74,71 | 17,80 |
| Secondary School | 51 | 75,55 | 16,13 | 41 | 74,51 | 15,57 |
| High school | 81 | 76,42 | 17,35 | 82 | 74,29 | 16,89 |
| Undergraduate and higher | 85 | 72,69 | 15,42 | 139 | 74,35 | 16,66 |

Table 5 summarizes the distribution of children's executive function skills scores according to the educational status of their parents. The results of the ANOVA applied regarding the significance of the observed differences between the averages are indicated in Table 6. Since there were not enough observations in the illiterate category for father's education level (N<30), ANOVA analyzes were made over other educational status.

*Table 6. ANOVA result of executive function skills scores according to mother and father education status.*

| Parent | Source of the variance | Sum of squares | Sd | Mean squares | F | p |
|---|---|---|---|---|---|---|
| Mother | Intergroup | 851,99 | 4 | 213,00 | 0,76 | 0,55 |
| | Intragroup | 91653,92 | 327 | 280,29 | | |
| | Total | 92505,91 | 331 | | | |
| Father | Intergroup | 7,902 | 3 | 2,63 | 0,01 | 1,00 |
| | Intragroup | 90745,5 | 321 | 282,70 | | |
| | Total | 90753,4 | 324 | | | |

When Table 6 is examined, differences observed between the average of the executive function skills scores of the children according to both the mother's educational status (F4.327=0.76; p>0.05) and the father's educational status (F3.321=0.01; p>0.05) were not found significant.

***Regarding the 5th sub-problem of the study: the state of parental age:*** The answer to this sub-problem for independent samples was sought through one-way variance analysis (ANOVA), and the results are summarized in Tables 7 and 8.

*Table 7. The distribution of executive function skills according to parental age status*

| Age | Mother | | | Father | | |
|---|---|---|---|---|---|---|
| | N | Mean | Standard Deviation | N | Mean | Standard Deviation |
| Ages 20-30 | 154 | 74,42 | 16,76 | 51 | 76,76 | 17,74 |
| Ages 31-40 | 155 | 74,54 | 16,59 | 231 | 73,64 | 16,18 |
| Ages 40 and higher | 23 | 73,96 | 18,00 | 50 | 75,78 | 18,11 |

Table 7 summarizes the distribution of children's executive function skills scores according to the age of the parents. The results of the ANOVA applied regarding the significance of the observed differences between the averages are presented in Table 8.

*Table 8. ANOVA result of executive function skills scores according to maternal and paternal age status.*

| Parent | Source of the variance | Sum of Squares | Sd | Mean squares | F | p |
|---|---|---|---|---|---|---|
| Mother | Intergroup | 7,076 | 2 | 3,54 | 0,01 | 0,99 |
| | Intragroup | 92498,84 | 329 | 281,15 | | |
| | Total | 92505,91 | 331 | | | |
| Father | Intergroup | 512,979 | 2 | 256,49 | 0,92 | 0,40 |
| | Intragroup | 91992,93 | 329 | 279,61 | | |
| | Total | 92505,91 | 331 | | | |

When Table 8 was examined, according to the age of both the mother's (F2,329=0.01; p>0.05) and the father's age status (F2,329=0.92; p>0.05), the differences observed between the averages of children's executive function skills scores were not significant.

***Regarding the 6th sub-problem of the study: the maternal employment status:*** An answer to this sub-problem was sought for independent samples with t-test and the results were summarized in Table 9.

*Table 9. The result of the t test based on the maternal employment status of the executive function skills scores.*

| Employment status | N | Mean | Standard Deviation | t | sd | p |
|---|---|---|---|---|---|---|
| Yes | 298 | 74,31 | 16,78 | -0,43 | 330 | 0,67 |
| No | 34 | 75,62 | 16,37 | | | |

When Table 9 is examined, the average executive function skills scores of children whose mothers are not working are 74.31, while the average of children whose mothers work is 75.62. The differences observed between the averages were not found statistically significant (t=-0.43; p>0.05).

***Regarding the 7th sub-problem of the study: the state of digital game playing:*** An answer to this sub-problem for independent samples was sought through t-test and the results were summarized in Table 10.

***Table 10. T test result of executive function skills scores based on digital game playing status.***

| Digital game playing status | N | Mean | Standard Deviation | t | sd | p | η2 |
|---|---|---|---|---|---|---|---|
| No | 60 | 66,53 | 15,95 | -4,15 | 330 | 0,00 | 0,05 |
| Yes | 272 | 76,19 | 16,40 | | | | |

When table 10 is examined, it is seen that the average of executive function skills scores of children who do not play is 66.53, while the average of children playing games is 76.19. The differences observed between averages are statistically significant (t=-4,15; p<0,05). In addition, whether or not to play a digital game explains 5% of the variability in executive function skills scores (η2=0.05).

***Regarding the 8th sub-problem of the study: the status of digital gaming frequency:*** A response to this sub-problem for independent samples was sought through one-way variance analysis (ANOVA) and the results were summarized in Tables 11 and 12.

***Table 11. Distribution of executive function skills scores according to frequency of digital gaming.***

| Game Playing Frequency | N | M | sd |
|---|---|---|---|
| (1) Rarely | 58 | 74,19 | 16,64 |
| (2) A Few Times a Week | 59 | 74,14 | 13,49 |
| (3) Once a Day | 76 | 72,58 | 18,99 |
| (4) More than Once a Day | 79 | 82,66 | 14,52 |

Table 11 summarizes the distribution of executive function skills scores according to the children's digital game playing frequency. ANOVA results on the significance of the differences observed between the averages are presented in Table 12.

***Table12. ANOVA result based on the frequency of digital gaming of executive function skills scores.***

| Source of the Variance | Sum of squares | Sd | Mean Squares | F | p | Eta-square | Difference |
|---|---|---|---|---|---|---|---|
| Intergrroup | 4777,31 | 3 | 1592,44 | | | | 1-4 |
| Intragroup | 68130,13 | 268 | 254,22 | 6,26 | 0,00 | 0,07 | 2-4 |
| Total | 72907,44 | 271 | | | | | 3-4 |

In Table 12, the ANOVA result of the executive function skills scores according to the frequency of playing digital games is summarized. According to this, the differences observed between the average scores of children's executive function skills were found to be significant (F3,268=6.26; p<0.05). In order to find out which group causes the difference, Tamhane's T2 test, one of the post hoc tests, was used because the variance between groups was not homogeneous (F=2.80; p=0.04) according to Levene's test. As a result of Tamhane's T2 test, the difference between the averages was observed to be between playing more than once a day and playing once a day, once a week and rarely. In addition, the frequency of game playing explains 7% of the variability in executive function skills scores (η2=0,07).

**Discussion and Result**

The results of this study, which aimed to examine the executive function skills of 5-year-old children in preschool education according to some variables, were discussed in according with the findings.

When the findings were examined in terms of the gender variable, it was seen that the executive function skills of the children differ significantly difference according to this variable, and this difference was on behalf of the boys. Similarly, there are studies that found a significant difference in executive function skills according to gender and showed that this difference was on behalf of boys (Blasiman & Was; 2018; Camerota et al., 2018). In his research with preschoolers, Sağlam (2020) also found that boys scored higher on working memory scores than girls fin terms of executive function skills. Another study with individuals of different ages found that boys performed better than girls in working memory scores from executive function skills in only 13-15 age groups (Gathercole et al., 2004). However, there are also studies that have found that executive function skills differ on behalf of girls (Isquith et al., 2004; Mileva-Seitz et al., 2015; Wiebe et al., 2008). In the study of Hamamcı (2020) in the form of parent and teacher evaluation, it was found that the inhibitory control ability, one of the executive function skills,

differed on behalf of girls. In his study with preschool children, Yılmaz (2022) also reached a result on behalf of girls in working memory and inhibitory control skills. Additionally, there are studies that do not show any difference according to the gender variable (Diamond & Taylor, 1996; Harvey, 2011). In Öğütcen's (2020) study with 48-66 months old children, it was seen that teacher and parent evaluations did not differ according to the gender variable. Similarly, in his study with 48-72 months old children, Tuncer (2021), who used the parent form of the inventory used in the current study, found that executive function skills did not change according to gender. In Decker's (2010) study, which examined the relationship between working memory and early academic skills of children aged 4-6, while there was a significant relationship between verbal skills and auditory short-term memory, no gender difference was found. However, there are different results about the effect of gender in the literature, when the effect size is examined in the current study, it is seen that gender has a moderate effect on executive function skills. In this case, it can be stated that the effect of gender on executive function skills cannot be ignored.

When the findings were examined in terms of the variable of the duration of preschool education, it was determined that the executive function skills of the children did not show a significant difference according to this variable. Similarly, in the study conducted by Hamamcı (2020), as a result of teacher evaluations, it was seen that the executive function skills of children did not differ according to the duration of preschool education. In Öğütcen's (2020) study, it was determined that the executive function skills of preschool children did not differ significantly according to the years of preschool education. However, in the study of Yılmaz (2022), it was determined that the working memory skills scores of children who received preschool education were higher than those who did not. Burrage et al., 2008) also reported in their study that children who attend pre-primary education institutions perform better in the task of working memory skills compared to children who do not attend. Belsky et al. (2007) stated in their study that higher quality teacher-child interactions in the preschool period have a significant effect on the executive function skills of children, and this situation contributes to the executive function skills of preschool children who attend school. However, some studies show that supportive programs applied in the preschool education process have a positive effect on children's executive function skills (Burger, 2010; Gormley et al., 2005; Weiland & Yoshikawa, 2013). As a result of the present study, the fact that the duration of preschool education does not show a significant difference in executive function skills may be due to the quality of educational activities or the interaction of teachers and parents with children.

When the findings were examined in terms of the parent education level variable, it was determined that the executive function skills of the children did not show a significant difference according to this variable. Similarly, Öğütcen's (2020) study indicated that children's executive function skills did not differ significantly according to the education level of their parents. In the study conducted by Hamamcı (2020), it was seen that the executive function performances of children did not differ according to both mother's and father's education level in the evaluations of parents and teachers. In the study conducted by Groen (2015), it was concluded that parental education level did not have an effect on cognitive flexibility, which is a sub-dimension of executive functions, but had a small effect on working memory and inhibitory control. In his study, Schady (2011) found that the mother's year of going to school and the mother's vocabulary were strongly associated with the child's cognitive development, while the father's school-going year was weaker in relation to the child's cognitive development. In other studies (Ardila et al., 2005; Hoff, 2003; Noble et al., 2015; Kaçamak Öğüt et al., 2020) it was found that parent's education is related to the child's executive function skills. In the study of Castillo et al. (2011) on the sample of adolescent age group, parental education level was found to be associated with cognitive performance. In the study of Yılmaz (2022), it was determined that the executive function skills of children of parents with higher education levels are higher. This case has been explained by the fact that as the education level of the parents increases, they spend more quality time with their children and

give more importance to their development. As a result of the current study, it can be said that the fact that the executive function skills of children do not differ according to the educational status of the parents may be related to the homogeneous distribution of the data obtained from the study group.

When the findings were examined in terms of the age variable of the parents, it was determined that the executive function skills of the children did not show a significant difference according to this variable. Similarly, in Yılmaz's (2022) study, no difference was observed in the working memory sub-dimension and inhibitory memory sub-dimension of executive function skills according to both mother and father ages. Yılmaz (2022) explained this result by the fact that there was no difference between the ages of the families forming the sample and their child-rearing attitudes. Considering the studies conducted in line with this explanation, it is seen that parental behaviors may affect the development of executive functions in early childhood (Blair et. al., 2014; Fay-Stammbach et.al., 2014; Valcan et.al., 2018). In this case, considering parental attitudes along with the age factor may provide a more detailed interpretation of these factors that affect children's executive function skills.

When the findings were examined in terms of the maternal employment status variable, it was determined that the executive function skills of the children did not show a significant difference according to this variable. Similarly, Hamamcı (2020) found in his study that the executive function skills of children in parent and teacher evaluations did not differ according to their maternal employment status. However, in the study of Yılmaz (2022), while there was a significant difference in working memory skills, which is one of the executive function skills of children, no significant difference was found in the inhibitory control skills in accordance with the working conditions of the parents. This matter can be attributed to the fact that the family is at a better socio-economic level and can offer a richer environment to their child, together with the work. Contrary to the study of Yılmaz (2022), De Jong (1993) created an attention model comprising the relationship between home background factors and academic success at school and by including the parent profession in its variables, he showed that the socioeconomic level variable did not have an effect on the regulation of attention. Similarly, by adding parental occupation to the socioeconomic level variable, DePrince et al. (2009) stated that it had no predictive effect on executive function scores. In studies dealing with the parent-child relationship (Bernier et al., 2012; Sosic-Vasic et al., 2017), it has been stated that errors in the executive function performance of children are less in the cases that the quality of the parent-child relationship, parent involvement, and parental responsibility are high. Considering this situation, it is thought that the findings of significant differentiation in the executive function performances of children stem from the characteristics of the parents. Since the parent-child relationship was not measured in the current study, besides the parent-child relationship could not be interpreted within the scope of the variable under consideration, the lack of significant difference according to the maternal employment status may be related to the homogeneous distribution of the data obtained from the study group.

When the findings were examined in terms of digital game playing status, it was seen that the executive function skills of the children differed significantly according to this variable and that the children who played digital games had higher executive function skills than those who did not. According to Aksoy (2014), digital games can contribute to the cognitive development of individuals because they require time constraints or race against time and force them to perform mental operations. There are many studies in the literature that support the results of the current study. In a study, it was concluded that science education with educational digital games was effective on the cognitive development of preschool children (Yıldız & Zengin, 2021). In their research examining the cognitive development of 5-6-year-old children using computers, Nir-Gal and Klein (2004) concluded that integrating computers into learning environments positively affects cognitive development. In experimental

studies with preschool children, children were let play different digital games developed for working memory and it was observed that these games had positive effects on children's working memory (Bergman Nutley et al., 2011; Thorell et al., 2009). Similarly, the studies in which digital games containing brain-enhancing activities were used for individuals aged 4 and over indicated that game was effective in executive function skills such as working memory (Klingberg et al., 2005; Olesen et al., 2004) and inhibitory control (Klingberg et al., 2005). An experimental study in which a digital game developed on cognitive skills for individuals aged 6 and above was played concluded that this game was effective in the development of cognitive skills of children aged 6-13 (Helms & Sawtelle, 2007). Kavanaugh et al. (2019) let preschool children play a digital game developed for executive function skills and concluded that the game improved children's executive function skills. When the studies on the use of digital games are examined, it is seen that positive results are obtained in the acquisition of learning outcomes, increasing the learning speed and permanence of individuals, their academic success, critical thinking and problem-solving skills, cognitive development and motivation (Basak et al., 2008; Chuang & Chen, 2007; Jong et al., 2013; Hsu et al., 2017; Kanthan & Senger, 2011; Prensky, 2001; Samur, 2016; Subrahmanyam & Greenfield, 1994). As seen in the studies, digital games have positive effects on executive function skills, which are also expressed as cognitive skills. In the current study, the effect size is concerned, it is seen that the state of digital gaming has a moderate effect on executive function skills.

When the findings were examined in terms of the frequency of digital game playing, it was observed that children's executive function skills differed significantly according to this variable and that the difference was between playing more than once a day and playing once a day, once a week and rarely. Additionally, it was found that the frequency of gaming had a moderate effect on executive function skills. This effect indicates that as the frequency of playing increases, so do the executive function skills. Similarly, in a study conducted by Ramos and Melo (2019) with children between the ages of 7 and 9 in Brazil, the impact of digital game played in the school environment on attention was examined. After a routine program applied to children for 6 weeks and 15 minutes per day, it was determined that digital games improved children's attention performances. The American Academy of Pediatrics (AAP) (2016) recommends time limits, not more than 1 hour per day, on the use of digital media for children between the ages of 2 and 5. In this context, it is seen that although playing digital games more than once a day positively affects executive function skills, it is important to organize this frequency not exceeding 1 hour per day.

In this study, children's executive function skills were examined based on teacher evaluation. In future studies, it is recommended to evaluate the child's skills in detail by making measurements in the focus of the child's performance, as well as the evaluations of the adults around the child regarding the child's behavior.

In the current study, it was concluded that playing digital games positively affects children's executive function skills. Considering this result, it can be suggested to conduct experimental studies to examine their effectiveness by developing digital games to support executive function skills in the pre-school period.

It is recommended for preschool teachers to be supported through various training so that they can effectively use classroom strategies to evaluate, develop and support children's executive function skills.

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