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# An examination of the relationship between 9-12-month-old children's executive functions and social skills

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**Abstract**

This study is a descriptive study aiming to identify the relationship between 9-12-month-old children's executive function performances and their social skills. Adopting a survey method, this research study used the Wisconsin Card Sorting Test and Stroop Test-TBAG Form as well as the School Social Behavioral Scale and Personal Information Form as data collection instruments. The population of the study includes 131 9-12-year-old students continuing their education in the İstanbul province. The results of the study indicate that among executive functions, 9-12-year-old children's levels of perseveration and resistance to interfering effect vary depending on their gender and their levels of perseveration, conceptualization/reasoning, and resistance to interfering effect vary depending on the grade they are in.



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*Keywords:* executive functions; social skills; neuropsychological tests

## 1. Introduction

The cognitive system is not only a system enabling the hearing, perceiving, memorizing, learning and retrieving the learned stimuli when needed. Instead, an effective cognitive system should be able to protect schemes and sets, change and arrange them when necessary, recreate them, protect them from the interfering effects, integrate events based on time and space, scan the memory, work on its traces, set up strategies and change them, and finally make plans (Karakaş & Karakaş, 2000).

The dynamic and complicated nature of the information processing in the brain has led to the emergence of the concept of executive functions referred while describing the high-level cognitive processes. This concept embodies skills, such as self-regulation, the behavior sequence, flexibility, response inhibition, planning and the organization of behavior (Lezak, 1995; Borkowski & Burke 1996; Mercugliano, 1999). Additionally, other main executive

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functions are motivation, spontaneity, initiative ability, observance of social compliance, judgment, problem solving, ability to follow a multi-step direction and the ability to maintain the behavior output without falling into perseveration (Öktem, 2006). These functions pave the way for a person to think about him/herself and determine what will happen in the future and how these functions will affect him/her (Barkley, 1997; Mercugliano, 1999).

The term *executive functions* is a general term used to refer to all the processes, such as planning, attention, controlling impulse and incorrect responses, conducting organized research, initiating and performing an action, thinking and action flexibility (Hill, 2004; Anderson, 1998; Anderson, 2002). The development of the executive functions begins in the early childhood period, and it continues throughout the periods of adolescence and young adulthood as the prefrontal cortex develops. It is observed that as the executive functions regularly develop, children begin to deal with more complex tasks (e.g. driving motor vehicles, success at school) which require children to manage themselves. It is also indicated that children's executive functions have regulatory control on their thoughts and behaviors while they are solving a problem. It is stated that data regarding children's executive functions can be obtained by doing the following: observing their abilities to solve problems and to initiate games in their natural environment, evaluating how flexible children are when their routines change and collecting information from parents about their children's inhibition capabilities (Baron & Fennel 2000; Blair, Zelazo & Greenberg, 2005).

On the other hand, based on cognitive and social abilities, the *social skill* is a term influenced by individual characteristics and environmental factors (Wyman et al., 2000); in addition, this term refers to the process of demonstrating appropriate goal-oriented behavior (Bacanlı, 1999). Social skills can be described as skills of adapting to the social environment and using appropriate communication paths to cope with conflicts that may occur (Hilooğlu & Cenkseven, 2010). For the development of social skills, basic sensory/perceptual, cognitive and emotional structures are needed. The skills of socialization and realizing faces, emotions and what passes though someone else's mind are only a few examples of social skills contributing to the process of reasoning in the social context. Still, these skills are not sufficient for the emergence of socially appropriate behavior. In order to meet developmental goals required by the social context, it is also important for the child to be able to organize his/her social skills (Guralnick, 2005). Thus, it is essential that the child's skills of reasoning and ratiocinating should be well-developed, and this is directly related to executive functions. However, a limited number of studies have so far focused on the effect of executive functions on social skills. These studies are mostly related to the field of special education and have mainly dealt with the social communication disorders of the autistic children (McEvoy, Rogers & Pennington, 1993; Griffith, Pennington, Wehner & Rogers, 1999; Landry & Loveland, 1988), adaptation disorders (Gilotty, Kenworthy, Sirian, Black & Wagner, 2002; Kleinhans, Akshoomoff & Delis, 2005), developmental retardation (Kiley-Brabeck & Sobin, 2006; Anderson, Anderson, Northam, Jacobs & Mikiewicz, 2002) and social skills of children with behavioral problems (Clark, Prior & Kinsella, 2002; Huang-Pollock, Mikami, Pfiffner & McBurnett, 2009). On the other hand, there have been some other studies involving children passing through normal developmental processes. To illustrate, the development of executive functions after the age of 5 and during the period of puberty (Best, Miller & Jones, 2005; Anderson, Anderson, Northam, Jacobs & Catroppa, 2001; Brocki & Bohlin, 2004), the evaluation of executive functions and special cognition (Blakemore & Choudhury, 2006) and the investigation of executive functions and social-emotional development (Riggs, Jahromi, Razza, Dillworth-Bart & Mueller, 2006; Domitrovich, Cortes & Greenberg; 2007) are topics studied so far. In our country, relevant studies are mostly centered around executive functions of adults and the elders, and especially following 2000s, studies started to shift attention to children and adolescents (Öztürk, 2004; Çelik, 2004; Köksaldı Özgül, 2005; Soysal, 2007; Karateke, 2009; Yulaf, 2010; Etel, 2012; Sakarya, 2013; Sezgin, 2013). On the other hand, other studies focusing on different variables dealt with social skills of pre-school children (Yukay Yüksel, 2013; Pırtık, 2013; Tunçeli, 2012; Erten, 2012; Erler, 2011; Bilek, 2011) and individuals who did not yet reach the period of adulthood (Yukay, 2003; Bedir, 2013; Gezer, 2010; Kurt, 2010; Gülaçtı, 2009; Kara, 2000). However, no research study has so far been carried out dealing with the issues of executive functions and social skills at the same time.

Thus, the current study aims to investigate the executive functions of the children at concrete operational stage and formal operational stage (between the ages of 9 and 12) and to reveal the effects of these functions on social skills. Therefore, the following research questions have been formulated:

- Do the executive functions of 9-12-year-old children vary depending on the level of gender and grade?
- Do the social skills of 9-12-year-old children vary depending on the level of gender and grade?
- Is there a relationship between the executive functions and social skills of 9-12-year-old children and does this relationship vary based on the levels of gender and grade?

## 2. Method

**2.1. Research Design:** This is a descriptive research study aiming to identify the relationship between the executive function performances and the social skills of 9-12-year-old children. In the present research study in which a survey method was applied, the Wisconsin Card Sorting Test, Stroop Test-TBAG Form, School Social Behavioral Scale and Personal Information Form were used as data collection instruments.

**2.2. Sample:** The population of the present study intended to explore the relationship between executive functions and social skills includes 9-12-year-old children attending schools in the İstanbul Province. The sample of the study, on the other hand, includes 131 students attending six primary schools in the Kadıköy district of the İstanbul Province.

**2.3. Data Collection Instruments:**

**2.3.1. Wisconsin Card Sorting Test (WCST):** This neuropsychological test was first developed by Berg in 1948 and then reorganized by Heaton in 1981. WCST is an executive function test (Baddeley, 1990; Baddeley et al., 1986; Lezak, 1995). The test assesses concept formation, abstract scrutiny skills, working memory, attention, and perseverative tendency.

13 scores can be calculated from this test. These scores are as follows: the total number of errors (WCST2) and correct answers (WCST3), the total number of response (WCST1), the number of completed categories (WCST4), the number of perseverative response (WCST5), the number of perseverative error (WCST6), the number of error that is not perseverative (WCST7), perseverative error percentage (WCST8), the number of responses used for the completion of the first category (WCST9), the number of conceptual level response (WCST10), the conceptual level response percentage (WCST11), the score of failure to maintenance set scores (WCST12) and the sore of learning how to learn (WCST13) (Karakaş, 2004).

The standardization study of the WCST for the Turkish culture was carried out within the BILNOT Battery (Karakaş, 2004). On the other hand, the standardization study of the WCST for Turkish children was done by Şahin-Aközel, Irak, Altınoğlu- Dikmeer, Erol and Akçakın (2006) who involved in their study 474 6-15-year-old children attending 1-8 grades (276 female, 198 male).

In this study, this test was used to assess participants' conceptualization/inquiry and perseverative tendency properties. The conceptualization/inquiry properties were assessed considering the Conceptual Level Response Percentage Scores (WCST11) while perseverative tendency properties were assessed using the Perseverative Error Percentage Scores (WCST8).

**2.3.2. Stroop Test-TBAG Form**: The Stroop Test was developed by Stroop in 1935 on the basis of an experiment. The main properties assessed by means of the Stroop Test are the skills of perceptual setup under the interference effect and changing the response. Other properties include information processing speed and attention (Karakaş, 2004).

The reliability study of the Stroop Test-TBAG Form was carried out by Karakaş and colleagues (1999) whose participants were 65 20-55-year-old people (32 female and 33 male). The test-retest correlation coefficients of the time scores of the five sub-tests ranged from 0,26 to 0,88 ($p<0,05$). Kılıç and colleagues (2002) carried out the standardization study of the Stroop Test-TBAG Form for the healthy Turkish children between the ages of 6 and 11.

In the present study, the Stroop Test-TBAG Form was especially used to assess the skill of resisting to interfering effect. The property of resisting to interfering effect was assessed using the time score of the fifth Part of the Stroop Test.

**2.3.3. School Social Behavioral Scales (SSBS):** The School Social Behavioral Scale developed by Merrell in 1993 was translated into Turkish by Yüksel (2009).

School Social Behavior Scales enabling classroom teachers or other teachers at school to individually assess pre-school and primary school children was designed in line with the five-point Likert model. The scales are comprised of 65 items. The scale includes two forms: Form A: Social Competence and Form B: Anti Social Behavior. In the scale of "Social Competence", a total number of 32 items are available in three sub-scales that are "Interpersonal Relationship" (14 items), "Self-control Skill" (10 items) and "Academic Skills" (eight items). On the other hand, in the "Anti Social Behaviors" scale, there are 33 items in three sub-scales: "Assailant-Angry" (14 items), "Antisocial-

Aggressive" (10 items) and "Destructive-Demanding" (9 items) (Yüksel 2009).
These scales aim to help teachers to rate students' behaviors in their academic and social environments by also considering their observations. Taking the theoretical background of the scales into consideration, it would be true to state that the scales can evaluate all the sub-areas dealt with under the term "social skills". The scales were designed in such a way that they can be used both as a whole and as separate sub-scales (Yüksel 2009).

## 3. Findings

### 3.1. Findings Related to the Executive Functions of 9-12-year-old Children:

Among the executive functions of 9-12-year-old children, their levels of perseveration and resistance to interfering effect vary depending on their genders. According to the t-test applied for this difference, the results are as follows:

- Among the executive functions, 9-12-year-old boys and girls' levels of perseveration are significantly different and this different is in favor of boys [$t_{(129)}$=2,19 and p<.05].
- There is no difference in the 9-12-year-old boys and girls' levels of conceptualization/inquiry which are executive functions [p>.05].
- Among the executive functions, 9-12-year-old boys and girls' levels of resistance to interfering effect are significantly different considering the gender variable and this difference is in favor of girls [$t_{(129)}$=2,11 and p<.05].

It was also found that 9-12-year-old children's levels of perseveration, conceptualization/inquiry and resistance to interfering effect vary depending on the grade they are in. About this difference, the t-test results reveal 9-12-year-old children's levels of perseveration [t(129)=2,06 and p<.05], conceptualization/inquiry [t(129)=2,18 and p<.05] and their levels of resistance to interfering effect [t(129)=4,72 and p<.001] vary significantly depending on the grade they are in, and this difference is in favor of seventh graders

### 3.2. Findings Related to the Social Skills of 9-12-year-old Children:

It was found that 9-12-year-old children's levels of social competence, anti social behaviors and general social skills show variations depending on their gender variable. The t-test applied to justify this difference revealed that girls and boys' levels of social competence [$t_{(129)}$=3,01 and p<.05], exhibiting anti social behaviors [$t_{(129)}$=2,28 and p<.05] and exhibiting positive social behaviors [$t_{(129)}$=2,37 and p<.05] are significantly different, and this difference is in favor of girls.
Also, it was found that 9-12-year-old children's levels of social competence and general social skill vary depending on the grade these students are in, and the findings of the t-test are as follows:

- The social competence levels of fourth and seventh graders [$t_{(129)}$=2,06 and p<.05] and their levels of exhibiting positive social behaviors [$t_{(129)}$=3,44 and p<.05] are significantly different, and this difference is in favor of fourth graders.
- In the fourth and seventh graders' levels of exhibiting anti social behaviors, no significant difference is found [p>.05].

### 3.3. Findings Related to whether the Relationship between the Executive Function Skills and Social Skills of 9-12-year-old Children Varies Depending on the Gender and Grade Variable:

**Table 1. The relationship between children's executive function skills and social skills of (N=131)**

| Dimension/Scale | | Social Competence | Anti Social Behavior | SSBS Total Score |
|---|---|---|---|---|
| Perseveration | *r* | -0,082 | -0,038 | -,178* |
| | *p* | 0,355 | 0,670 | 0,042 |
| Conceptualization/inquiry | *r* | 0,127 | 0,064 | ,284** |
| | *p* | 0,148 | 0,469 | 0,001 |
| Resistance to interfering effect | *r* | -,195* | ,239** | 0,007 |
| | *p* | 0,025 | 0,006 | 0,936 |

**Correlation (relationship) is significant at the level of p<.05.*

*** Correlation (relationship) is significant at the level of p<.01.*

A negative significant relationship was found between children's levels of perseveration and their total scores in the SSBS (r= -,178 and p<.05). As children's levels of perseveration increased, their positive social behaviors decreased. Besides, a positive significant relationship was found between the conceptualization/inquiry levels of the children and their total SSBS scores (r=,284 and p<.01). As their conceptualization/inquiry levels increased, their levels of positive social behaviors similarly increased.

Moreover, it was found that there is a negative significant relationship between children's scores of resistance to interfering effect and social competence scores (r=-,195 and p<.05). In other words, as their scores of resistance to interfering effect increased, their social competence levels decreased. On the other hand, a positive significant relationship was found between children's resistance to interfering effect scores and their anti social behavior scores (r=,239 and p<.01). In other words, as the resistance to interfering effect scores of the children increased, their anti social behavior scores also increased.

The Fisher's Z test was applied in this study to be able to explore whether the relationship between the children's executive function skills and social skills varies depending on the grades they are in and their genders.

According to the results of the Fisher's Z test used to reveal whether the relationship between the executive function skills and social skills of the children varies depending on the gender variable revealed that the gender variable caused a significant difference only in the relationship between conceptualization/inquiry and anti social behavior [$Z_{Girl*Boy}$=2,04>1,96 and p<,05]. While negative relationship was found between the scores of girls in the conceptualization/inquiry dimension and their anti social behavior ($r_{Girl}$=-,118), this relationship was found to be positive for boys ($r_{Boy}$=0,247).

On the other hand, according to the results of the Fisher's Z test applied to find out whether the relationship between the executive function skills and social skills of the children varies depending on the grade variable, the relationship between children's executive functions and their social skills does not vary for any of dimensions depending on the grade they are in.

## 4. Discussion

As a result of the statistical analysis of the data of the study, it was revealed that the executive functions of the 9-12-year-old children vary depending on their genders and grade levels. It was found that among executive functions, levels of perseveration and resistance to the interfering effects vary depending on the gender variable, and this difference is in favor of the female participants. Similarly, some studies evaluating the results of neuropsychological tests based on the gender variable yielded the finding that girls in the puberty period achieve more successful results than boys do (Yeniad, 2009; Soysal, 2007; Alpanda, 2010). This finding was justified by Ehlers and colleagues (2001) with the fact that the brain mutation of the girls is completed at an earlier stage (Şeneli, Gölgeli, Küçük, Süer & Özesmi, 2004). In their study entitled "The Standardization of the Turkish Form of Marking Test for the 6-11-year-old group of Children", Kılıç, Irak, Koçkar, Şener and Karakaş (2002b) found that the effect of gender is significant because 8 out of 56 parametric scores of the Marking Test were in favor of the girls. However, this effect does not show a regular pattern taking the four sub-tests into consideration. For this reason, they organized the data by combining the levels of gender in the normative data tables. Contrary to some studies proving that the gender does not have a significant effect on marking tests, there have been other studies demonstrating that the performance of the girls are better. However, it was thought by the researchers that the unsystematic result they found about the effect of gender cannot be generalized. In the same study, another important finding was that in parallel with the increase in age and grade, the systematic organization of screening increases. This situation caused a significant difference between 6-8 and 11-year-old children. In the study, the developmental effect in the systematic organization of screening is an indication of the rapid development of the stages of organizing the motor output occurring in the later stage of information processing and organizing the response for 7-11-year-old children.

The fact that 9-12-year-old children's executive function skills vary depending on the age and grade variables was also confirmed by a study carried out by Yalçın and Karakaş (2007). In their paper entitled "Qualitative and Quantitative Effects of Development In Wisconsin Card Sorting Test Performance", they found that in terms of WCST performance and executive functions, the WCST performance of children over and under 11 are significantly different from each other. Their results indicate that children under the age 11 make more mistakes and give fewer correct responses (Yalçın &Karakaş, 2007).

The findings of the present study showed that 9-12-year-old children's levels of social skills vary depending on the gender and grade variables. The findings when interpreted from the point of the gender variable revealed that girls and boy's levels of social competence, exhibiting anti social behavior and positive social behavior are significantly

different, and this difference was found to be in favor of girls. When analyzed according to the grade level of the children, the difference showed that fourth graders exhibited more positive social behaviors, and the level of exhibiting anti social behaviors does not vary depending on the grade variable.

In Yukay Yüksel's (2013) study entitled "An investigation of social behaviors of primary school children in terms of their grade, learning disability and intelligence potential", it was found that there is no difference in the social competence levels of first, second and third primary school graders; nevertheless, third graders (9-year-old students) exhibit more anti social behaviors than first graders who are at the age of 7. Furthermore, it was revealed that girls are socially more competent than boys, and boys exhibit more anti social behavior than girls. In many other research studies, girls were found to exhibit more social adaptive behavior than boys, and thus boys should be supported more about this issue (Güven et al, 2004; Gizir, 2002; Çimen, 2000; Marcon, 1993; Elliott, Barnard & Gresham, 1989). In contrast to these findings, in Morais and Rocha's (2000) study, it was concluded that the gender variable does not significantly affect the development of social competence.

Starting from the first days of the primary school, children rapidly socialize and adopt group rules. While girls prefer more calm and less action-based games in this period, boys may play more action-based and violent games. From the age of 9, friendship relations become more important (Kılıççı, 2006; Yavuzer, 2000); therefore, it would wise to think that 9-year-old children whose friendship relations have recently begun to develop are inclined to take these rules into account more seriously while structuring their social relations, and thus they might exhibit more social behavioral patterns than 12-year-old children currently entering the adolescence. This finding corroborates with the results of the study pertaining to the gender level. In some other studies, it was emphasized that as the level of age increases, children become more independent and may tend to exhibit anti social behaviors by ignoring the rules (Ruffalo & Elliott, 1997; Elliott, Barnard, & Gresham, 1989). It would be fair to suggest that as a result of raising children in line with the roles attributed to girls and boys as well as women and men in our society, the social skills of girls are more developed than boys because girls take more responsibility, have more social relations, cooperate and express their feelings more easily (Öztürk, 2006).

In the third research question of the current study, whether there is a relationship between the executive functions and social skills of 9-12-year-old children and whether this relationship varies depending on the levels of gender and grade are focused.

There is a negative significant relationship between perseveration and resistance to interfering effect levels of children and their total scores in the SSBS. It can be stated that as children's levels of perseveration and resistance to interfering effect increase, their positive social behaviors decrease. It was also found that there is a positive significant relationship between conceptualization/reasoning levels and their total scores in the SSBS. The more children's levels of conceptualization/reasoning increase, the more their positive social behavior levels rise. It was also revealed that there is a positive significant relationship between their scores of resistance to interfering effect and anti social behavior scores. Thus, as the scores of resistance to interfering effect increase, scores of anti social behavior also increase.

It was indicated that the relationship between children's executive functions and social skills varies depending on their genders, but this relationship does not vary depending on the grade they are in. It was also revealed that while there was a negative relationship between girls' conceptualization/reasoning and anti social behaviors, this relationship was positive for boys.

For effective social responses, individuals should have all the skills, such as social perception and problem solving as well as behavioral skills. Evaluating social cues in an effective way, making plans, suppressing improper ratings of different response options and deciding on the appropriate option are all among cognitive competences affecting social skills. Thus, cognitive processes are necessary for an effective social performance (Karakaş, 2004). In the literature, there have been no studies dealing with sample groups with normal psychologically healthy development to explore the relationship between executive functions and social skills. The reflections of executive dysfunctions on social skills have mostly focused in studies done with patients diagnosed with psychiatric disorders (Kılınçaslan, Motavalli Mukaddes, Sözen Küçükyazıcı & Gürvit, 2011; Cangöz & Selekler, 2003; Demir & Uluğ, 2002). In Topçuoğlu and colleagues' study (2009) whose participants are patients diagnosed with social phobia, it was found that the social phobia disrupts executive functions. It was also revealed that when compared to patients in the control group who are not diagnosed with social phobia, the ones diagnosed with this disorder have higher scores of mistakes in the Wisconsin Card Sorting Test. As a result, it was found that social anxiety has negative effect on WCST results. This result also supports the finding that as conceptualization/reasoning levels increase, the levels of positive social behavior also increase, and as scores of resistance to interfering effect increase, anti social behavior

scores similarly increase.

According to other data obtained in this study, girls responded more positively than boys regarding executive functions and social skills. Thus, it would be fair to suggest that the more developed executive functions are, the more positive behaviors are exhibited; moreover, girls are more successful in exhibiting positive behaviors. However, considering the gender and age variables, carrying out studies involving children with normal development and investigating the effect of executive functions on social development and different developmental areas will pave the way for the emergence of different perspectives related to the field. In light of the findings of the present study, it is advisable in the educational environment to attach importance to activities aiming to improve the prefrontal cortex, and thus the executive function in addition to supporting children's developmental areas starting from the pre-school period so that children can continue their lives in a more advantageous position.

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