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Research Article

The relationship between executive function skills and motivation in preschool children

Şebnem Özge Özsoy[1], Hatice Dağlı[2] and H. Elif Dağlıoğlu[3]

[1]*Ministry of National Education, Merkez 65 Bin Dev Öğrenci Sevgi Kindergarten, Amasya, Türkiye (ORCID: 0000-0002-8002-7769)*
[2]*Kahramanmaraş Sütçü İmam University, Department of Preschool Education, Türkiye (ORCID: 0000-0002-0788-0413)*
[3]*Gazi University, Department of Preschool Education, Türkiye (ORCID: 0000-0002-7420-815X)*

This study aims to examine preschool children's executive function skills and motivation about various variables and determine the relationship between these two domains. A correlational survey method was employed in the study, and the study group consisted of 224 children aged 48–72 months attending preschool education institutions in Türkiye. The data collection tools used in the study were the Family Information Form, the Childhood Executive Function Inventory, and the Dimensions of Mastery Questionnaire for Preschool Children. The findings revealed that children's executive function skills significantly differed based on gender, age, and type of school attended. At the same time, their motivation significantly varied according to gender, the duration of preschool education, and the type of school attended. Furthermore, a significant relationship was found between children's motivation and executive function skills. It is recommended that educators adopt suitable pedagogical approaches that incorporate specific arrangements, activities, and instructional methods designed to foster the development of these skills in children.

Keywords: Executive function skills; Motivation; Preschool education

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1. Introduction

Executive functions are critically important skills that have both short- and long-term impacts on factors determining individuals' quality of life, such as physical and mental health, academic performance, and socioeconomic status (Aarnoudse-Moens et al., 2009; McClelland et al., 2014; Otterman et al., 2019). They encompass a range of cognitive abilities required to regulate behaviour, including inhibitory control, working memory, and planning. Executive functions are the abilities that allow individuals to guide and control their behavior. In educational settings, these skills help children follow instructions, stay focused, and manage their learning behaviors (McClelland et al., 2014). Observable from an early age, executive functions include planning, organizing, monitoring, and regulating cognitive and behavioral processes (Devine & Hughes, 2014).

It also encompasses a range of cognitive abilities necessary for regulating individual behavior. In the literature, these abilities are described as emotional control, focusing and sustaining attention, task orientation, prioritization, impulse control, and inhibitory control (Best et al., 2009).

Address of Corresponding Author

Şebnem Özge Özsoy, Ministry of National Education, Merkez 65 Bin Dev Öğrenci Sevgi Kindergarten, Yüce Street, Amasya, Türkiye.

✉ ozgeozsoyo@gmail.com

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Among these abilities, attention helps children filter incoming information, shift their focus from one task to another, and cope with distractions in a given context, while sustained attention is essential for planning, problem-solving, and executing goal-directed actions (Rothbart & Posner, 2005; Tominey & McClelland, 2011). Inhibitory control, on the other hand, is defined as the ability to suppress a dominant response and replace it with a less automatic but more adaptive behavior (McClelland et al., 2007). Miyake et al. (2000) proposed that executive functions consist of three core components in adults: working memory, inhibitory control, and cognitive flexibility. The first component, working memory, refers to the ability to manage cognitive processes in the mind, encompassing the retention and manipulation of information in short-term memory (Neitzel, 2018). It is essential for linking old and new information, understanding concepts, and establishing connections among increasingly complex pieces of information. For example, a child's ability to remember the rules in a storytelling game, retain instructions, match specific actions to corresponding rules, and recall previously narrated parts of the story are all related to working memory. The second component, inhibitory control, represents the capacity to suppress the effects of negative stimuli to complete a task (Durston et al., 2002; McClelland et al., 2007).

Additionally, inhibitory control involves pausing to think before starting a task, resisting impulsive reactions, focusing on important thoughts amid various stimuli, and exercising selectivity (Diamond, 2013; Neitzel, 2018). For instance, in a game, a child demonstrating inhibitory control would organize their contribution to a story based on the additions made by others before them, resist the impulse to add without prior organization, and appropriately take and stop their turn. The final component, cognitive flexibility, encompasses prioritizing tasks, focusing on goals, adopting new and different perspectives through abstract thinking, evaluating situations, and reordering priorities as they change (Diamond, 2014; Neitzel, 2018; Nguyen & Duncan, 2019). An example of cognitive flexibility is a child's ability to pay attention to the additions made to the story by the children before and after them, notice how the story evolves, and make relevant evaluations. In this context, it can be stated that the development of executive function skills accelerates the growth of children's cognitive, emotional, social, and language skills (Buss & Spencer, 2014; Dick & Overton, 2010).

Executive functions in early childhood are increasingly recognized for their contribution to children's developmental progress, forming a strong foundation for learning and success throughout life. These skills are essential not only for academic achievement but also for parenting, school readiness, social relationships, mental and physical well-being, and future social status (Diamond, 2013; Vitiello et al., 2011; Zelazo et al., 2016). In this context, during the preschool education process, it is evident that in addition to executive function skills, children’s motivation plays a crucial role in their participation and sustained engagement in activities. Particularly, the teacher’s approach, the methods and techniques they employ, and the pedagogical strategies used to guide children in exploring their curiosity and interests are essential for fostering motivation toward learning (Rachanioti et al., 2024; Schmeichel & Tang, 2015; Stucke & Doebel, 2024). Research has demonstrated that executive functions in early childhood influence later stages of life, supporting children's development and enabling them to acquire more effective social cognition, higher motivation, and positive social skills (Carlson, 2005; Diamond, 2013; Weiland et al., 2014). In this context, it is observed that, in addition to executive function skills, children's motivation also plays a positive role in their participation in and persistence with activities. Particularly in the learning process, the reinforcement of these behaviors through appropriate pedagogical approaches appears to enhance their motivation. In other words, executive function skills contribute positively to children’s learning processes, information processing speed, language skills, academic achievement, and motivation (Rachanioti et al., 2024; Schmeichel & Tang, 2015; Stucke & Doebel, 2024).

Motivation is a process driven predominantly by intrinsic energy, which initiates action, stimulates the desire to learn and act, directs behaviour toward a specific goal, regulates actions, and ensures the continuity of these behaviours. In other words, motivation is the force that guides

an individual toward a goal, triggers an action to achieve that goal (Ormrod, 2013), and enables behaviours aimed at fulfilling the individual's needs (Morgan, 1996). The motivation process can be intrinsic, stemming from internal factors such as needs, interests, desires, aspirations, expectations, and curiosity (intrinsic motivation), or extrinsic, arising from external factors like rewards, incentives, reinforcement, punishment, and pressure (extrinsic motivation) (Akbaba, 2006). A review of the literature emphasizes that children's motivation levels and types, which enable them to initiate and sustain an action, may vary due to factors such as the nature of their attachments, the presence of supportive conditions, and variables related to family or educational environments (Dağlı, 2022).

Studies have shown that children with high motivation levels are more likely to become successful and self-confident individuals (Huang & LingLay, 2017). Moreover, research highlights the critical role of supporting preschool children's social and emotional skills with motivation in ensuring their psychological and physical well-being and achieving academic success in later stages of life (Kılıç & Güngör Aytar, 2017). Consequently, it can be stated that the development of executive functions in early childhood facilitates increased cognitive awareness, desired patterns of behaviour and thinking, and the ability to manage these processes to achieve positive outcomes in later years (Viterbori et al., 2015). In general, motivation influences new and prior learning and executive function skills, strategies, and the reflection of behaviours on performance. In this context, motivation affects not only the learning behaviour of children but also its frequency and duration (Marulis & Nelson, 2021; Stucke & Doebel, 2024; Veraksa et al., 2022). Research indicates that children's beliefs about what they have done and what they can do in the future significantly influence their decisions about academic meaning-making (Kvintova et al., 2022). At the core of this belief lies the child's orientation toward their actions or future actions with proper motivation or being guided with appropriate motivation. In conclusion, studies have found that ensuring high motivation through intrinsic and extrinsic factors positively impacts an individual’s life. The presence of executive function skills, which are understood to be positively influenced by such motivation (Cartwright et al., 2020; Marulis & Nelson, 2021; Veraksa et al., 2022; Vergara-Lopez et al., 2013), and their sustainability are particularly critical during early childhood (Gray et al., 2019; Marulis & Nelson, 2021; Vergara-Lopez et al., 2013). Moreover, it is understood that during the preschool period, the pedagogical approaches adopted by adults, along with the environments and experiences provided to children, play a critical role in the development of their executive functions and motivation (Bronson, 2000). In particular, outdoor learning environments, games that facilitate peer interaction, settings that provide opportunities for social engagement and self-monitoring, and less structured activities within these contexts have been found to enhance children's intrinsic motivation. These settings also promote autonomy, inquiry, critical and creative thinking skills, and contribute positively to the development of executive functions (Ernst & Burcak, 2019; Kahriman Pamuk et al., 2025; McCree et al., 2018; Zamzow & Ernst, 2020).

It is noteworthy that numerous studies in the international literature have examined the relationship between children's executive function skills and motivation levels (Amukune & Jozsa, 2023; Gray et al., 2019; Marulis & Nelson, 2021; Schmeichel & Tang, 2015; Veraksa et al., 2022). However, considering the pedagogical approaches implemented in educational settings, it can be stated that further research is needed in this area to better understand the role and significance of executive function skills and motivation in children's developmental processes and their long-term impact on life outcomes.In parallel, the absence of studies in Türkiye investigating the relationship between executive function skills and motivation in children attending preschool institutions and the limited scope of such studies at the international level constituted the starting point for this research. In line with this, the present study aims to examine the executive function skills and motivation of children attending preschool education institutions based on specified variables and to understand the relationship between their executive function skills and motivation. To achieve this aim, the following research questions were addressed:

RQ 1) Do preschool children's executive function skills and motivation show significant differences based on gender, age, duration of preschool education, and type of school attended?

RQ 2) Is there a relationship between preschool children's motivation and executive function skills?

2. Method

This study, which examines the relationship between preschool children's executive function skills and motivation regarding various variables, is an example of the correlational survey model. Relational survey models explore the relationships between two or more variables without intervening in these variables (Creswell, 2005).

2.1. Study Group

The study group consisted of 224 children, comprising 112 girls and 112 boys, aged between 48 and 72 months. These children were selected from public preschools and kindergarten classes within primary schools affiliated with the Ministry of National Education in a city located in Türkiye's Central Anatolia Region. A maximum of two girls and two boys from each class were included in the study.

Table 1
Distribution of participants by demographic characteristics

Demographic Characteristics	*N*	*%*
Gender		
Female	112	50.0
Male	112	50.0
Age		
48-60 months	87	38.8
61-72 months	137	61.2
Duration of Preschool Education		
First year	154	68.5
Second year	64	28.4
Third year	6	2.6
Type of School Attended		
Public Preschool	124	55.4
Kindergarten within Primary School	100	44.6

As shown in Table 1, half of the children in the study group are female and half are male; 68.5% have received one year of preschool education, and 55.4% attend independent preschools.

2.2. Data Collection Tools

The data for this study were collected using the *Family Information Form* developed by the researcher, the *Childhood Executive Function Inventory,* and the *Dimensions of Mastery Questionnaire for Preschool Children.*

2.2.1. Family information form

The researchers prepared the *Family Information Form* to identify the demographic characteristics of the participating children. The form includes items related to the child's gender, age, duration of preschool education, and type of preschool institution attended.

2.2.2. Childhood executive functioning inventory [CHEXI]

CHEXI was developed by Thorell and Nyberg (2008) to evaluate the executive function skills of children aged 4–12. It is based on Barkley's (1997) model, which highlights inhibitory control, working memory, and self-regulation as critical executive function deficits in children with ADHD (Attention Deficit Hyperactivity Disorder). The CHEXI consists of 24 items rated on a 5-point Likert scale and is divided into two main dimensions (working memory and inhibition) and four subscales (working memory, planning, inhibition, and regulation). The scale is completed by parents or teachers, who are asked to evaluate the statements based on their applicability to the child, ranging from "1: Not at all true" to "5: Completely true" (Thorell & Catale, 2014; Thorell & Nyberg, 2008).

The Turkish adaptation of the scale was initially conducted by Kayhan (2010) with the parents and teachers of 1st and 2nd-grade children. Subsequently, the validity and reliability study for the teacher form in the 48–72-month age group was carried out by Arslan-Çiftçi et al. (2020). In their study, Arslan-Çiftçi et al. (2020) performed confirmatory factor analysis and item analyses, removing two items from the scale while maintaining its 24-item, two-factor structure. The Cronbach's Alpha reliability analysis revealed a reliability coefficient of .95 for the working memory subdimension and .91 for the inhibitory control subdimension. The test-retest reliability coefficients were .89 for working memory and .85 for inhibitory control. In the current study context, the data analysis yielded a reliability coefficient of .97 for the working memory subdimension and .90 for the inhibitory control subdimension.

2.2.3. Dimensions of Mastery Questionnaire for Preschool Children [DMQ18]

Jozsa and Morgan (2015) revised DMQ18, and validity and reliability studies were conducted for the DMQ18 version. The items on this 5-point Likert scale are rated from "1 = Not at all like him/her" to "5 = Exactly like him/her." Higher scores on the scale indicate higher levels of motivation. The DMQ18 consists of 39 items and 7 subscales: cognitive persistence, gross motor persistence, social persistence with adults, social persistence with peers, high-level pleasure, negative reaction, and general competence.

The Turkish adaptation of the DMQ18 was carried out by Özbey and Dağlıoğlu (2017). The translation process revealed that the items in the adapted version were consistent with those in the original scale. Confirmatory Factor Analysis validated the 7-factor structure of the scale. The Cronbach's Alpha reliability coefficients for the subscales ranged between .84 and .91. In contrast, the Spearman-Brown Split-Half reliability coefficients varied between .77 and .90. The test-retest reliability of the scale was found to be .85. In the present study, the Cronbach's Alpha reliability coefficients for the subscales were determined to range between .91 and .79.

2.3. Data Collection Process

During the data collection process, the necessary approval was obtained from the Ethics Committee of Gazi University (Date: 27.07.2022 /417706). Subsequently, the application forms to be used for collecting research data were submitted to the Sivas Provincial Directorate of National Education, and the required permissions and approvals were obtained (Date: 24.10.2022 / 61717460). With the necessary approvals in hand, the researchers visited the designated institutions. First, school principals or institution administrators were provided with detailed information about the study, followed by teacher meetings. The first researcher explained the Family Information Form, CHEXI, and the DMQ18 to the teachers. The forms were reviewed with the teachers, and their questions were answered. The teachers requested additional time to complete the forms more accurately. The forms were distributed to the teachers and were collected on predetermined dates by the first researcher.

2.4. Data Analysis

The data were collected using the CHEXI and DMQ18 scales. To assess whether children's scores on these scales differed significantly by demographic characteristics (gender, age, duration of preschool education, type of school), the normality of the data was tested separately for each scale using the Kolmogorov-Smirnov test. The results showed that the data for both scales were not normally distributed [DMQ18: Cognitive Persistence ($p < .05$), Gross Motor Persistence ($p < .05$), Social Persistence with Adults ($p < .05$), Social Persistence with Peers ($p < .05$), High-Level Pleasure ($p < .05$), Negative Reactions ($p < .05$), General Competence ($p < .05$); CHEXI: Working Memory ($p < .05$), Inhibitory Control ($p < .05$)]. Accordingly, non-parametric tests were used. The Mann-Whitney U test was applied for comparisons involving two independent variables, and the Kruskal-Wallis H test for comparisons involving more than two. Pairwise comparisons following the Kruskal-Wallis H test were conducted using the Mann-Whitney U test, with Bonferroni correction applied (.05 divided by the number of tests) to maintain an overall error rate of 5%. Spearman's rank-order correlation coefficient was used to examine relationships between the CHEXI executive function subdimension scores and the DMQ18 motivation subdimension scores.

3. Results

In this study, the executive function skills and motivation of preschool children were examined according to the relevant variables, and the findings regarding the relationship between children's executive function skills and motivation were addressed in line with the research questions. Tables 2 through 5 present the distribution of children's CHEXI scores by gender, age, preschool duration, and school type, respectively.

Table 2
Distribution of children's CHEXI scores by gender

Subscales / Gender	*N*	*Mean Rank*	*Sum of Ranks*	*U*	*z*	*p*
Working Memory						
Female	112	122.48	13595.50	5052.50	−2.42	.016
Male	112	101.61	11380.50			
Inhibitory Control						
Female	112	124.72	13843.50	4804.50	−2.93	.003
Male	112	99.40	11132.50			

As shown in Table 2, there was a significant difference in favor of female children on the Working Memory ($U = 5052.50$, $z = -2.42$, $p = .016$) and Inhibitory Control ($U = 4804.50$, $z = -2.93$, $p = .003$) subscales. Female children scored significantly higher than male children on both executive function skills.

Table 3
Distribution of children's CHEXI scores by age

Subscales / Age	*N*	*Mean Rank*	*Sum of Ranks*	*U*	*z*	*p*
Working Memory						
48-60 months	87	105.51	9179.50	5351.50	−1.20	.229
61-72 months	137	116.15	15796.50			
Inhibitory Control						
48-60 months	87	99.28	8637.50	4809.50	−2.36	.018
61-72 months	137	120.14	16338.50			

According to Table 3, age did not significantly affect Working Memory scores ($U = 5351.50$, $z = -1.20$, $p = .229$). However, a significant difference was found for Inhibitory Control ($U = 4809.50$, $z = -2.36$, $p = .018$), with children in the 61–72 months age group scoring higher than those in the 48–60 months age group.

Table 4
Distribution of children's CHEXI scores by duration of preschool education

Subscales / Duration	*N*	*Mean Rank*	*Kruskal-Wallis H*	*df*	*p*
Working Memory					
First year	154	107.01	3.55	2	.170
Second year	64	124.55			
Third year	6	1124.83			
Inhibitory Control					
First year	154	109.87	0.82	2	.663
Second year	64	118.09			
Third year	6	120.42			

As shown in Table 4, the duration of preschool education did not create a significant difference in Working Memory scores, $\chi^2(2, N = 224) = 3.55$, $p = .170$, or Inhibitory Control scores, $\chi^2(2, N = 224) = 0.82$, $p = .663$.

Table 5
Distribution of children's CHEXI scores by type of school attended

Subscales / Type of school	*N*	*Mean Rank*	*Sum of Ranks*	*U*	*z*	*p*
Working Memory						
Independent Preschool	124	103.83	12875.0	5125.0	−2.23	.026
Kindergarten within PS	100	123.25	12325.0			
Inhibitory Control						
Independent Preschool	124	105.97	13140.50	5390.50	−1.68	.093
Kindergarten within PS	100	120.60	12059.50			

Note. PS: Primary school.

According to Table 5, the type of school attended did not create a significant difference in Inhibitory Control scores ($p > .05$). However, a significant difference was found in Working Memory scores, $U = 5125.50$, $z = -2.23$, $p = .026$, with children attending kindergartens within primary schools scoring higher than those attending independent preschools.

Tables 6 through 9 present the distribution of children's DMQ18 scores by gender, age, preschool duration, and school type, respectively.

Table 6
Distribution of children's DMQ18 scores by gender

DMQ18 Subdimensions	*Gender*	*N*	*Mean Rank*	*Sum of Ranks*	*U*	*z*	*p*
Cognitive Persistence	Female	112	120.68	13516.50	5355.50	−1.89	.058
	Male	112	104.32	11683.50			
Gross Motor Persistence	Female	112	112.87	12641.50	6230.50	−0.08	.932
	Male	112	112.13	12558.50			
Social Persistence with Adults	Female	112	117.32	13140.00	5732.00	−1.12	.264
	Male	112	107.68	12060.00			
Social Persistence with Peers	Female	112	119.34	13366.00	5506.00	−1.58	.113
	Male	112	105.66	11834.00			
High Level Pleasure	Female	112	117.41	13150.00	5722.00	−1.14	.253
	Male	112	107.59	12050.00			
Negative Reactions	Female	112	111.17	12451.00	6123.00	−0.31	.758
	Male	112	113.83	12749.00			
General Competence	Female	112	123.54	13836.00	5036.00	−2.55	.011
	Male	112	101.46	11364.00			

Table 6 shows that gender did not produce a significant difference in Cognitive Persistence, Gross Motor Persistence, Social Persistence with Adults, Social Persistence with Peers, High-Level Pleasure, or Negative Reaction subscales ($p > .05$). However, a significant difference was found in the General Competence subscale, $U = 5036.00$, $z = -2.55$, $p = .011$, with female children scoring higher than male children.

Table 7
Distribution of children's DMQ18 scores by age

DMQ18 Subdimensions	*Age*	*N*	*Mean Rank*	*Sum of Ranks*	*U*	*z*	*p*
Cognitive Persistence	48-60 months	87	106.35	9252.50	5424.50	−1.13	.256
	61-72 months	137	116.41	15947.50			
Gross Motor Persistence	48-60 months	87	112.25	9766.00	5938.00	−0.04	.964
	61-72 months	137	112.66	15434.00			
Social Persistence with Adults	48-60 months	87	115.86	10080.00	5667.00	−0.62	.535
	61-72 months	137	110.36	15120.00			
Social Persistence with Peers	48-60 months	87	115.06	10010.50	5736.50	−0.47	.636
	61-72 months	137	110.87	15189.50			
High Level Pleasure	48-60 months	87	112.19	9760.50	5932.50	−0.06	.954
	61-72 months	137	112.70	15439.50			
Negative Reactions	48-60 months	87	113.70	9892.00	5855.00	−0.22	.825
	61-72 months	137	111.74	15308.00			
General Competence	48-60 months	87	106.82	9293.50	5465.50	−1.05	.295
	61-72 months	137	116.11	15906.50			

Table 7 shows that age did not produce a significant difference in any of the subscales ($p > .05$).

Table 8
Distribution of children's DMQ18 scores by duration of preschool education

DMQ18 Subdimensions	*Duration of Preschool Education*	*N*	*Mean Rank*	*Kruskal-Wallis H*	*df*	*p*
Cognitive Persistence	First year	154	107.42	3.66	2	.160
	Second year	64	121.81			
	Third year	6	143.50			
Gross Motor Persistence	First year	154	106.28	5.53	2	.063
	Second year	64	123.90			
	Third year	6	150.67			
Social Persistence with Adults	First year	154	106.13	8.52	2	.014
	Second year	64	121.95			
	Third year	6	175.25			
Social Persistence with Peers	First year	154	109.25	1.96	2	.375
	Second year	64	117.66			
	Third year	6	141.00			
High Level Pleasure	First year	154	111.94	0.58	2	.746
	Second year	64	111.99			
	Third year	6	132.33			
Negative Reactions	First year	154	111.16	0.53	2	.765
	Second year	64	114.10			
	Third year	6	129.83			
General Competence	First year	154	104.19	8.45	2	.015
	Second year	64	129.48			
	Third year	6	144.58			

As shown in Table 8, it was found that the duration of preschool education did not create a significant difference in cognitive persistence, gross motor persistence, social persistence with peers, high-level pleasure, and adverse reaction subdimensions ($p > .05$). However, significant differences were identified in the Social Persistence with Adults ($\chi^2(2.224) = 852$; $p = .014$; $p < .05$) and General Competence ($\chi^2(2.224) = 8.45$; $p = .015$; $p < .05$) subdimensions. In the Social Persistence with Adults subdimension, a significant difference was found in favour of children who attended preschool for three years compared to those in their first year of education (Adj. $p = .031$; $p < .05$). In the General Competence subdimension, a significant difference was observed in favour of children who attended preschool for two years compared to those in their first year (Adj. $p = .025$; $p < .05$).

Table 9
Distribution of children's DMQ18 scores by type of school attended

DMQ18 Subdimensions	*Type of School Attended*	*N*	*Mean Rank*	*Sum of Ranks*	*U*	*z*	*p*
Cognitive Persistence	Independent Preschool	124	106.05	13150.00	5400.00	−1.66	.096
	Kindergarten within Primary School	100	120.50	12050.00			
Gross Motor Persistence	Independent Preschool	124	108.70	13479.00	5729.00	−0.98	.327
	Kindergarten within Primary School	100	117.21	11721.00			
Social Persistence with Adults	Independent Preschool	124	105.75	13113.00	5363.00	−1.74	.082
	Kindergarten within Primary School	100	120.87	12087.00			
Social Persistence with Peers	Independent Preschool	124	110.13	13655.50	5905.50	−0.61	.540
	Kindergarten within Primary School	100	115.45	11544.50			
High Level Pleasure	Independent Preschool	124	100.80	12499.00	4749.00	−3.03	.002
	Kindergarten within Primary School	100	127.01	12701.00			
Negative Reactions	Independent Preschool	124	106.33	13184.50	5434.50	−1.59	.112
	Kindergarten within Primary School	100	120.16	12015.50			
General Competence	Independent Preschool	124	108.11	13405.50	5655.50	−1.13	.257
	Kindergarten within Primary School	100	117.95	11794.50			

Table 9 shows that the type of school attended did not produce a significant difference in Cognitive Persistence, Gross Motor Persistence, Social Persistence with Adults, Social Persistence with Peers, Negative Reactions, or General Competence subscales ($p > .05$). However, a significant difference was found in the High-Level Pleasure subscale, $U = 4749.00$, $z = -3.03$, $p = .002$, with children attending kindergartens within primary schools scoring higher than those attending independent preschools.

Table 10 presents the results of the Spearman's rank-order correlation analysis examining the relationship between children's motivation and executive function skills.

Tablo 10
Relationship between children's motivation and executive function skills

		Executive Function Skills (CHEXI)	
		Working Memory	*Inhibitory Control*
Motivation (DMQ18)	Cognitive Persistence	.54**	.43**
	Gross Motor Persistence	.44**	.21**
	Social Persistence with Adults	.24**	.11
	Social Persistence with Peers	.37**	.24**
	High Level Pleasure	.40**	.17*
	Negative Reactions	−.04	−.15*
	General Competence	.64**	.49**

Note. *($p < .05$).

Table 10 presents the results of the Spearman's rank-order correlation analysis examining the relationship between children's executive function skills and motivation. Working Memory showed positive and significant correlations with Cognitive Persistence ($r = .54$, $p < .05$), Gross Motor Persistence ($r = .44$, $p < .05$), Social Persistence with Peers ($r = .37$, $p < .05$), High-Level Pleasure ($r = .40$, $p < .05$), and General Competence ($r = .64$, $p < .05$). A positive but weak correlation was found between Working Memory and Social Persistence with Adults ($r = .24$, $p < .05$), while no significant relationship was observed with Negative Reactions ($r = -.04$, $p > .05$).

Inhibitory Control was positively and significantly correlated with Cognitive Persistence ($r = .43$, $p < .05$) and General Competence ($r = .49$, $p < .05$), and showed weaker but significant correlations with Gross Motor Persistence ($r = .21$, $p < .05$), Social Persistence with Peers ($r = .24$, $p < .05$), and High-Level Pleasure ($r = .17$, $p < .05$). A negative, low-level significant correlation was found between Inhibitory Control and Negative Reactions ($r = -.15$, $p < .05$). There was no significant correlation between Inhibitory Control and Social Persistence with Adults ($r = .11$, $p > .05$).

4. Discussion

This study explored how executive function skills and motivation are related in children attending preschool, considering various demographic factors.

4.1. Executive Functions

The study revealed a significant gender difference in preschool children's executive function skills, with girls outperforming boys in both Working Memory and Inhibitory Control subscales. This finding may reflect developmental differences that typically emerge between genders during early childhood. Girls' faster developmental progress, longer attention spans, richer communication through more frequent social interactions, and differences in the quality and structure of play may help explain this result. Consistent with these findings, Kayhan et al. (2018) reported that girls are more proficient than boys in recognizing and regulating emotions, and several studies have shown that girls outperform boys in executive function skills due to earlier developmental progress (Camerota et al., 2018; Veraska et al., 2022). However, other studies have reported contradictory results (Blasiman & Was, 2018; Camerota et al., 2018), and some have found no significant gender differences (Harvey, 2011; Öğütcen, 2020). Such inconsistencies may stem from differences in sample characteristics across studies.

Regarding age, no significant difference was found in Working Memory scores, whereas children aged 61–72 months scored significantly higher in Inhibitory Control. This may reflect age-related improvements in attention, focus, and the ability to avoid negative situations. Given that Inhibitory Control is among the first executive function components to develop and forms the core of executive functioning (Barkley, 1997; Diamond, 2002; Diamond & Goldman-Rakic, 1989; Garon et al., 2008), this finding aligns with the literature. Prior studies similarly report positive age-related differences in executive function skills (Carlson, 2005; Camerota et al., 2018; Nilsen et al.,

2017). The absence of a significant age effect on Working Memory is consistent with findings that age-related increases in working memory are difficult to detect in early childhood (Gathercole et al., 2004).

The duration of preschool education did not significantly affect executive function skills, in line with previous studies (Karabekmez & Akman, 2022; Öğütcen, 2020). This may be due to factors beyond school duration, such as the quality of parent–child communication, teacher–child interactions, pedagogical approaches, and the nature of classroom and extracurricular activities (Anderson, 2002; Daniels & Peters, 2015). In addition, The Century of Türkiye Maarif Model, which was put into effect in 2024, places more emphasis on out-of-school learning environments, game-based practices, interaction with nature, social responsibility, participation in society, and pedagogical activities integrated with families (Ministry of National Education [MoNE], 2024). It can be argued that this model prioritizes skill acquisition over preschool education, placing greater emphasis on supporting children's attention, planning, and flexibility skills. Some studies suggest that teachers may repeat activities from previous years without adapting them to children's developmental levels, which could also contribute to this result (Dağlı & Dağlıoğlu, 2021; Pekince & Avcı, 2016).

When analyzed by school type, no significant difference was found in Inhibitory Control. However, children attending kindergartens within primary schools scored significantly higher in Working Memory. This may be due to these classrooms' focus on school readiness and the presence of older peers, which could positively influence executive function development (Göğebakan, 2011; Kaya & Köse, 2020; Yapıcı & Ulu, 2010). Additionally, the relative lack of materials and environmental suitability in kindergartens within primary schools compared to independent preschools (Günindi, 2011) may encourage children to seek creative solutions, fostering cognitive flexibility and advanced mental representations. Given that executive functions are essential for literacy, mathematics achievement, and socio-emotional development (McKinnon & Blair, 2019; Nguyen & Duncan, 2019), supporting these skills is crucial. Identifying children with advanced potential and providing educational opportunities aligned with their interests and abilities can further promote their development (Dunn et al., 2020; Rachanioti et al., 2025). In this context, teachers' ability to design learning environments responsive to children's developmental characteristics, interests, and curiosity plays a vital role in enhancing both executive functions and motivation.

4.2. Motivation

The analyses revealed that motivation scores differed by gender only in the General Competence subscale, with girls scoring higher than boys. This may be explained by girls' faster developmental progress, stronger performance and comprehension abilities, and their efforts toward social adaptation (Lepola et al., 2005; Ural et al., 2015). Prior studies have shown that girls tend to be more persistent, demonstrate greater proficiency in attention and self-regulation skills, engage more in social play, and exhibit stronger control abilities (Acar et al., 2019; Veijalainen et al., 2017). Both biological and environmental factors likely contribute to girls' higher social skills, which in turn may positively influence their motivation. Consistent with these findings, numerous studies have reported higher achievement motivation among girls compared to boys (Kalaylı & Gültekin-Akduman, 2024; Öner & Özbey, 2023; Özbey, 2018; Taghinejad et al., 2021; Veraksa et al., 2022).

No significant differences were found in motivation across age groups for any subscale. This may be due to the socially influenced nature of motivation, as well as environmental factors that support motivation consistently across early childhood, regardless of age. The structuring of home and school environments to meet children's interests and the relatively narrow age range of the sample may also explain this finding. Similarly, Özbey (2018) reported no age-related differences in motivation. However, many other studies have shown that motivation generally increases with age (Huang & LingLay, 2017; Kalaylı & Gültekin-Akduman, 2024; Morgan et al., 2017; Özbey & Dağlıoğlu, 2017). For example, Sigman et al. (1987) and Mischel et al. (1989) found that older

children are better at directing attention, achieving cognitive goals, showing persistence, coping with frustration, and exercising self-discipline.

When examined by duration of preschool attendance, no significant differences were found in most subscales of motivation, except for Social Persistence with Adults and General Competence. Children who attended preschool for three years showed higher Social Persistence with Adults, and those who attended for two years had higher General Competence compared to those with only one year of preschool. This suggests that longer preschool attendance may enhance children's motivation by exposing them to more academic experiences, supporting social adaptation, fostering a sense of school belonging, and strengthening social relationships (Gültekin, 2008; Yılmaz & Tepeli, 2013). These findings align with other studies showing higher motivation scores among children who attended preschool for two or more years (Köyceğiz & Özbey, 2019).

Finally, the type of school attended created a significant difference only in the High-Level Pleasure subscale, favoring children in kindergartens within primary schools. This may reflect the greater focus on school readiness activities, structured pedagogical approaches, teacher attitudes, and disciplinary practices typical of these settings (Öner & Özbey, 2023). Additionally, opportunities for interaction with older peers and the need for independent problem-solving may contribute to higher motivation levels. These results are consistent with findings by Öner and Özbey (2023), who reported that children attending kindergartens within primary schools demonstrated higher motivation and stronger social information processing skills compared to those in independent preschools.

4.3. Relationship between Motivation and Executive Functions

The analysis revealed significant correlations between children's motivation and executive function subscales. The Working Memory subscale showed positive, moderate correlations with Cognitive Persistence, Gross Motor Persistence, Social Persistence with Peers, High-Level Pleasure, and General Competence. It also demonstrated a positive but low-level correlation with Social Persistence with Adults, while no significant relationship was observed with Negative Reactions.

The link between Working Memory and persistence may reflect children's positive attitudes in sustaining communication and interaction with peers and adults, as well as their effective use of executive function skills (Arslan-Çiftçi, 2020). The mental representations involved in executive functioning likely support children in managing daily and academic tasks and building social relationships. Similarly, Cartwright et al. (2020) found that cognitive intrinsic motivation is associated with skills such as reading comprehension, language understanding, and executive functioning. Other studies support the present findings, indicating that higher motivation levels are linked to stronger executive function skills and fewer problem behaviors (Gray et al., 2019; Schmeichel & Tang, 2015; Veraksa et al., 2022).

Children invest cognitive and physical effort in completing tasks, selectively filtering stimuli, and experiencing satisfaction upon task completion, which in turn increases motivation (Diamond, 2013; Veraksa et al., 2022). Vergara-Lopez et al. (2013) similarly noted that improvements in attention, focus, and the integration of prior knowledge enhance the time and effort children devote to tasks. Veraksa et al. (2022) further observed that children with stronger executive function skills tend to act more independently, displaying higher motivation for learning.

Inhibitory Control showed positive, moderate correlations with Cognitive Persistence and General Competence, as well as low-level positive correlations with Gross Motor Persistence, Social Persistence with Peers, and High-Level Pleasure. A low-level negative correlation was found with Negative Reactions, while no significant relationship was observed with Social Persistence with Adults.

The significant association between Inhibitory Control and the Cognitive Persistence and General Competence subscales likely reflects children's ability to focus on mastering tasks and striving for success. The satisfaction derived from achieving goals may enhance motivation across related subscales (Akbaba & Aktaş, 2005). Vergara-Lopez et al. (2013) reported that as children

improve their ability to resist impulsivity and regulate emotional responses, they devote greater effort to tasks, which in turn boosts motivation and emotional regulation. These findings highlight the link between executive functioning and motivation, supporting the notion that stronger executive skills promote both social and academic motivation (Veraksa et al., 2022).

The negative correlation between Inhibitory Control and Negative Reactions suggests that as inhibitory skills develop, children are less likely to display adverse responses. Barkley (1997) and Gray et al. (2019) emphasized that suppressing undesirable behaviors or thoughts requires the combined use of executive functions and motivation. Children who can act without impulsivity are better able to persist, regulate attention, filter irrelevant information, and organize their responses. These skills, shaped by intrinsic motivation, advance in parallel with executive function development.

5. Conclusion and Recommendations

In conclusion, the findings of this study, supported by the relevant literature, highlight significant relationships between the subdimensions of executive function skills and motivation across variables such as gender, age, duration of preschool education, and type of school attended. The result that children with stronger executive function skills also demonstrate higher levels of motivation underscores the close link between executive functioning and motivation. Given that the subdimensions of motivation encompass both cognitive and emotional processes, this relationship appears consistent and meaningful.

The primary limitation of the study is that it was conducted with children aged 48–72 months attending preschool institutions affiliated with the Ministry of National Education in a province of Türkiye's Central Anatolia Region. The study relied solely on teachers' reports to assess both executive functions and motivation. This reliance on a single source limits the scope of perspectives captured. To gain a more comprehensive understanding, it is important to integrate insights from all components of the educational environment, accounting for pedagogical variations, contextual opportunities, and effective, formative assessment practices. Future research would benefit from using measurement tools designed for teachers, parents, and children to better reflect children's skills and developmental progress. Additionally, identifying the variables that most influence executive function and motivation during early development and conducting cross-cultural comparisons would provide valuable insights.

It is also recommended that future studies broaden their scope to include private and community-based preschool education settings, in addition to public institutions. Combining qualitative research methods with quantitative approaches could offer deeper insights and support the development of comprehensive research designs. Furthermore, identifying effective strategies, activities, and techniques for both teachers and parents to foster children's motivation and executive function skills would be highly valuable. Providing practical training opportunities, enhancing access to relevant resources, and improving coordination between family and school-based support systems are also recommended to strengthen efforts in this area.

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Data availability: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethical statement: This study was approved by the Scientific Research and Publication the Ethics Committee of Gazi University on 27 July 2022 with the approval code: E-77082166-302.08.01-417706. During the research process, participants were provided with detailed information about the purpose, procedures, and potential risks of the study, and their informed consent was obtained. Participants were informed that their participation was voluntary.

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