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Investigating the Relationship Between Executive Functions and Social Skills in Children with Externalizing Behavior Problems

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ABSTRACT

Externalizing behavior problems refer to a set of symptoms that can lead to significant psychological problems over time. These disorders affect a person's behavior as well as their physical, cognitive, and social abilities, disrupting their functioning in social, occupational, and academic areas. The present study investigated the relationship between executive functions and social skills in children's play with externalizing behavior problems. This research was conducted in a descriptive manner, and its statistical population included all children in Tehran in the academic year 2024-2025. In this study, using a multi-stage random sampling method, several schools were selected from district 6 of Tehran, and 130 children whose parents or teachers were willing to participate in the research and were identified as children with externalizing behavior problems according to the results of the Achenbach Child Behavior Checklist questionnaire (CBCL) were selected as the sample. Data were collected using the BRIEF Executive Function Questionnaire and a researcher-made Social Skills Questionnaire, and data analysis was performed using single-variable regression. The results showed a positive and significant relationship between the components of executive functions (including set shifting, working memory, inhibitory control, and inhibition) and the social skills of children with externalizing behavior problems (P value = 0/0001). Therefore, it is emphasized that by using strategies to promote executive functions and social skills in the play process, it is possible to prevent the formation and continuation of externalizing behavior problems in preschool children.

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Introduction

Executive functions refer to high-level cognitive processes that regulate goal-directed behavior and are primarily associated with the frontal lobe. These functions include response inhibition, interference control, working memory updating, and set shifting (Friedman & Miyake, 2017). Working memory provides temporary storage and manipulation of information (Baddeley, 1992), while set shifting allows individuals to switch between different tasks or mental sets (Monsell, 2021). Interference control helps suppress irrelevant information (Nigg, 2000), and response inhibition is the ability to delay or prevent impulsive reactions (Barkley, 1999).

Executive functions play a vital role in social skills and influence the development of internalizing and externalizing behaviors (Wang & Liu, 2020). Deficits in executive functions are associated with aggression and other problematic behaviors in peer interactions (Sulik & Obradovic, 2017). Understanding these cognitive processes and their impact on social development is essential for addressing behavioral challenges in children.

Social skills encompass two key components: specific behaviors required for establishing relationships and competencies that enable effective social interactions (Baron & Tang, 2009; Baron, 2004; Segrin & Kinney, 1995). These skills are fundamental to human development, and deficiencies in social competence can negatively affect academic progress, interpersonal relationships, mental health, and long-term behavioral outcomes (Özerk et al., 2021).

Emotional-behavioral disorders affect various aspects of functioning, including cognitive, physical, and social domains, leading to difficulties in multiple life areas (Michel et al., 2019). These disorders are commonly classified into internalizing and externalizing problems (Burt, 2012). Externalizing behavioral problems, which include aggression, rule-breaking, conduct disorder, and oppositional defiant disorder, are of particular concern (Donolato et al., 2022). Behavioral disorders, with an estimated prevalence of less than 1% among school-aged children and adolescents, pose significant challenges to mental health (U.S. Department of Education, National Center for Education Statistics, 2018).

Research suggests that school-aged children with disruptive behavior disorders and peer-related aggression may benefit from individual and technology-based social skills training (Gortz-Dorten et al., 2022). Additionally, empathy is positively correlated with emotional and cognitive regulatory functions, while aggression and defiant behaviors are associated with deficits in executive functions. In contrast, rule-breaking behaviors are negatively correlated with emotional empathy, behavioral skills, and executive functions (Christophani et al., 2020). Children with behavioral problems often face academic difficulties, challenges in family and school settings, and long-term social costs (Okano et al., 2020).

Existing research highlights the mediating role of working memory in social functioning among children with attention-deficit/hyperactivity disorder compared to typically developing peers (Rodrigues & Hestenes, 2024). Furthermore, time spent in social environments has been identified as a potential means of enhancing children's cognitive, social, and academic abilities (Olst et al., 2023). Empirical findings suggest that children receiving executive function-based interventions demonstrate improvements in social competence and reductions in behavioral problems (Romero-Lopez, 2020; Enzmann et al., 2021).

Moreover, a study by Motamedi et al. found that inattention (but not hyperactivity) is associated with poor executive functioning, social isolation, and aggression, and that executive function skills mediate the relationship between inattention and both aggressive behavior and social isolation. Also, hyperactivity (but not inattention) was specifically associated with reaction to rejection, and each uniquely contributed to the reinforcement of aggressive acts (Motamedi et al., 2016).

On the other hand, in a study by Zhang and Pang entitled "The Longitudinal Reciprocal Relations Between Reading, Executive Function, and Social-Emotional Skills: Maybe Not for

All," part of the results showed that there were no longitudinal reciprocal relationships between executive functions and social skills in any of the three groups studied in this research.

Despite these insights, the precise nature of the relationship between components of executive functions and social skills in children with externalizing behavior problems has not yet been fully explored. While past studies have provided valuable perspectives, there are significant gaps in understanding how specific components of executive functions (working memory, set shifting, interference control, and response inhibition) interact with the development of social skills in this population.

Therefore, it is essential to investigate how executive functions influence the development of social skills. By identifying cognitive deficits and their impact on social interactions, this research can (1) inform early intervention strategies, (2) support educators and clinicians by tailoring interventions, and (3) ultimately improve long-term outcomes for children with externalizing behavior problems. In this vein, this study aimed to investigate the relationship between components of executive functions and social skills in children with externalizing behavior problems.

Method

The present research method is of the descriptive type, and the method of data collection in this research is descriptive. The statistical population of the present study includes all children in Tehran in the academic year 2024-2025 who are studying. Several schools were selected by random sampling method from the 6th district of Tehran, and finally, after the implementation and interpretation of the CBCL questionnaire, 130 children with externalizing behavioral problems whose parents or teachers were willing to cooperate and participate in the research were considered as the sample. In this research, the children were in the age group of 6 to 8 years, including both genders; so that 50.8% of them were boys and 49.2% were girls.

At first, the social skills questionnaire was prepared in the game, and its components were defined and adjusted based on the existing research literature. In order to adjust the main items of this questionnaire, its face validity was checked by experts and irrelevant items were removed. Then, the questionnaire was implemented in a pilot sample and its validity and reliability were measured using SPSS software.

After that, the questionnaires were delivered to teachers and parents to confirm the externalized behavioral problems. After confirming the existence of externalized behavioral problems, executive functions questionnaires and researcher-made questionnaires in the field of social skills were made available to parents and teachers.

Measurement tools

Achenbach Child Behavior Checklist-Parent Form (CBCL) questionnaire: This questionnaire was developed by Rescorla and Achenbach in 2001 and evaluates the problems of children and adolescents aged 6-18 years in 8 different factors such as internalized and externalized from the perspective of parents and teachers. The duration of its implementation is 20 to 25 minutes. This questionnaire has 113 questions and answering the questions is done based on a three-option Likert scale from 0 to 2. Score 0 is assigned to cases that have never been observed, and score 2 is assigned to cases that are mostly observed in the person's behavior. The validity and reliability coefficient of various forms through Cronbach's alpha of 0.97 and test-retest reliability of 0.94 have been reported. (Achenbach and Rescorla, 2001).

The translation and normalization of this questionnaire was done for the first time by Tehrani Doost et al. in (2002). Studies in later years showed that the reliability coefficient using Cronbach's alpha was 0.63 to 0.95, test-retest was 0.32 to 0.67, and the agreement coefficient between respondents was in a range between 0.90 and 0.67%. According to the numbers obtained in this research, they concluded that this questionnaire has desirable and high values of validity and reliability and can be used with confidence as a tool to measure behavioral-

emotional disorders. (Minaei, 2004). The validity and reliability coefficient of this questionnaire in this research is equal to 0.849.

Researcher-made questionnaire of Social Skills in play: This questionnaire includes 12 items, and the answers to its questions are based on a four-option Likert scoring scale, and the scores are scaled from 1 to 4. The questionnaire includes two reverse items (items 2 and 4), and its scores vary from 12 to 48, a score of 36 and lower indicates a deficiency in social skills, and a score of 37 and higher indicates high and appropriate social skills. In this research, Cronbach's alpha was used to evaluate the reliability of the social skills questionnaire, in such a way that first in the pilot sample and then in the main sample, the inappropriate items were corrected or removed, and the reliability of the questionnaire was checked again and was reported to be equal to 0.963. By examining the results of Cronbach's alpha in the main sample, due to reporting high and very close correlation values in the main sample, there is no need to remove another item.

To determine the suitability of the test using the factor analysis method, the Kaiser-Meyer-Olkin and Bartlett tests were used. The value of the Kaiser-Meyer-Olkin test statistic and the significance level of the Bartlett test indicate that the items of the questionnaire are suitable for this method. The obtained values are as follows: The KMO test is equal to 0.941 and the Bartlett test with a significance level of 0.001 has been reported.

After confirming the suitability of the factor analysis method, the varimax rotation method was used to investigate the existence and number of subscales. The results of the scree plot showed that only one of the items had a special value above one, and as a result, this questionnaire has only one factor, which shows that only one subscale is measured in this test.

BRIEF Executive Functions Questionnaire: This questionnaire was designed in 2000 by Gioia, Isquith, Guy, and Kenworthy. This questionnaire has 86 questions that are scored based on the Likert scale, which examines the child's behavior at home and school, which is designed to explain the behavioral performance of children's executive functions at the age of 5 to 18 years. The reliability coefficients for the parent form and the teacher form are above 0.90, and for the self-report form are above 0.80. (Gioia et al., 2000). The duration of this test is 10 to 15 minutes.

This tool is scored by the Likert scale in such a way that the option never gets a score of zero, the option sometimes gets a score of 1, and the option always gets a score of 2. The lowest score of a person in this tool is 86, which means the existence of executive functions at a very good level, on the other hand, the maximum score in this questionnaire is 172, which is considered as a weak level of executive functions. While a score between 86 and 130 is considered as an average level of executive function. This questionnaire measures components such as working memory, set shifting, interference control, and response inhibition. The reliability of this questionnaire reported values of 0.87 to 0.94 (Nodehi et al., 1395). The reliability of the BRIEF questionnaire by Cronbach's alpha is reported to be equal to 0.969.

Inclusion criteria

- Informed consent to participate in the research.
- Availability of the child's teacher, parents, or primary caregivers.
- Being in the age range of (6) to (8) years.
- Receiving a diagnosis of the presence of externalizing behavioral problems/disorders.

Exclusion criteria

- Receiving treatment methods concurrent with the research.
- Participating in another related scientific research.
- Having a diagnosis of concurrent disorders (learning disability, intellectual disability, autism, mood disorders).

Results

In the present study, the data were analyzed using the univariate regression statistical method at the significance level of $\alpha = 0.01$.

Table 1. Statistical indicators related to the "Gender" variable

Levels	Frequency	Percentage
Female	64	49.2
Male	50	50.8
Total	130	100

Table 2. Statistical indicators related to the "Age" variable

Variable	Mean	Standard Deviation
Age	6.455	0.5631

According to the information in Tables 1 and 2, the participants included 64 girls and 50 boys with a mean age of 6.455 (SD = 0.5631).

Table 3. Statistical indicators related to the variables "Executive Functions", "Inhibition", "Set Shifting", "Interference Control", "Working Memory" and "Social Skills"

Components	Central Tendency Indicators	Dispersion Indicators	Distribution Indicators
	Mode	Median	Mean
Inhibition	28	28	27.85
Set Shifting	22	22	22.22
Interference Control	18	18	18.20
Working Memory	20	20	20.18
Executive Functions	130	131	132.38
Social Skills	29	30	30.55

Table 3 reports the mean and standard deviation in different variables. In this regard, the assumption of normality of data should also be checked. In this research, the significance of the normality of the data has been evaluated using the Kolmogorov-Smirnov test.

Table 4. Results of the Kolmogorov-Smirnov test to check the establishment of the normality assumption of the "Executive Functions" and "Social Skills" variables

Component	N	Most Differences	Z Value	Sig
Inhibition	130	0.07	0.84	0.474
Set Shifting	130	0.11	1.30	0.067
Interference Control	130	0.13	1.33	0.064
Working Memory	130	0.13	1.28	0.066
Executive Functions	130	0.08	0.94	0.331
Social Skills	130	0.04	0.55	0.914

Based on the reports in Table 4, the non-significance of this test indicates the confirmation of this assumption and the use of this statistical method.

Table 5. Pearson correlation coefficient matrix in the components of "Executive Functions" with "Social Skills"

	Social Skills
Executive Functions	Coefficient: 0.59
Inhibition	Coefficient: 0.39
Set Shifting	Coefficient: 0.40
Interference Control	Coefficient: 0.34
Working Memory	Coefficient: 0.59

According to the results obtained from the correlation statistical method, the relationship between social skills and executive functions and its related components, according to Table 5, is reported to be significant and positive. In particular, the correlation of the executive functions variable with social skills is equal to 0.59, the correlation of the inhibition component with social skills is 0.39, the set shifting component with social skills is 0.40, the interference control component with social skills is 0.34, and finally, the correlation of the working memory component with social skills is also reported to be 0.39. These results indicate the positive and significant effect of executive functions on social skills.

Table 6. Summary table of the model in the relationship between the Executive Functions variable and Social Skills

	R	R2	Standard Error of the Estimate
Executive Functions and Social Skills	0.59	0.79	3.98
Inhibition and Social Skills	0.39	0.15	8.18
Set Shifting and Social Skills	0.39	0.15	8.18
Interference Control and Social Skills	0.34	0.11	8.35
Working Memory and Social Skills	0.40	0.16	8.14

As mentioned, the univariate regression statistical method has been used to investigate the objectives of the present study. According to Table No. 6, the values of the coefficient of determination (R^2) for executive functions, the inhibition component, set shifting, interference control and working memory with social skills are equal to 0.79, 0.15, 0.11, 0.16 and 0.16%, respectively. For example, a coefficient of determination of 11% means that 11% of the changes in social skills are due to the set shifting variable.

Table 7. Results of univariate Regression

	Univariate Regression to predict "Social Skills" through "Executive Functions"
Source of variation	Sum of squares
Regression	8107.01
Residual	2035.10
	Univariate Regression to predict "Social Skills" through the "Inhibition" component
Source of variation	Sum of squares
Regression	1560.22
Residual	8581.90
	Univariate Regression to predict "Social Skills" through the "Set Shifting" component
Source of variation	Sum of squares
Regression	1558.81
Residual	2035.10
	Univariate Regression to predict "Social Skills" through the "Interference Control" component
Source of variation	Sum of squares
Regression	1650.85
Residual	8491.27
	Univariate Regression to predict "Social Skills" through the "Working Memory" component
Source of variation	Sum of squares
Regression	1200.04
Residual	8942.07

In this research, the significance of this statistical method is done through the statistical test of analysis of variance, which is significant in Table 7 and is reported to be equal to 0.0001, at the level of $\alpha = 0.01$.

Table 8. Table of Regression coefficient results

Predictor variable	Criterion variables	Beta coefficient	T level	Significance level
	Social Skills			
Executive Functions		0.59	22.58	0.0001
Inhibition		0.39	4.82	0.0001
Set Shifting		0.39	4.82	0.0001
Interference Control		0.40	4.98	0.0001
Working Memory		0.34	4.14	0.0001

In this regard, according to Table 8, the Beta coefficient is reported, which in relation to the social skills variable in the relationship of the executive function variable, the inhibition component, set shifting, interference control and working memory are reported to be 0.59, 0.39, 0.34, 0.40 and 0.39, respectively.

Discussion and Conclusion

This research was designed with the aim of identifying the relationship between social skills and executive functions and its components (inhibition, set shifting, interference control and working memory) in 6 to 8-year-old children with externalizing behavioral problems. The results obtained indicate that high levels of executive functions are associated with appropriate

social behaviors in this age group. The findings especially emphasize the importance of executive functions and its components in social relationships and confirm the main hypothesis of the research. These results are consistent with the achievements of some researchers such as Rodrigues and Hestenes (2024) and Olst et al. (2023), but are inconsistent with the findings of Zhang and Pang's research (2023), which reported contradictory results.

Based on the findings, it is suggested that in educational and therapeutic programs, teaching social skills, especially for children with deficits in executive functions, should be considered. This research opens the way for future studies and shows the need for deeper and longitudinal studies in the field of identifying the factors affecting changes in these variables. In particular, emphasis on comparative and longitudinal studies can provide a better understanding of this area. Also, it should be noted that the studied sample constitutes a relatively limited representation of the entire target population, and therefore, generalizing the results requires caution. This research can be a starting point for future research on the factors affecting externalizing behavioral problems and help to develop effective interventions in this field.

Declarations

Author Contributions

All authors contributed actively to the conception, design, and execution of the research.

Data Availability Statement

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

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Ethical considerations

All procedures performed in studies involving human participants were in accordance with the ethical standards of University of Tehran research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Ethic approval has been obtained before conducting the research.

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Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this research.

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