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Investigating the Effectiveness of "Executive Functions Educational" Package on Social Skill of Pre-school Children of the Age of 5-6 Years Old

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Abstract

The present study was conducted with the aim of investigating the effectiveness of the executive functions training package on the social skills of preschool children. The research was semi-experimental with a pre-test-post-test design with a control group and a two-month follow-up period. The research community was the new students who enrolled in preschool in 1401-1402. Among the preschool centers in Tehran, two centers were randomly selected as experimental and control groups. Among these two centers, 38 subjects were randomly assigned to two experimental and control groups. The parents of the new students of both groups answered the Gresham and Elliot social skills questionnaire before the experimental intervention. After the experimental group underwent 20 sessions of training related to executive functions and response inhibition, the parents of both groups responded to the mentioned questionnaire. Two months after the completion of the training, a follow-up test was conducted on both experimental and control groups. The results of mixed variance analysis, taking into account the relevant presuppositions, showed that different results were obtained from the combination of test levels and group levels, and it can be said that training based on response inhibition can play an effective role in improving the social skills of new learners.

Keywords: social skills, executive functions, preschool

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1. Introduction

The development of social skills in preschool-aged children is crucial for their overall growth and well-being. Social skills encompass various abilities, including cooperation, self-control, and initiating communication.(Maleki et al., 2019) Research indicates that children who possess strong interpersonal communication skills tend to be more successful in social interactions (Riggs et al., 2006).

Numerous studies have explored the impact of executive functions on children's social skills, revealing that these functions are significant predictors of social competence(Ahmadi et al., 2017). For instance, (Bustamante et al., 2023) found that training in impulse control plays a critical role in predicting social and emotional competence in preschoolers. Similarly, Gansleinkamp et al. (2011) demonstrated a correlation between advanced executive functions and higher levels of social competence(Ganesalingam et al., 2011). Moreover, Mair-Salvi (2012) highlighted the importance of cognitive-social information, such as emotional states and individual traits, for effective social interaction(Rivers et al., 2020).

However, some researchers have identified a link between deficits in executive functions and increased aggressive and negative behaviors in preschoolers. These emotional-social skills also mediate the relationship between executive functions and academic progress (Denham et al., 2012). Specifically, difficulties in social skills and executive functions may be associated with behavioral manifestations of these deficits. Research by Bertolín. (2023) suggests that executive function issues in childhood can lead to reduced social and communication skills in adulthood(Bertolín-Guillén, 2023).

Given these insights, the importance of executive function training during preschool years is evident due to physiological changes in the brain, particularly in the prefrontal cortex. While the physiological basis for these developmental changes is established, less attention has been given to the impact of environmental factors, such as family-based interventions, on these skills (Casey et al., 2005; Segundo-Marcos et al., 2022)

Recent studies support the idea that executive function training, combined with parental involvement, can significantly enhance children's social skills (Koşkulu-Sancar et al., 2023).Research, including studies by (Miyake et al., 2000) and (Kimberly & Cook, 2008), has shown that behavioral intervention programs can effectively reduce impulsive behaviors and improve self-control in children.

In light of these findings, the present study aims to design an executive function training package focused on response inhibition and assess its effectiveness on preschoolers' social skills. This experimental intervention involves not only providing executive function training to the children but also engaging their parents through parenting sessions, exercise materials, and behavioral and educational consultations. The primary objective of this research is to develop and evaluate the impact of the executive function training package on improving preschoolers' social skills.

2. Methodology

This study employs an experimental design with a pre-test, post-test, and follow-up assessment, incorporating a control group. The target population for this research includes preschool children aged 5-6 years in Tehran, who were enrolled in preschools during the 2022-2023 academic year. For sampling purposes, District 8 was randomly selected from among the educational districts in Tehran. Subsequently, two preschools within this district were randomly chosen. One preschool was assigned as the experimental group and the other as the control group.

According to (Brysbaert, 2019), a minimum sample size of 15 participants is required for experimental research. Therefore, 20 participants from each of the experimental and control groups were randomly selected, resulting in a total of 40 preschoolers participating in the study.

Before the experimental intervention, parents of children in both the experimental and control groups were asked to complete the Gresham and Elliott Social Skills Questionnaire regarding their child. The experimental group then underwent the intervention, receiving 20 one-hour training sessions, three times a week, based on the executive function training package. In contrast, the control group only received the standard preschool curriculum.

After the completion of the training, parents of both groups were asked to fill out the Social Skills Questionnaire again. Given that this study includes a follow-up period, parents from both groups completed the questionnaire once more two months after the end of the intervention.

For data description, descriptive statistics including means, standard deviations, and relevant tables were used. For inferential statistics, mixed analysis of variance (ANOVA) was employed, incorporating one within-subjects factor and one between-subjects factor. Data were analyzed accordingly, and the preschoolers in both groups were evaluated at three stages: pre-test, post-test, and follow-up.

Measurement Tools

Gresham and Elliott Social Skills Rating Scale (1990)

The Social Skills Rating Scale is a reference tool used to assess social functioning in children from preschool through 12th grade. The scale includes three specific forms for evaluation by parents, teachers, and students, designed for the preschool, elementary, and secondary school levels. The parent form consists of 52 items, with 40 items related to social skills and 12 items related to behavioral problems. Each form can be used independently or in combination.

Gresham and Elliott reported the reliability of this scale as 94% using test-retest and Cronbach's alpha methods (Gresham & Elliott, 2008). In a study conducted by Shahim on a group of children with developmental delays, the reliability of the questionnaire was reported to range from 77% to 92%, indicating a very high level of reliability comparable to the main system's coefficients. The split-half reliability was calculated using the Spearman-Brown formula for the two sections of the scale, with a coefficient of 86% for social skills (Shahim, 2005).

In a study by eslami et al, (2014), the reliability of the Gresham and Elliott questionnaire was reported as 83%, with content and construct validity confirmed by experts and specialists(Eslami et al., 2014) lopink and perez (2017) used Cronbach's alpha and test-retest methods to determine the reliability of the parent and teacher forms, with Cronbach's alpha for the social skills scale being 93% for both forms. The results of the test-retest method confirmed the correlation between the teacher and parent forms(Leppink & Pérez-Fuster, 2017).

In the present study, the parent form for the preschool level and the social skills section were used. The social skills section includes behaviors such as cooperation, assertiveness, and self-control. The score for social skills is derived from the sum of these subtest scores. Each item on the scale is rated on a three-point scale: never (score 0), sometimes (score 1), and often (score 2). A higher score on the social skills scale indicates greater social skills, while a lower score indicates fewer social skills. In the current study, the reliability coefficients for the 40-item social skills subtest were calculated as 0.60 for the pre-test, 0.87 for the post-test, and 0.95 for the follow-up.

Development of the Educational Package

In the present study, the development of the educational package was conducted in three stages:

Stage 1: Literature Review and Needs Assessment

The first stage involved conducting a comprehensive literature review to understand the importance and necessity of preventive education, particularly during the preschool years. This phase focused on examining existing research on executive function training packages, specifically in emotion regulation and response inhibition. Given the significance of recognizing, managing, and appropriately expressing emotions in social interactions, as well as understanding others' emotional states, the initial design of the educational package was developed. It became evident from the literature review that a comprehensive and multifaceted educational package had not yet been created. This gap highlighted the novelty of the research and the need for tools to teach skills related to executive functions that facilitate social relationships and social skills development in children, leading the researcher to focus on content creation in this area.

Stage 2: Design and Content Validity of the Educational Package

The second stage involved designing the executive function training package and evaluating its content validity. The design process drew upon previous programs (Diamond, 2012; Rasuli et al., 2017; Romero-Lopez et al., 2020; Rosas et al., 2019; Traverso et al., 2019) And incorporated widely used tests for assessing response inhibition, such as the Go/No-Go task. To assess content validity, the draft of the educational package was reviewed by 10 experts in the field of executive functions.

The educational package was designed to focus on social skills training and the introduction and education of emotional states during various emotional experiences. For this purpose, both short and long stories were read to the preschoolers, who were then asked to identify the facial expressions and emotional states of characters in different scenarios based on the emotions

experienced by individuals in those situations. Initially, images of individuals in the scenarios were designed in such a way that the specific facial expressions of the individuals were not clear, requiring children to infer the emotional state based on their understanding of other's emotions.

Following a review of the initial design, including discussions with a children's story writer, 500 one-line and paragraph-length scenarios depicting daily life and common occurrences were created. The educational package was then structured into various dimensions, with appropriate educational tools selected for each dimension. The final dimensions of the educational program were outlined based on the intended objectives and expert feedback, as detailed in Table 1.

Table 1*: Overview of the educational package dimensions for executive functions, including content designed to enhance understanding of emotions, teach emotion regulation principles, and improve response inhibition skills.*

Educational Package Dimensions	Content
Understanding Emotions and Facial Expressions	1. Workbook
	2. Response Inhibition Poster
	3. Cartoon Cards
Teaching Emotion Regulation Principles	4. Storybook
	5. Movement Games for Response Inhibition and Relaxation Techniques
	6. Photo Book
Response Inhibition	7. Illustrated Exercises and Storybook
	8. Inhibition Games and Worksheets

Stage3: Pilot Testing

In this phase, a pilot study was conducted with a small sample of 10 preschool children aged 5-6 years. This sample was chosen from the available pool, with informed consent obtained from their parents. The children were divided into two groups of five. The educational content was delivered over 12 one-hour sessions, held twice a week. After completing the pilot sessions, it was determined that additional sessions were necessary for comprehensive coverage of the educational material. Consequently, the number of lesson plans was increased from 12 to 20 sessions. Additionally, the teacher's protocol was revised with more varied questions, leading to the final design of the current educational package. The content of the educational package is detailed in Table 2.

Stage 4: Conducting the Main Study

Following the acquisition of necessary permissions from the Education Department and coordination with preschool centers, detailed explanations were provided to the parents of the participating children to ensure adherence to ethical research principles. The experimental

intervention was conducted over 20 sessions, each lasting 1 hour, and held 3 times a week with the experimental group. Meanwhile, the control group did not receive this training.

Table 2. Content of the Executive Function Training Package *This table outlines the dimensions of the Executive Function Training Package designed for preschool children, including the content and tools used for teaching each aspect of emotional recognition, emotional control, and response inhibition. The package aims to enhance social skills and emotional regulation through a variety of educational materials and activities.*

Session Number	Session Content	Materials Used
Sessions 1, 2, 3	Introduction to Joy: Understanding facial expressions, expressing joy, recognizing the spectrum of joy, inhibition exercises	Facial expression worksheets, joy expression, discussion, Stop/Go game, Red and Blue Inhibition game
Sessions 4, 5, 6	Introduction to Sadness: Understanding facial expressions, expressing sadness, inhibition exercises	Sad facial expression worksheets, discussion, storytelling, Sadness management techniques, photo book, inhibition worksheet
Sessions 7, 8, 9	Introduction to Fear: Understanding facial expressions, methods of expressing fear, inhibition exercises	Fear facial expression worksheets, understanding fear spectrum, discussion, storytelling, Fear management techniques, inhibition games
Sessions 10, 11	Introduction to Disgust: Understanding methods of expressing disgust, managing disgust	Disgusting scenarios, storytelling, discussion, inhibition games
Sessions 12, 13, 14	Introduction to Anger: Understanding facial expressions, introduction to relaxation techniques, anger management methods	Angry facial expression worksheets, discussion, storytelling, response inhibition
Sessions 15, 16, 17	Definition of Anger from Children's Perspective: Introduction to CBT techniques for children, introducing "Big Glasses" and better thinking, muscle relaxation techniques, effects of uncontrolled anger on relationships, response inhibition	Social scenarios, introducing the thought triangle, anger control methods, Q&A with children, discussion on why Grandpa was angry, thinking that made me angry, Number Inhibition game

Session Number	Session Content	Materials Used
Sessions 18, 19, 20	Review and Integration of All Emotions	Integrated emotion worksheets, discussion, use of emotion posters, inhibition games, worksheets

3. Data Analysis

For descriptive statistics, measures such as mean, standard deviation, skewness, and kurtosis were calculated. Inferential statistics were analyzed using mixed analysis of variance (one within-group factor and one between-group factor) with SPSS software. To address the first research question regarding the content validity of the executive function training package, the content validity ratio (CVR) and the Lawshe's content validity index were assessed. For evaluating CVR, 10 experts in the relevant field rated the content based on a three-point scale: "Essential," "Useful," and "Not Necessary." The acceptable CVR according to Lawshe's method for 10 experts was reported as 0.62. Table 3 shows the minimum acceptable CVR values based on the number of experts.

Table 3: *Minimum Acceptable CVR Values Based on Number of Experts (Adapted from Haji Zadeh & Asghari, 2011)*

Number of Experts	Minimum Acceptable CVR
5	0.99
6	0.99
7	0.99
8	0.85
9	0.78
10	0.62
12	0.59
15	0.49
20	0.42
25	0.37
30	0.33

This table presents the minimum acceptable Content Validity Ratio (CVR) values for different numbers of experts as used to evaluate the content validity of the executive function training package. The CVR is crucial for determining the essentiality of items in the content based on expert evaluations. The evaluation of the Content Validity Ratio (CVR) for the executive function training package showed that items such as the worksheet book, response inhibition poster, emotion recognition flashcards, and movement-based games received a CVR of 1, while the

storybooks and picture books scored 0.8. This indicates that the content of the training package is considered to have adequate content validity. The Content Validity Index (CVI) was assessed based on "Relevance," "Clarity," and "Simplicity" using a four-point Likert scale, with the minimum acceptable CVI for 10 experts being 0.79. According to expert evaluations, the worksheet book and movement-based games achieved a CVI of 1 in all three dimensions. The response inhibition poster, cartoon cards, and real image cards scored 1 in "Relevance" and "Clarity," and 0.9 in "Simplicity." The emotion ruler had a CVI of 0.8 across all dimensions. The storybook received a CVI of 0.9 for "Relevance" and 0.8 for "Simplicity" and "Clarity." The picture book scored 0.9 in "Relevance" and "Simplicity" and 1 in "Clarity." Overall, the CVR and CVI evaluations demonstrate that the executive function training package has satisfactory validity, thus supporting the first hypothesis of the study.

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To evaluate the second hypothesis regarding the effectiveness of the executive function training package on response inhibition in preschool children, the initial sample consisted of 40 participants. Due to incomplete data, one participant from the control group was excluded, leaving a final sample of 38 participants. The gender distribution of the participants is detailed in Table 4. Efforts were made to ensure a balanced representation of genders across both groups.

Table 4: *Gender Distribution of Participants*

Group	Girls	Percentage	Boys	Percentage
Control	10	26.3%	9	23.7%
Experimental	10	26.3%	9	23.7%
Total	20	52.6%	18	47.4%

Table 5 presents the descriptive statistics for social skills across three phases: pre-test, post-test, and follow-up. In the pre-test, the control group had a mean social skills score of 28.89 (SD = 6.59), while the experimental group had a mean of 33.26 (SD = 6.32). After the intervention, the mean scores were 28.10 (SD = 8.02) for the control group and 51.15 (SD = 5.13) for the experimental group. At follow-up, the control group’s mean score decreased to 24.36 (SD = 3.13), whereas the experimental group’s score increased to 57.84 (SD = 7.08). These results indicate a notable improvement in social skills in the experimental group compared to the control group. The lack of significant change in the control group’s scores suggests that the absence of targeted social skills training led to a decrease in social skills. Mauchly's test was applied to examine the homogeneity of covariances, and the results are provided in Table 6.

Table 5: *Summary of Within-Group and Between-Group Analysis of Variance*

Source	SS	DF	MS	F	Sig.
Social Skills	2227.38	2	1113.69	52.98	0.001
Social Skills * Group	4131.91	2	2065.95	98.29	0.001
Error	1513.36	72	21.01		
Between-Group	11742.53	1	11742.53	156.60	0.001
Error	2699.36	36	74.98		

The within-group ANOVA results show a significant effect of the test across the three phases ($F = 52.98$, $p < 0.001$) and a significant interaction effect between social skills and group ($F = 98.29$, $p < 0.001$). This interaction indicates that different results emerged from the combination of test phases (pre-test, post-test, and follow-up) and groups (control and experimental). The between-group ANOVA indicates a significant difference between the experimental and control groups ($F = 156.60$, $p < 0.001$).

Table 6: *Post-Hoc Bonferroni Test Results*

Sig.	Mean Difference	From	To
0.001	-8.55	Post-Test	Pre-Test
0.001	-10.02	Follow-Up	Pre-Test

The Bonferroni post-hoc test results show significant differences between the pre-test and both the post-test and follow-up periods. This indicates that the executive function training package effectively enhanced social skills in preschool children, as evidenced by the increased scores from pre-test to post-test and follow-up.

4. Discussion and Conclusion

The primary goals of this study were twofold: to assess the content validity of an executive function training package designed to enhance response inhibition and to evaluate its effectiveness in improving social skills among preschool children.

Effectiveness of Inhibitory Control Training

Our study confirms that the executive function training package is both content-valid and effective. The evaluation of the training materials by experts revealed strong Content Validity Ratio (CVR) and Content Validity Index (CVI) scores, indicating that the components are relevant and appropriate for achieving the desired outcomes. This validation underscores the robustness of the training package in targeting the intended skills.

The effectiveness of the training in improving social skills was evident through significant gains observed from pre-test to post-test and follow-up assessments. These results align with various studies that have explored the impact of executive function (EF) training on cognitive and behavioral outcomes. For instance, (Nejati & Mohammadi, 2023).found that while inhibitory control training enhanced specific cognitive functions like sustained attention and interference control, it did not generalize to broader social cognition or decision-making processes. Similarly, (Prager et al., 2023)reported that EF training improved specific EF skills but had limited generalization to untrained tasks and broader social competencies.Conversely, other research highlights more positive outcomes(Camuñas et al., 2022)demonstrated that EF training improved social integration and reduced behavioral issues among children in foster care, suggesting that such training can be beneficial in specific contexts. (Badau & Trifan, 2022). found that the DeCo-S.E. program led to significant improvements in emotional identification and peer problem-solving among preschoolers. Additionally, the Fun FRIENDS program in Japan reported notable enhancements in self-control and cooperation (Hosokawa & Katsura, 2018). These findings underscore the potential of EF training to positively impact social skills, particularly when tailored to the specific needs of children.

Social and Emotional Learning Programs

The broader literature on social and emotional learning (SEL) programs supports the efficacy of interventions aimed at enhancing preschoolers' social skills. For example, the Fun FRIENDS program demonstrated substantial improvements in self-control and cooperation, highlighting its effectiveness in fostering social skills on a class-wide basis (Hosokawa, 2023). Similarly, the DeCo-S.E. program showed significant gains in emotional identification and peer problem-solving (Badau & Trifan, 2022). Universal interventions have also been effective; a manualized social skills intervention resulted in higher prosocial behaviors and improved classroom conduct among

preschoolers (York, 2013).Meta-analyses suggest that while social skills training generally yields positive outcomes, the effects tend to be modest and more pronounced in behavioral observations than in self-reports (Beelmann et al., 2023).This points to the need for continued research into booster sessions and follow-up assessments to ensure the long-term sustainability of these skills (Beelmann et al., 2023).

Limitations

Several limitations of this study should be noted. The sample size, while adequate for initial findings, may restrict the generalizability of the results. Future research should include larger and more diverse samples to enhance the applicability of the findings across various demographic groups. Additionally, the study relied on self-reported and observational data, which may introduce biases. Incorporating objective measures of social skills and executive functions in future studies could provide a more comprehensive assessment of the training's impact. The relatively short duration of the training and the lack of thorough long-term follow-up are also limitations. Longitudinal studies are necessary to evaluate the sustainability of the training's effects. Moreover, the study did not explore potential differential effects across various subgroups of children, such as those with different baseline levels of executive function or social skills. Future research should investigate how the training impacts different subgroups to tailor interventions more effectively.

Recommendations

Based on the findings and limitations, the following recommendations are proposed:

1. **Expand Sample Size and Diversity**: Future studies should involve larger, more diverse samples to improve the generalizability of the findings and explore variations in training effects across different demographic groups.
2. **Incorporate Objective Measures**: Utilize a combination of self-reported, observational, and objective measures to provide a comprehensive evaluation of the training's impact on executive functions and social skills.
3. **Extend Training Duration**: Implement and assess longer-term training programs to better understand the sustained effects of the intervention on social skills and executive functions.
4. **Investigate Transfer Effects**: Explore how improvements in executive functions translate to other cognitive domains and everyday behaviors to assess the broader applicability and effectiveness of the training.
5. **Enhance Parent Involvement**: Continue involving parents in the training process, as their participation and reinforcement of skills at home can significantly enhance the overall effectiveness of the intervention.
6. **Examine Subgroup Variations**: Investigate how the training affects various subgroups of children, including those with different initial levels of executive function or social skills, to tailor interventions more effectively.
7. **Consider Contextual Factors**: Assess how contextual factors, such as the child's home environment or school setting, influence the training's effectiveness to ensure interventions are adaptable and applicable in diverse settings.

8. **Evaluate Long-Term Impact**: Conduct follow-up assessments and booster sessions to determine the long-term sustainability of the skills acquired through the training.

5. Conclusion

This study contributes valuable insights into the efficacy of an executive function training package designed to enhance preschoolers' social skills. The training demonstrated promising results in improving specific cognitive functions and social competencies, although its overall impact on broader social skills requires further exploration. The findings are consistent with existing research indicating that while EF training can enhance cognitive skills, its effects on social skills may be limited. The unique aspects of this training, including its focus on emotional recognition and parental involvement, provide additional avenues for future research and intervention development.

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