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Development and Testing of an Anxiety Model in Elementary School Students Based on Executive Functions and the Parent/Child Relationship: Mediating Role of Emotion Regulation

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ABSTRACT

Objective: This study aimed to develop and test a model of anxiety in elementary school students based on executive functions and the parent-child relationship, considering the mediating role of emotion regulation.

Methods: The research employed a correlational descriptive method. The sample size consisted of 336 participants selected through multi-stage cluster random sampling, and they completed standard questionnaires including the Spence Children's Anxiety Scale (2003), Barkley's Deficits in Executive Functioning Scale for Children and Adolescents (2012), Fine and colleagues' Parent-Child Relationship Scale (1983), and the Emotion Regulation Checklist for Children and Adolescents (2003). Data analysis was conducted using structural equation modeling in the AMOS software.

Results: The findings indicated that the research structural model fit the collected data. Executive functions were positively and significantly related to anxiety ($p = 0.001$, $\beta = 0.284$). The parent-child relationship was negatively and significantly associated with anxiety ($p = 0.001$, $\beta = -0.414$), teacher-student interaction was positively and significantly related to anxiety ($p = 0.001$, $\beta = 0.371$), and the factor of emotion regulation reappraisal had a negative relationship, while the factor of emotion regulation suppression had a positive and significant relationship with elementary school students' anxiety. Moreover, the factors of suppression and reappraisal of emotion regulation mediated the relationship between executive functions and anxiety ($p = 0.001$, $\beta = 0.112$), mediated the negative and significant relationship between the parent-child relationship and anxiety ($p = 0.001$, $\beta = -0.140$), and mediated the positive and significant relationship between teacher-student interaction and anxiety ($p = 0.001$, $\beta = 0.122$) in elementary school students.

Conclusions: Based on the findings of the current study, it has been determined that both executive functions and the parent-child relationship have a direct and indirect impact on children's anxiety levels through emotion regulation.

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Introduction

The impact of anxiety on academic performance and elementary school dropout rates has been a subject of extensive research. Numerous studies have explored the relationship between anxiety and academic outcomes, particularly in elementary school settings. Understanding the mechanisms through which anxiety influences academic performance is crucial for early intervention and support in educational settings. Research has shown that individuals with anxiety disorders are more likely to experience difficulties in completing high school and obtaining diplomas (Choudhury & Chechi, 2022). Anxiety disorders differ from the fear and anxiety experienced by children and adolescents as part of normative emotional development. These disorders are characterized by exaggerated symptoms related to real or perceived threats that persist over a long period of time and often leading to physical and psychological symptoms, as well as changes in behavior (American Psychiatric Association & Association, 2013). Anxiety disorders are the most common psychiatric disorder in children and adolescents, with a worldwide prevalence rate of 6.5% (Polanczyk et al., 2015). In Canada, the incidence of anxiety disorders is increasing, with professionally diagnosed anxiety disorder among youth aged 12 to 24 years doubling from 6.0% in 2011 to 12.9% in 2018 (Wiens et al., 2020). Anxiety disorders begin in childhood and, if left untreated, often persist into adulthood (Kieling et al., 2011). Comorbidity between anxiety disorders and other psychiatric disorders is common (Woodgate et al., 2023) and the associated impairment can affect various areas of health and well-being (e.g. psychosocial difficulties, more severe forms of mental illness) as well as future life outcomes (e.g. vocational, family functioning)(Costello & Maughan, 2015).

One of the potential factors and variables related to the occurrence of emotional and affective disorders, such as anxiety, in childhood is executive functions (EF). Executive function (EF) refers to an individual's ability to use thinking skills to achieve goals, develop problem-solving methods, and monitor and adjust their behaviors. It is a higher-level processing activity in the brain. In addition, it is the process by which individuals exercise conscious control over their thoughts and actions (Fan & Wang, 2023). EF development is particularly important in childhood to establish a foundation for better living and learning in the future. Indeed, various studies have shown that it can both immediately affect learning and behavioral problems in children and predict outcomes such as health, wealth, and delinquency in adulthood (Moffett et al., 2023).

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Executive functions (EFs) are cognitive processes that play a critical role in organizing, planning, and goal setting. They are supported by underlying core processes such as working memory, inhibition and cognitive flexibility/set shifting (Miyake et al., 2000). Specific EF processes are associated with emotional disorders such as anxiety. In a study by Toren et al. (2000) children with an anxiety disorder performed poorly on EF tasks compared with children without this disorder. Similarly, young adults with anxiety and depression had significantly lower scores on EF tasks compared with healthy controls (Ajilchi & Nejati, 2017).

In addition to Executive functions (EFs), recent research has focused on understanding the effects of parent-child interactions on childhood anxiety disorders. These interactions take place in the context of the child's environment, which can either promote healthy growth or jeopardize their well-being (Wood et al., 2003). Childhood plays a crucial role in holistic human development, including identity and personality formation. The circumstances in which children are born and raised can significantly influence their growth and development. Several adverse childhood experiences, such as persistent poverty, abuse and neglect, negative parental behavior, and family violence, can directly threaten children's health, growth, and well-being (Atashbahar et al., 2022). Furthermore, the majority of conflicts and behavioral disorders in adolescents and adults result from neglecting emotional-behavioral dimensions and failing to properly guide their growth and development in their childhood (Eiser, 2012). Parents play a crucial role in their children's growth and quality of life. Your parenting approach and interaction with your children can have a significant impact on their well-being (Siu & Law, 2020). In this context, Yue et al. (2022) showed in their study that there is a significant association between negative parent-child interactions and relationships with anxiety disorders, problems and harmful use of social networks.

Recent studies have examined the mediating role of emotion regulation in the relationship between parent-child interactions and child anxiety disorders. In particular, researchers have examined the individual effects of emotion regulation on parent-child relationships and anxiety disorders in children (Bence, 2022). Furthermore, the mediating effect of emotion regulation in the relationship between executive functions and emotional and affective disorders in childhood has been examined (Fernandes et al., 2023). However, there is a gap in the literature regarding the simultaneous relationship between parent-child interactions, executive functioning, and child anxiety disorders, as well as the mediating role of emotion regulation in this relationship. Some

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studies have highlighted the impact of childhood emotional abuse on vulnerability to emotional and psychological disorders, suggesting that emotional abuse has a greater impact than physical or sexual abuse (Li et al., 2021). Self-blame has been identified as a negative emotion regulation strategy that mediates the association between parental verbal abuse and subsequent depression and anxiety(Taşören, 2022). Other studies have also confirmed the mediating role of negative emotion regulation strategies in the association between parental and child emotional maltreatment and current emotional and mood disorders (Shahnazdoust et al., 2022; Shenaar-Golan et al., 2021). In addition, research has shown that certain executive functions are closely linked to emotional problems and the effective use of emotion regulation strategies to cope with stressful situations. For example, deficits in executive functions have been linked to maladaptive emotion regulation strategies such as rumination, which in turn are linked to anxiety (O'Rourke et al., 2020).

The study conducted by Jalilishishavan and Sadeghian (2023) aimed to examine the effects of executive function training on anxiety, self-efficacy and self-regulation in elite athletes participating in sports Olympics. Researchers found that executive function training had positive effects on participating athletes by reducing anxiety and increasing self-efficacy and self-regulation. Research by Mehmanpazir and Farokhi (2021) examined the comparative relationship between mother-child attachment, parenting styles and parental interaction in children with and without separation anxiety. The aim of the study was to examine the differences in the quality of mother-child interaction, parenting styles and parental interaction between these two groups. The results of the study showed significant differences in the overall quality of mother-child interaction, parenting styles and parental interaction between the two groups. However, specific differences were observed in certain aspects. For example, in terms of ease of child compliance and rejection (related to the mother-child interaction variable), authoritarian, logical and permissive parenting styles, and communication and listening skills (related to the parental interaction variable), statistically speaking Significant differences were observed between mothers of children with separation anxiety and mothers of children without separation anxiety.

Sabzian et al. (2018) in their study aimed to examine the effectiveness of parent-child relationship training at the level of emotional problems, including separation anxiety, generalized anxiety, specific phobias, depression, and social anxiety, in male elementary school students in strict no 3 of Isfahan city. The results of this study showed that providing a joint mother-child intervention

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resulted in a reduction in symptoms of several studied emotional problems among participants in both the posttest and follow-up phases. Based on the results of this study, it can be concluded that the provision of an intervention based on training mother-child joint play was effective in reducing emotional problems and that this intervention method can be used to treat emotional difficulties in children.

Fernandes et al. (2023) showed in a study that deficits in executive functions and impairments in emotional regulation are significant factors in the development of behavioral disorders such as anxiety in children and adolescents. Liu et al. (2023) in their study investigated the effects of both maternal and paternal corporal punishment on children's executive functions and whether these effects would be mediated by child anxiety in Chinese migrant families. The findings highlighted the importance of considering the emotional mechanisms in cognitive outcomes of migrant children who experienced parental corporal punishment, and provided intervention suggestions for parenting behaviors to improve children's developmental outcomes. Ha and Jue (2018) in their research investigated the relationship between parental psychological control (PPC) as perceived by adolescents, emotion inhibition, emotion regulation, and depression in adolescents. The results of this study indicated that PPC had a direct effect on depression. In addition, PPC had a significant effect on the emotion inhibition of dysfunctional emotion regulation, and emotion inhibition significantly affected depression. Therefore, emotion inhibition had a mediating effect between PPC and depression.

Based on a literature review, despite the high prevalence of emotional and mood disorders in Iranian children (Panahi et al., 2020), there is limited research on anxiety disorders with a focus on the mediating role of emotion regulation in this population in Iran. Previous studies have examined various aspects related to anxiety in children, including the effects of mother-child relationship, parenting style and parental interaction on separation anxiety (Mirsadeghi et al., 2018), the relationship between anxiety and executive functions, emotion regulation and working memory male sixth graders (Mehmanpazir & Farokhi, 2021), predicting children's anxiety based on parental reactions to their negative emotions, considering the mediating role of emotion regulation (Roitvandghiasvand et al., 2020), predicting children's anxiety based on Emotion regulation and resilience in children aged 7 to 12 years and their mothers (Varmzyar, 2020), the relationship between parent-child interaction styles and anxiety in children (Mokhtari Mosayebi

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et al., 2021), the direct effects of parental corporal punishment and children's executive functions in Chinese migrant families: The mediating role of child anxiety (Liu et al., 2022), the relationship between executive dysfunction and anxiety (O'Rourke et al., 2020) and etc. However, the present study aims to simultaneously examine the direct role of executive functions and the parent-child relationship on children's anxiety as well as the indirect role of these variables through the mediating effect of emotion regulation within a comprehensive model. By providing such a model, the study aims to provide a suitable framework for further research and practical application in the prevention, control and treatment of anxious children.

This study aimed to fill the research gap by examining the relationship between executive functions, parent-child relationships and anxiety disorders in children in Iran, focusing on the mediating role of emotion regulation. The results of this research have important implications for psychologists and counselors who work with children and adolescents and in schools across the country. By identifying the factors and components that contribute to anxiety disorders, this study may help select appropriate therapeutic approaches for this common disorder in children and adolescents. This study aimed to develop and test a model of childhood anxiety that incorporates executive functioning and the parent-child relationship, with emotion regulation acting as a mediator.

Material and Methods

The present study used a descriptive-correlative design. The target population consisted of all primary school students (fifth and sixth grade) in the City of Baneh in 2022-2023. According to Loehlin (2004), a minimum sample size of 100 and a desirable sample size of 200 are recommended for structural equation modeling. Furthermore, Kline (2023) suggests a minimum sample size of 200 for this method. In the literature, sample sizes between 200 and 400 are suitable for models with 10 to 15 indicators (Meyers et al., 2016). Based on these considerations, a sample size of 320 participants was selected for this study. With the possibility of fluctuation, a total of 360 participants were selected as a sample, which corresponds to the recommendations of Loehlin (2004) and Kline (2023). It is worth noting that after administering the questionnaires and excluding the invalid questionnaires, 336 valid questionnaires were included in the analysis The sampling method used in this study was a multistage cluster random sampling method. Ten

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schools, including five girls' schools and five boys' schools, were randomly selected from the list of primary schools in Baneh City. From each selected school, 18 students (fifth and sixth grades) were randomly selected by lottery. The questionnaires were then distributed to these selected students. Research inclusion criteria included parental and child consent to participate, age between 10 and 12 years, residence in Baneh City, absence of major physical and psychological disorders, no intellectual disability, no Down syndrome or cognitive impairment. good physical health, normal intelligence, based on school reports. Exclusion criteria included dissatisfaction and incomplete completion of the questionnaires. Data were analyzed using structural equation modeling (SEM) in SPSS 25 and AMOS 24 software.

Research Tool

Spence Children's Anxiety Scale (SCAS) - Child Version: The questionnaire consists of 45 items, of which 38 items are scored, and six items, which are positive filler items, are not included in the scoring. Furthermore, the SCAS includes an open-ended question to which children provide descriptive responses. The questionnaire is designed for children aged 8 to 15 years. The SCAS-Child assesses six domains of anxiety which constitute six subscales:

1. Fear and Anxiety of Open Spaces: This subscale is assessed by items 13, 21, 28, 30, 32, 34, 36, 37, and 39.
2. Separation Anxiety: This subscale is assessed by items 5, 8, 12, 15, 16, and 44.
3. Fear of Physical Injury: This subscale is assessed by items 2, 18, 23, 25, and 33.
4. Social Phobia: This subscale is assessed by items 6, 7, 9, 10, 29, and 35.
5. Obsessive-Compulsive Symptoms: This subscale is assessed by items 14, 19, 27, 40, 41, and 42.
6. Generalized Anxiety: This subscale is assessed by items 1, 3, 4, 20, 22, and 24.

Psychometric evaluations of the SCAS have shown positive results. The internal consistency of the subscales, the correlation between parent and child reports, the item-total correlations, and test-retest reliability have all demonstrated the validity and reliability of the scale. Furthermore, factor analysis confirmed the construct validity of the SCAS. Comparisons with other anxiety measures such as the Child Behavior Checklist (CBCL) further confirmed the validity of the scale (Spence et al., 2001).

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The Barkley Child and Adolescent Executive Functioning Scale: This scale was developed by Barkley (2012) to assess executive function in both non-clinical and clinical populations, particularly in children and adolescents. The scale consists of 70 items rated on a 4-point Likert scale from "Never" to "Always." It also includes five subscales that measure self-management of time, self-organization/problem-solving, self-control/inhibition, self-motivation, and emotional self-regulation. Seven scores are derived from this instrument, including five subscale scores, a total score, and an 11-question score that provide a checklist for managerial functioning. For example, scores between 70 and 140 indicate impaired executive function, scores between 140 and 175 indicate average executive function, and scores above 175 indicate strong executive function (Barkley, 2012). The overall reliability of the scale was reported to be 0.99, with subscale reliabilities ranging from 0.74 to 0.33 according to Cronbach's alpha (Barkley, 2012). The validity of this scale has been confirmed by professors at Al-Zahra University. Research and clinical experiences confirmed the validity, reliability, and usefulness of this instrument in assessing executive function across these dimensions. The strong evidence for the validity and desirable reliability of this scale is well reported (Zarenezhad et al., 2018).

The Parent-Child Relationship Scale: This scale was developed by Fine et al. (1983) to assess the quality of parent-child relationships and measure children's perceptions of their relationships with their parents. It consists of two 24-item forms, one to assess the relationship with the father and one to assess the relationship with the mother. The scale is scored on a 7-point Likert scale (1 = not at all, 7 = very much), with higher scores indicating better quality of the parent-child relationship (Mehraban et al., 2019). Fine et al. (1983) reported Cronbach's alpha coefficients of 0.96 for the father version and 0.94 for the mother version, indicating high reliability of this questionnaire (Shiroodaghaei et al., 2020). Farshad et al. (2015) in their study, the final coefficients for the father form were reported as 0.93 and for the mother form as 0.92, indicating high internal consistency of the items. In a study by Mehraban et al. (2019), the Cronbach's alpha coefficient for the father subscale ranged from 0.83 to 0.96, and for the mother subscale, it ranged from 0.67 to 0.96. The overall Cronbach's alpha coefficient for the parents was 0.87.

The Emotion Regulation Questionnaire for Children and Adolescents (ERQ-CA): This questionnaire was developed by Gross (2002). It consists of 10 items that measure two general emotion regulation strategies: reappraisal and suppression. Six items assess the reappraisal

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strategy, while four items assess the suppression strategy. Gross (2002) reported satisfactory validity and reliability of the ERQ-CA. The internal consistency coefficient was 0.73, indicating good reliability. The test-retest reliability coefficient was 0.69 for both reappraisal and suppression strategies. A study conducted by Lotfi et al. (2019) aimed to adapt and validate the ERQ-CA on a sample of Iranian students. Confirmatory factor analysis revealed that the questionnaire had two factors: reappraisal and suppression. The Persian version of the ERQ-CA showed desirable psychometric properties, with a Cronbach alpha coefficient of 0.81 for the entire questionnaire and 0.79 and 0.68 for the reappraisal and suppression factors, respectively. Significant correlations were found between the reappraisal and suppression factors and subscales of positive and negative affect, anxiety symptoms, and depression. Overall, the ERQ-CA has proven to be a valid and reliable measure for assessing emotion regulation strategies in children and adolescents. It can be confidently used for both research and clinical purposes.

To conduct the research, the Baneh Department of Education office was asked to obtain the necessary permits to administer the questionnaires in schools and access a list of primary schools. From the compiled list, primary schools in different districts of Baneh were randomly selected. Two girls' and two boys' schools were then randomly selected from each district and these schools were visited. After coordination with the school Principals and administrators, a number of classrooms from the fifth and sixth grades of each school were randomly selected and the questionnaires were distributed to the students. Necessary explanations were provided to students to introduce the research objectives, ethical considerations, and instructions for completing the questionnaires. Ethical considerations such as obtaining full consent from participants and maintaining confidentiality and confidentiality of information were taken into account throughout the research.

Results

In the present study, 336 students (153 females and 183 males) participated. The educational level of fathers indicated that 241 participants (71.7%) had a diploma or lower, 37 participants (11%) had post-secondary education, 40 participants (9.4%) had a bachelor's degree, and 18 participants (4.5%) had a postgraduate degree or higher. Regarding the educational level of mothers, 282 participants (83.9%) had a diploma or lower, 22 participants (5.6%) had post-secondary education,

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23 participants (6.8%) had a bachelor's degree, and 9 participants (2.7%) had a postgraduate degree or higher. It is worth mentioning that 38 participants (11.3%) were the first-born child, 154 participants (45.8%) were the second-born child, 93 participants (27.7%) were the third-born child, Table 1: Mean, standard deviation and correlation matrix between research variables. Table (1) displays the means, standard deviations, and correlation coefficients between executive functions, parent-child relationship, emotion regulation, and anxiety.

Based on the correlation coefficients, the variables showed the expected direction and were consistent with theories in the research field. In this study, to assess the assumption of the normality of the univariate data distribution, skewness and kurtosis of each variable were examined. Furthermore, the assumption of collinearity was evaluated using the Variance Inflation Factor (VIF) and tolerance coefficient. The results of these assessments are presented in Table 1.

Table 1. Examining the assumptions of normality and collinearity

Variable	The assumption of normality		Collinearity assumption	
	crookedness	tension	tolerance coefficient	Variance inflation
Executive functions - self-management of time	0.66	-0.15	0.36	2.82
Executive functions - self-organization/problem solving	0.56	-0.28	0.29	3.48
Executive functions - self-control/inhibition	-0.50	-0.59	0.30	34.3
Executive functions - self-motivation	0.67	-0.52	0.27	3.70
Executive functions - self-regulation of emotion	0.19	-0.60	0.40	2.48
Parent/child relationship - relationship with father	-0.57	-0.36	0.63	1.60
Parent/child relationship - relationship with mother	-0.91	0.05	0.59	1.69
Emotion regulation—a reappraisal	-0.03	0.65	0.64	1.56
Emotion-suppression regulation	-0.08	-0.60	0.63	1.59
panic -Child anxiety	0.17	0.33	-	-
separation anxiety - Child anxiety	-0.14	-0.39	-	-
fear of physical harm - Child anxiety	0.23	0.10	-	-
social fear - Child anxiety	-0.36	-0.28	-	-
obsession -Child anxiety	0.59	0.17	-	-
general anxiety - Child anxiety	0.48	0.27	-	-

Based on the findings in Table (1), the values of skewness and kurtosis for all components fall within the range of ±2. This indicates that the assumption of normality in the distribution of the univariate data is satisfied within the dataset (Kline, 2023). Table (1) demonstrates that the assumption of collinearity holds among the present research data, as the tolerance coefficients for the predictor variables are greater than 0.10, and the variance inflation factor (VIF) values for each

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of them are less than 10. Consistent with the perspective of (Meyers et al., 2016), a tolerance coefficient below 0.10 and a VIF value above 10 would indicate a violation of the assumption of collinearity. In this study, to evaluate the fulfillment or violation of the assumption of multivariate normality in the distribution, the analysis of information related to "Mahalanobis distance" was utilized.

The values of skewness and kurtosis were obtained as 12.1 and 97.0, respectively, indicating that the multivariate data distribution is normal. To evaluate the homogeneity of variances, a scatterplot of standardized error variances was examined. The results indicated that the assumption of homogeneity of variances was met.

Model Analysis

a) Measurement Model: In the measurement model of the study, executive functions, parent-child relationship, and anxiety were treated as latent variables. It was assumed that the latent variable of executive functions is measured by indicators of time management, self-organization/problem-solving, self-control/inhibition, self-motivation, and emotion regulation. The latent variable of parent-child relationship is measured by indicators of father-child relationship and mother-child relationship. The latent variable of anxiety is measured by indicators of fear, separation anxiety, fear of physical harm, social anxiety, obsessive-compulsive symptoms, and general anxiety. The fit of the measurement model was evaluated using confirmatory factor analysis (CFA), AMOS 24.0 software, and maximum likelihood (ML) estimation. Table 3 displays the fit indices for the measurement and structural models.

Table 2. Fit Indices for Measurement and Structural Models

Fitness indicators	Measurement model	Structural model	cut point
chi square	140.26	221.88	-
Degree of freedom of the model	61	83	-
χ^2/df	30.2	2.67	Less than
GFI	0.939	0.918	>0.90
AGFI	0.908	0.881	>0.85
CFI	0.966	0.946	>0.85
RMSEA	0.062	0.0771	<0.08

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Table (2) demonstrates that all fit indices resulting from confirmatory factor analysis support an acceptable fit of the measurement model to the collected data (χ^2/df = 67.2, CFI = 0.956, GFI = 0.928, AGFI = 0.895, and RMSEA = 0.071). In the measurement model, the highest factor loading was observed for the self-motivation indicator (β = 0.889), while the lowest factor loading was associated with the fear of physical harm indicator (β = 0.626). Thus, considering that all factor loadings were above 0.32, it can be concluded that all indicators possessed the necessary power to measure the latent variables in the current study.

b) Structural Model: In the second stage of the analysis, the fit indices of the structural model (Figure 1) were estimated and evaluated. The structural model assumed that executive functions and parent-child relationship have a relationship with anxiety in elementary school students, mediated by emotion regulation. Table 3 shows that the fit indices resulting from the analysis support an acceptable fit of the structural model to the collected data (χ^2/df = 2.67, CFI = 0.946, GFI = 0.918, AGFI = 0.881, RMSEA = 0.071). Table 4 displays the path coefficients in the structural model.

Table 3. Total and direct path coefficients between the research variables in the structural model

Effect	Direction	b	SE	β	p
Direct	Suppression ←Parent/child relationships	-0.117	0.033	0.333	0. 001
	re-evaluation ←Parent/child relationships	0.201	0.069	0.334	0. 001
	Child anxiety ←Parent/child relationships	-0.075	0.031	-0.241	0. 001
	Suppression ←Executive functions	0.203	0.065	0.246	0.001
	re-evaluation ←Executive functions	0.317	0.103	-0.250	0.001
	Child anxiety ←Executive functions	0.094	0.052	0.140	0.001
	Child anxiety← Suppression	0.136	0.050	0.168	0.001
	Child anxiety← re-evaluation	0.138	0.033	0.266	0.001
indirect	Child anxiety ←Parent/child relationships	0.044	0.013	-0.140	0.001
	Child anxiety ←Executive functions	0.071	0.022	0.107	0.001
Total	Child anxiety ←Parent/child relationships	-0.119	0.034	-0.381	0.001
	Child anxiety ←Executive functions	0.165	0.052	0.247	0.001

Table (3) illustrates that the total path coefficient between executive functions and anxiety (P = 0.001, β = 0.247) is positive, indicating a significant relationship. Moreover, the total path coefficient between parent-child relationship and anxiety (P = 0.001, β = -0.381) is negative and significant. Additionally, the path coefficient between the emotion regulation factor of reappraisal and anxiety (P = 0.001, β = -0.266) is negative, while the path coefficient between the emotion regulation factor of suppression and anxiety (P = 0.004, β = 0.168) is positive and significant.

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Table 4 also reveals that the indirect path coefficient between executive functions and anxiety through suppression (P = 0.001, β = 0.107) is positive, and the indirect path coefficient between parent-child relationship and anxiety through suppression (P = 0.001, β = -0.140) is negative and significant. To determine the significance of the mediating role of each emotion regulation factor, Baron and Kenny's formula (Mallinckrodt et al., 2006) was employed. The results demonstrate that the indirect path coefficient between executive functions and anxiety through suppression (P = 0.031, β = 0.042) and through reappraisal (P = 0.001, β = 0.067) is positive and significant. Furthermore, applying Baron and Kenny's formula indicates that the indirect path coefficient between parent-child relationship and anxiety through suppression (P = 0.013, β = -0.051) and through reappraisal (P = 0.001, β = -0.088) is negative and significant. Thus, the findings of the study indicate that the suppression and reappraisal emotion regulation factors mediate the relationship between executive functions and anxiety in elementary school students positively and the relationship between parent-child relationship and anxiety negatively and significantly. Figure (1) depicts the structural model of the study, illustrating the relationships between executive functions, parent-child relationship, emotion regulation, and anxiety in elementary school students.

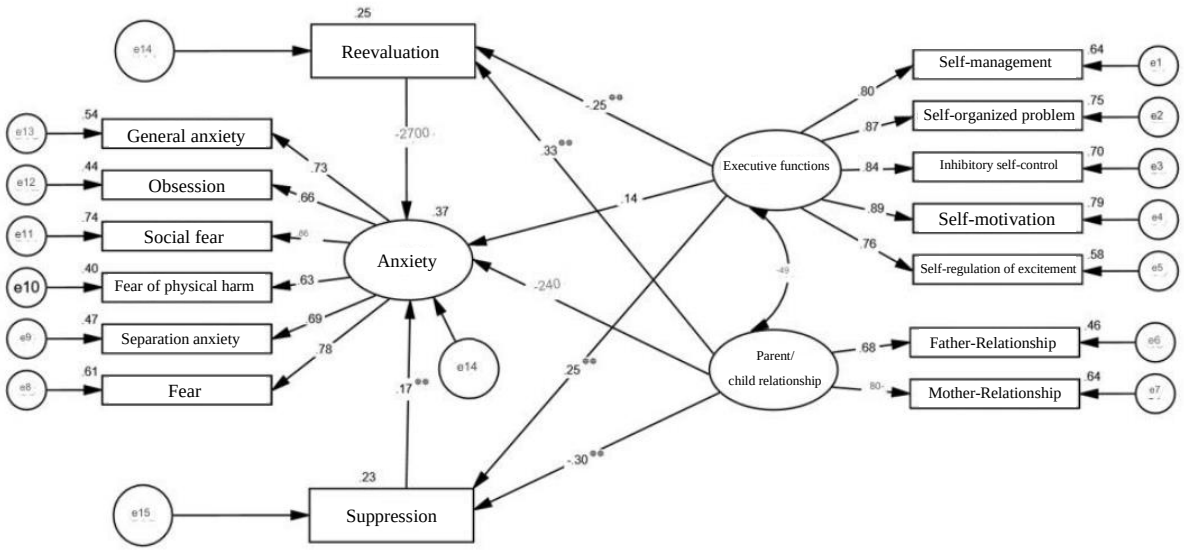

Figure 1. Standardized Estimates in Structural Equation Modeling Research

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Figure (1) illustrates that the total squared multiple correlations for the anxiety variable are obtained as 0.37. This finding indicates that executive functions, parent-child relationships, and emotion regulation collectively explain 37% of the variance in anxiety among elementary school students.

Discussion

The present study aimed to investigate the relationship between anxiety and executive functions in elementary school students, taking into account the role of parent-child relationships and emotion regulation as potential mediators. The researchers developed a structural model that proposed executive functions and parent-child relationships would influence anxiety in elementary school students through the mediating effect of emotion regulation. The findings of the study showed that the collected data supported an acceptable fit of the structural model, suggesting executive functions and parent-child relationships indeed have an impact on anxiety in elementary school students and that this relationship is mediated by emotion regulation. The results of this study are consistent with previous research, such as those by Bence (2022) and Fernandes et al. (2023). Bence (2022) showed that there is a connection between anxiety and parent-child relationship with the mediating role of emotional regulation. Similarly, Fernandes et al. (2023) showed that there is a relationship between emotional and behavioral problems in childhood and executive functions with the mediating role of emotion regulation strategies.

The overall framework of the present study suggests that executive functions and the parent-child relationship play a significant role in predicting and explaining both emotion regulation and anxiety in children. Emotion regulation acts as a mediating variable in the relationship between executive functions, the parent-child relationship, and anxiety. The parent-child relationship and executive functions have a negative impact on childhood anxiety, but this impact can be influenced by positive and negative emotion regulation strategies, leading to either an increase or decrease in anxiety levels. The mediating role of emotion regulation in the connection between the parent-child relationship and childhood anxiety is crucial. The development of positive and adaptive emotion regulation strategies in children are hindered when parents are unable to establish appropriate relationships with their children and create the necessary conditions and environment for the formation of healthy emotions and feelings. In an unfavorable and restrictive environment,

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the core of a child's authentic personality is suppressed and inhibited, leading to severe anxiety. When parents do not allow children to develop an independent personality with autonomy and strong emotional and affective responses, it creates anxiety in children. Therefore, parents must create the necessary conditions and environment for the healthy development of positive emotion regulation strategies in children that are attuned to the child's autonomy and individuality. This allows children to develop learning mechanisms and positive emotion regulation strategies that reduce anxiety levels (Ollendick & Grills, 2016).

Understanding the connection between executive functions, emotion regulation, and childhood anxiety is critical to promoting effective functioning and adaptation in real-world situations. Desirable executive functions play a critical role in regulating and controlling behavior, which is important for successful functioning and adaptation. Desirable executive functions coupled with positive emotion regulation enable students to effectively manage and regulate their emotions when faced with threatening and stressful challenges. This ability reduces vulnerability to the negative effects of adverse and conflicting emotions while improving competence and control over emotional states and ultimately alleviating anxiety. The mediating role of emotion regulation in the relationship between executive functions and childhood anxiety can be explained by the empowering nature of executive functions and the skills associated with them. Skills such as time management and active memory updating enable individuals to maintain their emotion regulation goals in the face of changing circumstances. Continuous monitoring and updating of the content of active memory plays an important role in the application of positive emotion regulation strategies, such as cognitive reappraisal. Cognitive reappraisal has been shown to effectively reduce negative emotions and increase positive emotions, promoting perseverance and allowing individuals to overcome fears and their manifestations (Ng et al., 2023).

The results of the study showed a significant and positive correlation between executive functions and anxiety in elementary school students. These results are consistent with the previous studies (Fernandes et al., 2023; Jalilishishavan & Sadeghian, 2023; Mehmanpazir & Farokhi, 2021) (Gunther & Pérez-Edgar, 2021; O'Rourke et al., 2020; Sabzian et al., 2018). O'Rourke et al. (2020) showed in their study that deficits in executive functions and difficulties in regulating emotions are crucial factors that contribute to the susceptibility of children and adolescents to behavioral disorders such as anxiety. To further explain these results, it can be stated that executive functions

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encompass a wide range of cognitive processes and behavioral skills, including problem solving, attention, reasoning, organization, planning, working memory, inhibitory control, cognitive flexibility and response inhibition. Impairments in these components of executive functions can have adverse effects on individuals' daily functioning, such as their ability to work, concentrate, and perform in evaluative situations, thereby giving rise to anxiety in children (Lezak, 2004). One possible explanation for this impact could be attributed to the neural and psychological underpinnings of anxiety and the involvement of the prefrontal cortex in the experience of anxiety. The prefrontal cortex plays a pivotal role in the development and operation of executive functions. Furthermore, the presence of executive function impairments leads to reduced adaptability in the information processing system in children, further exacerbating anxiety (Snyder et al., 2015).

The results of the present study indicated a significant negative relationship between parent-child relationships and students' anxiety in elementary school. This finding is consistent with previous studies (Cobham et al., 2020; Zeevi-Cousin & Lavenda, 2023). Zeevi-Cousin and Lavenda (2023) found that hostile and aggressive parent-child relationships contribute to emotional disorders and anxiety disorders, particularly anxiety. On the other hand, these researchers also showed that parents who provide supportive and involved parenting, characterized by positive emotions towards the child, acceptance through love, shared activities, emotional support and instrumental support, contribute to improving and promoting positive and adaptive emotions and reducing negative emotions, particularly anxiety, in children. The positive association between supportive/engaged parenting style and parental openness and different ways of thinking is also consistent with the findings of previous studies. Children whose parents express open-mindedness and encourage independent thinking and self-discovery tend to develop better psychological, social, and cognitive flexibility; therefore, they have better coping mechanisms. These children experience the world as a place with many opportunities to experiment within secured boundaries. Such developmental conditions of emotional wellbeing and self-concept are associated with a low probability of experiencing depression, fear, and anxiety (Zeevi-Cousin & Lavenda, 2023). Furthermore, children with good coping mechanisms and emotional control better manage situations. The results of the present study confirmed the mediating role of the parental hostile/coercive style in the association between openness to different ways of thinking and child anxiety. It seems that parental openness to different ways of thinking reduces the chance of

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adopting a hostile/coercive parenting style, which, in turn, reduces the levels of anxiety experienced by the child. Therefore, the anxiety levels of children are not directly affected by the parent's cognitive ability for flexible thinking, but this characteristic allows for the parent to consolidate parenting that does not resort to coercive and hostile behaviors, control, obedience, and severe strictness. However, several methodological limitations must be taken into account when interpreting these results. First, the study relied on self-report questionnaires, which may be susceptible to social desirability bias. Participants were asked to rank their answers on a Likert scale, which could potentially impact the variability of the variables and consequently the results of the study. Second, the study used a cross-sectional design, meaning that causal relationships cannot be established with certainty. To address this limitation, future research should use longitudinal designs to examine the temporal relationships between parent-child relationships, executive functions, emotion regulation, and child anxiety. Finally, the age range of children in the study was limited to 11 to 12 years, which may limit the generalizability of the results to other age groups. Future studies should consider including a broader age range to gain a more comprehensive understanding of the effects of parent-child relationships and executive functioning on children's anxiety.

The results of this study have significant implications for psychologists and counselors, including family therapists, school psychologists, and developers of programs to improve the psychological and emotional well-being of children and families. These professionals need to recognize the influence of the parent-child relationship and executive functioning on positive and adaptive emotion regulation strategies, as this may help reduce the risk of childhood anxiety. To help children develop positive emotion regulation strategies and reduce their vulnerability to anxiety, experts can help parents change their interaction patterns with their children and help children improve their executive function skills. Encouraging and guiding parents to develop empathy toward their children can improve the parent-child relationship and promote emotional well-being. Parents can be encouraged to adopt a supportive and cooperative parenting style that allows for the child's autonomy and independence. This parenting style is associated with positive effects on children's psychological and emotional well-being.

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Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Studies involving human participants provided their written informed consent to participate in this study.

Author contributions

All authors contributed to the study conception and design, material preparation, data collection and analysis. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that this research was conducted in the absence of any commercial or financial relationships that could be interpreted as a potential conflict of interest.

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