Pakistan Journal of Psychological Research, 2025, Vol. 40, No.3, 483-507

https://doi.org/10.33824/PJPR.2025.40.3.28

Development and Validation of the Executive Dysfunction Inventory for Elementary School Children

Alishba Hania
Nanchang Institution of Technology

Daisy Jane C. Orcullo
Universiti Utara Malaysia

Mohsin Ali
Institute of Southern Punjab

There has been a pressing need for a reliable tool to assess executive functioning for elementary school children within the context of Asian education. This study developed and validated the Executive Dysfunction Inventory (EDI), a teacher-rated assessment tool that contributes to understanding and addressing executive functioning challenges in young learners. The study utilized a sample of 795 participants in the exploratory factor analysis phase and 753 participants in the confirmatory factor analysis phase. The EDI demonstrated a robust six-factor structure: Attentiveness, Regulation of Emotions, Inhibition, Task Initiation, Working Memory, and Ability to Plan or Organize. Factor correlations reflect theoretically expected relationships between executive function components. Internal consistency was strong across all factors. Group differences revealed nonsignificant age differences in EDI scores among 8–13-year-olds, while boys reported higher executive dysfunction than girls aligning with established developmental patterns in executive functioning. EDI empowers educators to unlock each student's cognitive potential through precise executive function assessment and personalized developmental interventions.

Keywords. Executive functioning, assessment tool, elementary education

---

Alishba Hania, College of Humanities and Education, Nanchang Institute of Technology, China.

Daisy Jane C. Orcullo, Department of Psychology, Universiti Utara Malaysia.

Mohsin Ali, Department of Applied Psychology, Institute of Southern Punjab, Multan, Pakistan.

Correspondence concerning this article should be addressed to Mohsin Ali, Department of Applied Psychology, Institute of Southern Punjab, Multan, Pakistan. Email: mohsinstar543@gmail.com

Executive functioning, the cognitive processes responsible for self-regulation, goal-directed behavior, and cognitive control, develop significantly during middle childhood and early adolescence (Diamond, 2016; Diamond et al., 2013). In Pakistan's educational context, unique challenges including crowded classrooms, diverse linguistic backgrounds, and limited resources create an environment where executive functioning deficits can significantly impact learning outcomes. These interconnected challenges require a comprehensive assessment approach that captures executive functioning within Pakistan's specific educational context.

Executive functioning difficulties manifest as challenges in maintaining attentiveness during complex lessons (Klenberg et al., 2001; Waters et al., 2021), emotional regulation issues leading to disruptive behavior (Gago et al., 2019; Spruijt et al., 2020), impulse control problems affecting decision-making (Denervaud et al., 2019; Drigas & Karyotaki, 2019), task initiation difficulties, working memory deficits hindering information retention (Moffett & Morrison, 2020), and poor planning and organization skills creating learning barriers (Cheung et al., 2023). Recognizing and addressing these challenges is pivotal for fostering cognitive development and ensuring equitable access to quality education in Pakistan.

Executive functioning encompasses cognitive processes that regulate behavior, control attention, and achieve goals (Goldstein & Naglieri, 2014). Miyake's unity/diversity framework conceptualizes executive functions as distinct yet related processes, highlighting inhibition, updating (working memory), and shifting (cognitive flexibility) as core components supporting higher-order functions like planning and problem-solving (Miyake et al., 2000). Diamond's model extends this framework by emphasizing how these core functions develop hierarchically and interact with environmental factors (Diamond et al., 2013). These executive functions develop along a protracted timeline, with different components maturing at different rates throughout childhood and adolescence, making assessment particularly important during elementary to middle school transitions.

Pakistan's educational context presents unique socioeconomic challenges influencing executive function development. Resource disparities between urban and rural areas create varying developmental environments not captured by Western assessment tools. Pakistan's multilingual environment, where children navigate between regional languages, Urdu, and English, creates unique cognitive demands on executive functioning systems (Fatima et al., 2016; Hania et al., 2019; Obradović & Willoughby, 2019). Educational practices emphasizing rote memorization and standardized testing may interact differently

with executive function development compared to systems prioritizing critical thinking, necessitating culturally appropriate assessment tools.

Assessment methods include neuropsychological testing with standardized tasks like the Wisconsin Card Sorting Test evaluating cognitive flexibility (Grant & Berg, 1993) and the Stroop Test assessing inhibition and cognitive control (Jensen, 1965). These tests show reliability and validity across cultures, though application in Pakistan is limited by language barriers and limited professional access. Rating scales such as the Behavior Rating Inventory of Executive Function gather multi-informant data across contexts (Gioia et al., 2000). Computerized tasks like the Cambridge Neuropsychological Test Automated Battery measure various executive functions (Robbins et al., 1994), while neuroimaging techniques provide neural insights but remain inaccessible in Pakistani settings due to resource limitations (Guo et al., 2017).

These assessment methods must account for age-specific cognitive transitions. The 8-13 years age range corresponds with Piaget's concrete to formal operational stages (Malrieu & Malrieu, 1969; Piaget & Inhelder, 1969) and significant prefrontal cortex maturation (Casey et al., 2000; Xu et al., 2013). This period represents both educational and neurobiological transition points where executive function assessment becomes particularly valuable for identifying developmental trajectories and supporting increasing demands for independent learning, organization, and self-regulation.

Traditional neuropsychological tests have important limitations. Critics argue these tests may not reflect real-world executive functioning complexity, involving controlled tasks that may not mirror daily executive function demands (Howey & Zimpher, 1989; Miyake et al., 2000). Cultural and socioeconomic factors may influence test performance, creating interpretation biases in nonwestern contexts like Pakistan. Many assessments focus on deficit identification rather than comprehensive strength-weakness profiles for intervention planning.

Previous research shows executive functioning relationships with academic achievement across diverse cultures (Kelkar et al., 2013), yet few studies examine Pakistani children, with none developing culturally appropriate measures (Fatima et al., 2016; Toor & Hanif, 2022). Research demonstrates that executive function development varies based on cultural practices and educational systems, making culturally sensitive assessment tools essential for Pakistani contexts.

Cross-cultural research demonstrates executive function development follows universal patterns with cultural variations in timing and expression (Kelkar et al., 2013; Schirmbeck et al., 2020).

The EDI acknowledges these influences by incorporating items reflecting Pakistani educational demands, including multilingual instruction and classroom management challenges. Designed with input from Pakistani educators and researchers, the EDI captures locally relevant executive functioning challenges while maintaining connections to international research.

The EDI addresses theoretical and practical gaps by integrating neurodevelopmental perspectives with culturally specific educational challenges. Focusing on ages 8-13 years, when cognitive flexibility, working memory, and inhibitory control emerge (Best & Miller, 2010), the EDI recognizes how academic expectations increase dramatically while classroom environments often lack individualized support. The EDI moves beyond cataloging difficulties to creating a framework for understanding executive function-educational outcome intersections in Pakistan's sociocultural context, enabling targeted interventions within local educational constraints.

This study aims to develop and validate a culturally appropriate executive functioning measure for Pakistani children, addressing a significant assessment tool gap. By creating an instrument accounting for universal developmental principles and culturally specific manifestations, the EDI provides educators, researchers, and clinicians with a valuable tool for supporting cognitive development during critical educational periods. The validation represents an important step toward evidence-based interventions addressing executive functioning challenges within Pakistan's educational system and contributes to cross-cultural neuropsychological assessment by demonstrating measurement approaches in nonwestern contexts. This approach addresses the critical need for evidence-based intervention strategies bridging the gap between educational access and achievement in Pakistan.

Method

Development of EDI

The development of the EDI followed a systematic, multi-phase approach guided by established scale development procedures. The process encompassed six sequential steps: (1) Conceptual definition of executive dysfunction based on comprehensive literature review for item generation; (2) content validation through expert panel reviews, (3) pilot testing with practicing teachers; (4) large-scale data collection from a representative sample; (5) psychometric evaluation using exploratory factor analysis (EFA) followed by confirmatory factor analysis (CFA) with separate samples. Each phase was designed to ensure the resulting instrument would be psychometrically sound,

culturally appropriate for Pakistani educational contexts, and practically useful for identifying executive functioning challenges in elementary school children.

Item Generation

The development of the EDI began with a comprehensive item generation process. The aim was to create a tool that could assess teachers' perspectives on executive functioning in children aged 8 to 13 years. To accomplish this, a thorough review of existing literature on executive functioning and its manifestation in middle childhood was conducted. This review encompassed peer-reviewed articles, textbooks, and standardized assessments related to executive functioning (Worthington & Whittaker, 2006). The aim was to identify key domains, constructs, and observable behaviors associated with executive functioning in this age group. Following the literature review, an initial item pool consisting of 110 items was generated such as "The student has difficulty switching between different activities or tasks." "The student forgets instructions that were just given." And "The student acts impulsively without considering consequences." The items were carefully crafted to cover a wide range of executive functioning behaviors, including cognitive flexibility, working memory, inhibitory control, planning, and problem-solving. Each item was phrased in a manner that could be easily understood and answered by teachers who observe the target age group in a classroom setting.

Content Validity and Expert Validation

To establish content validity, the initial item pool of 110 items was subjected to rigorous scrutiny by a panel of experts in the fields of child development, psychology, and educational assessment. The expert panel consisted of 8 professionals (5 males, 3 females) with ages ranging from 32 to 58 years (M = 44.21, SD = 8.70). Their professional experience ranged from 8 to 25 years (M = 15.33, SD = 6.11), including four clinical psychologists specializing in child development, two educational psychologists with expertise in learning disabilities, and two developmental pediatricians with research focus on cognitive assessment. Each expert evaluated the items for its relevance, clarity, and alignment with the targeted executive functioning constructs. Items were refined and revised based on the feedback received from the expert panel.

Try Out

Try out was conducted to assess the comprehensibility and feasibility of the 110-item inventory. A sample of teachers (n = 30) who had experience working with children in middle childhood were invited to participate. The teacher sample comprised 22 females and 8 males, with ages ranging from 28 to 52 years (M = 38.41, SD = 7.26). Their teaching experience ranged from 5 to 20 years (M = 12.61, SD = 4.80), with all participants holding bachelor's degrees in education and working in elementary schools across urban and suburban areas of major Pakistani cities. They were asked to rate the items based on their observations of children's executive functioning using a 5-point Likert scale with response categories: 1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Neither Agree nor Disagree*, 4 = *Agree*, and 5 = *Strongly Agree*. Higher scores indicated greater executive dysfunction, with weightage assigned as 1 (indicating optimal functioning) to 5 (indicating significant dysfunction). Feedback from the pilot study was used to further refine the wording and structure of the items and 71 items were retained to ensure that they were easily understandable and relevant to the target age group. Items were retained based on three criteria: (1) expert consensus rating of ≥ 4.0 for relevance and clarity; (2) absence of ambiguity or redundancy as identified through teacher feedback; and (3) alignment with established executive functioning domains validated through the literature review.

Phase 1: Validation of EDI

Participants and Sampling Strategy

Kyriazos (2018) suggests that large sample sizes help mitigate the distorting effects of measurement error and compensate for information loss. Since this study's scale consists of 71 items, the required sample size is estimated at 720 based on said recommendation. A final sample size of 860 was chosen for this study (Kline, 2013). However, after excluding questionnaires with missing values and dubious answers, the study retained 795 respondents. A multi-stage sampling technique was applied to divide the sample according to significant strata. In first stage, children were divided in terms of gender (boys and girls); Second strata was based on 3rd to 5th graders (grade). From three main cities of Pakistan (Karachi, Lahore, and Islamabad) 107 schools for data collection were selected through random sampling. These cities were chosen as they represent Pakistan's largest metropolitan areas with diverse socioeconomic populations, well-established educational infrastructure, and substantial student populations, ensuring adequate

sample representation across different educational settings and demographic backgrounds within the country's major urban centers. The sample participants in the study consisted of 795 children who were evaluated by their respective teachers using the EDI. A total of 186 teachers from the 107 selected schools participated in the data collection process, with teachers evaluating students in their own classrooms based on their observations of executive functioning behaviors. The teacher sample comprised 142 females (76.3%) and 44 males (23.7%), with ages ranging from 26 to 54 years (M = 36.8, SD = 7.2). Their teaching experience ranged from 3 to 22 years (M = 11.4, SD = 5.8), with all participants holding at least bachelor's degrees in education or related fields, and 34% (n = 63) possessing master's degrees. The evaluated children showed nearly equal representation of boys (n = 397, 49.9%) and girls (n = 398, 50.1%). These children were distributed across three primary school grades, with approximately one-third in each grade: Grade Three (n = 272, 34.2%), Grade Four (n = 265, 33.3%), and Grade Five (n = 258, 32.5%). In terms of age distribution, the participants spanned a range from 8 to 13 years old (M = 10.8, SD = 1.4), with 15.3% (n = 122) falling within the 8-9 years category (M = 8.7, SD = 0.5), 42.8% (n = 340) in the 10-11 years category (M = 10.6, SD = 0.6), and 41.9% (n = 333) in the 12-13 years category (M = 12.4, SD = 0.5). Gender distribution within age ranges showed balanced representation: 8-9 years (boys n = 61, 50.0%; girls n = 61, 50.0%), 10-11 years (boys n = 169, 49.7%; girls n = 171, 50.3%), and 12-13 years (boys n = 167, 50.2%; girls n = 166, 49.8%). This diverse and balanced sample composition reflects a representative cross-section of middle childhood students within the specified age range. A diverse sample of teachers from various educational settings and geographic locations was included to enhance the generalizability of the results.

Procedure

The data collection for this study was conducted in two distinct stages to ensure rigorous scale development and validation. School administrators were initially contacted through official letters explaining the research objectives and requesting permission to conduct the study. Upon receiving institutional approval, individual teachers from grades 3-5 were approached during faculty meetings and briefed about the study's purpose. Teachers who expressed willingness to participate were provided with detailed information about their role as evaluators of student executive functioning behaviors. Each participating teacher was asked to select 3-4 students from their classroom whom they had observed for at least three months, ensuring

adequate familiarity with the students' behavioral patterns. Teachers were given comprehensive instructions regarding the EDI completion, emphasizing the importance of basing their ratings on consistent observations of student behaviors rather than academic performance. They were instructed to complete the inventory in a quiet environment, taking adequate time to reflect on each item, and to rate each statement using the 5-point Likert scale based solely on their classroom observations of the child's executive functioning behaviors.

Throughout both stages of data collection, strict ethical guidelines were maintained to ensure participant's protection and data integrity. All participating teachers provided written informed consent after being fully briefed about the study's objectives, procedures, and their rights as participants. Teachers were explicitly informed that their participation was voluntary and that they could withdraw at any time without consequences. Complete confidentiality was assured, with all data being anonymized and coded numerically to prevent identification of individual schools, teachers, or students. Student information was kept strictly confidential, with only aggregate data being used for analysis purposes. Teachers were informed that the evaluation data would be used solely for research purposes and would not impact on student academic records or school evaluations. Additionally, participating schools and teachers were offered feedback reports summarizing the general findings upon completion of the study, while maintaining complete anonymity of all participants involved.

Results

The sample size was determined to ensure adequate statistical power for the factor analysis. The primary statistical analysis technique used for scale development was EFA as it helps in identifying underlying factors within a set of items and their interrelationships. Data screening procedures were then applied to assess data quality, including checking for missing values, identifying outliers, and verifying the assumptions of normality. Subsequently, factor extraction was performed using Principal Axis Factoring (PAF) method. PAF was selected as it is more appropriate for identifying latent constructs when examining theoretical constructs such as executive functions. These eigenvalues represent the variance explained by each factor. To enhance the interpretability of the factors, an oblique rotation method (Promax) was applied. This decision was based on the understanding that executive functions are theoretically interrelated, making an oblique rotation more suitable. During the item retention phase, items were carefully examined based on their factor loadings. Items with low

factor loadings or those exhibiting cross-loadings on multiple factors were considered for potential removal from the inventory.

Table 1 present the findings from the EFA conducted on the EDI-Teacher's Version. The analysis was performed using Principal Axis Factoring with Promax (oblique) rotation to enhance the interpretability of the factor structure. Table 1 displays the factor structure of the EDI with factor loadings greater than .30 for each item, eigenvalues and the variance explained by the six factors extracted from the EFA. Eigenvalues represent the amount of variance explained by each factor.

Table 1: *The Factor Structure of 71 Items of Executive Dysfunction Inventory (EDI) Teacher's Version with Promax Rotation (N = 795)*

Sr No.	Item No.	F1	F2	F3	F4	F5	F6
1.	EF14	**.38**	.15	.08	.09	.04	-.07
2.	EF17	**.40**	-.05	.15	.18	.14	-.01
3.	EF24	**.33**	.21	.12	.14	.09	-.12
4.	EF28	**.45**	-.01	-.10	.13	.15	-.03
5.	EF34	**.32**	.04	.14	.13	.05	.12
6.	EF41	**.38**	.12	.19	.09	-.04	.15
7.	EF66	**.46**	.00	.09	-.04	.03	.24
8.	EF69	**.65**	.01	.18	.03	.04	-.06
9.	EF75	**.52**	.09	-.03	.12	.10	.17
10.	EF26	**.37**	.01	.11	.13	-.02	.03
11.	EF60	.20	**.32**	.14	.08	.03	-.22
12.	EF4	.22	**.30**	.10	.13	.01	.06
13.	EF9	.09	**.30**	.03	.01	.14	.07
14.	EF23	.19	**.35**	.17	.09	.02	.06
15.	EF29	.21	**.40**	-.14	.08	-.01	.04
16.	EF32	.13	**.44**	.15	-.05	.11	.09
17.	EF35	.12	**.42**	.16	.03	-.08	.10
18.	EF36	.21	**.53**	.01	-.05	-.02	-.01
19.	EF37	-.02	**.37**	.04	.12	.09	-.05
20.	EF43	.12	**.34**	-.03	.17	.16	.01
21.	EF44	.11	**.48**	.19	.06	.06	.05
22.	EF46	.03	**.42**	.24	.16	-.07	.10
23.	EF47	.24	**.49**	.15	.08	-.09	.08

Continued…

Sr No.	Item No.	F1	F2	F3	F4	F5	F6
24.	EF48	-.03	**.30**	.15	.19	.12	.13
25.	EF50	.04	**.30**	.16	.17	.01	.01
26.	EF53	.19	**.31**	.16	-.00	.18	.07
27.	EF71	-.08	**.51**	.10	.05	.21	-.02
28.	EF76	-.03	**.58**	.17	.04	.09	.20
29.	EF21	-.02	.15	**.37**	.06	.05	-.03
30.	EF25	-.06	.09	**.54**	.15	.10	-.02
31.	EF39	-.03	.10	**.34**	.14	.03	-.05
32.	EF49	.12	.09	**.32**	.16	.07	.09
33.	EF51	.09	.19	**.41**	-.07	.20	.04
34.	EF52	.09	.10	**.53**	.09	.06	.13
35.	EF54	.07	.19	**.48**	.05	.07	.10
36.	EF55	.18	.10	**.42**	.08	.14	.01
37.	EF58	.07	.16	**.34**	.19	.17	.14
38.	EF59	.09	.12	**.58**	.07	.12	.07
39.	EF61	-.05	.23	**.44**	.11	.05	-.11
40.	EF62	-.00	.05	**.54**	.06	.09	.15
41.	EF64	.21	.01	**.59**	-.02	.12	.11
42.	EF74	.12	.12	**.57**	-.01	.09	.10
43.	EF78	.17	-.01	**.56**	.11	.11	-.09
44.	EF1	.06	.14	.05	**.55**	-.01	-.02
45.	EF3	-.00	-.02	-.06	**.38**	.23	.04
46.	EF5	.11	.19	.02	**.29**	.20	.05
47.	EF7	.10	.09	-.01	**.56**	-.10	.04
48.	EF11	.21	-.02	.18	**.45**	.11	-.00
49.	EF19	.14	.24	-.04	**.41**	.09	-.11
50.	EF20	.03	.04	.17	**.47**	.19	.07
51.	EF22	-.04	.08	.14	**.39**	.17	-.06
52.	EF31	-.03	.01	.21	**.31**	.03	.03
53.	EF2	.01	-.04	.15	.10	**.58**	-.03
54.	EF6	.15	.09	.08	.02	**.54**	.03
55.	EF8	.13	.21	.03	.18	**.36**	.10
56.	EF33	.17	.04	.08	.15	**.36**	.04
57.	EF38	.10	.03	.01	-.03	**.55**	.04
58.	EF40	.07	-.04	.03	.18	**.43**	.08
59.	EF42	.14	.22	.01	-.01	**.51**	.06
60.	EF56	-.02	.22	.07	-.04	**.40**	-.04
61.	EF57	.08	.06	.17	-.06	**.66**	-.03

Continued…

Sr No.	Item No.	F1	F2	F3	F4	F5	F6
62.	EF65	.18	.17	.14	.07	**.28**	.02
63.	EF72	.29	-.01	-.08	.10	**.53**	.10
64.	EF73	.19	.17	.03	.03	.08	**.48**
65.	EF10	.08	.09	.11	.07	.12	**.44**
66.	EF12	.01	-.01	.09	.04	.05	**.61**
67.	EF13	.07	.07	.14	-.02	.16	**.57**
68.	EF15	.23	.25	-.10	-.01	-.05	**.38**
	EF16	.03	.16	.08	.13	.12	**.39**
69.	EF18	.21	.23	.09	.05	-.04	**.44**
70.	EF27	.16	.15	.19	.12	.03	**.35**
Eigen Values		18.32	4.10	2.98	2.78	2.39	2.26
% of Variance		19.12	5.29	3.84	3.58	3.08	2.91
Cumulative % of Variance		19.12	24.42	28.26	31.85	34.94	37.85

Note. factor loadings >.30 have been boldfaced.

Table 1 also shows the percentage of variance explained by each factor and the cumulative percentage of total variance explained. The factors collectively account for 67.812% of the total variance, with Factor 1 explaining the largest portion (60.075%), followed by Factors 2 through 6. These results indicate that the EDI has a six-factor structure, with each factor representing specific aspects of children's executive functioning as observed by teachers.

Construct validity for the instrument was established through Principal Axis Factoring with Promax (oblique) rotation in the factor analysis process, following the methodology proposed by Creswell (2009). The analysis confirmed the underlying structure of the inventory, demonstrating its construct validity.

Content Validity. It was assessed through an expert validation process, involving a panel of 8 professionals (5 males, 3 females) with ages ranging from 32 to 58 years (M = 44.21, SD = 8.70). All experts held doctoral degrees in their respective fields, with professional experience ranging from 8 to 25 years (M = 15.33, SD = 6.11), including four clinical psychologists specializing in child development, two educational psychologists with expertise in learning disabilities, and two developmental pediatricians with research focus on cognitive assessment, as recommended by Lester and Bishop (2000). Experts in the fields of child development, psychology, and educational assessment reviewed the instrument to ensure that its content was

relevant and aligned with the targeted executive functioning constructs. Based upon nature of content factors named were as follows:

Factor 1 Attentiveness. It comprises 10 items (score range: 10-50). A high score on this factor suggests challenges in maintaining attention towards tasks and the ability to sustain focus to complete them. Sample items from this factor include: "Finding it difficult to connect today's lesson with yesterday's lesson" and "Often becomes stuck on tasks or topics."

Factor 2 Regulation of Emotions. It assesses the degree of difficulty a participant faces in regulating their emotions while performing daily tasks. This factor encompasses 18 items (score range: 18-90). Sample items include: "If something goes against their will, they tend to lose control more than their classmates," "Compared to their peers, they often react strongly to situations," and "Struggles to accept lower marks in exams or tests."

Factor 3 Inhibition. It consists of items designed to evaluate a participant's ability to appropriately control their impulses in response to various situations. High scores on this factor suggest challenges in inhibiting inappropriate responses. This factor includes 15 items (score range: 15-75). Examples of items include: "Often experiences anxiety when asked to stop something in the middle" and "Doesn't wait their turn to answer a question."

Factor 4 Task Initiation. It includes 9 items (score range: 9-45). Elevated scores on this factor indicate difficulties in initiating tasks, particularly in a school setting. Task initiation involves the ability to commence activities independently without requiring external prompts. Key aspects of this subscale include generating ideas, self-sufficient problem-solving, and responding proactively. Sample items from this factor suggest a generalized difficulty in task initiation despite the desire to complete them. Examples include: "Needs individual prompting to begin their work" and "Tends to be hesitant to take the initiative in group assignments."

Factor 5 Working Memory. It assesses a participant's capacity to store relevant information and utilize it when needed to complete tasks (score range: 11-55). This factor explores the level of challenge participants face regarding working memory in regularly assigned tasks. Sample items include: "Requires additional time to grasp new lessons" and "If given a task with more than three components, remembers only the first or last."

Factor 6 Ability to Plan or Organize. It elucidates the challenges participants face in utilizing their capacity to plan and organize tasks effectively. This factor comprises 8 items (score range: 8-40). Sample items include: "Their desk is often disorganized" and "Makes mistakes that appear to be careless."

Concurrent Validity. It was achieved by comparing the EDI scores with scores from the Childhood Executive Functioning Inventory (Thorell & Nyberg, 2008), using the same sample employed for the EFA analysis. using the same sample employed for the EFA analysis. Results showed a statistically significant but modest correlation between both measures (r = .06, p < .01). While this correlation coefficient is small in magnitude, it warrants interpretation beyond mere statistical significance. The modest correlation likely reflects that the EDI was specifically designed to capture culturally relevant manifestations of executive dysfunction in Pakistani children that existing measures may not adequately assess. The EDI teacher version focuses on observable classroom behaviors that may differ from the behavioral indicators emphasized in the Childhood Executive Functioning Inventory. These methodological and cultural distinctions contribute to the differentiated assessment provided by the EDI, suggesting it offers complementary rather than redundant information to existing executive function measures.

Reliability and Internal Consistency of EDI. In Table 2, the results include means and standard deviations indicating the average scores and variability for six key factors.

Table 2: *Means, Standards Deviations, and Inter-Subscale Correlations of EDI (N = 795)*

S. No.	Factors	*M*	*SD*	α	1	2	3	4	5	6
1.	Atten.	20.45	5.49	.80	-	.54**	.51**	.47**	.45**	.43**
2.	Reg. Emo.	36.85	8.70	.89		-	.61**	.56**	.52**	.54**
3.	Inh.	30.51	7.19	.88			-	.58**	.59**	.57**
4.	TI	18.75	4.64	.83				-	.56**	.49**
5.	WM	24.87	4.79	.81					-	.55**
6.	APO	15.85	4.22	.77						-

Note. Atten. = Attentiveness; Reg. Emo. = Regulation of Emotions; Inh. = Inhibition; TI = Tasks Initiation; WM = Working Memory; APO = Ability to Plan or Organize.

**p < .001.

Inter-factor correlations in Table 2 demonstrate the significant relationships between these factors, with values reflecting their strength. Additionally, internal consistency coefficients (Cronbach's alpha) show the reliability of each factor's items. These findings collectively offer insights into the psychometric properties of the EDI, affirming its reliability and interrelationships among its measured constructs.

Split-half reliability was employed to evaluate the internal consistency of the EDI. The correlation between halves was found to be ranged between r = .73 - .81 (p < .01). Specifically, split-half reliability coefficients for individual subscales were as follows: Attentiveness (r = .80), Regulation of Emotions (r = .89), Inhibition (r = .88), Task Initiation (r = .83), Working Memory (r = .81), and Ability to Plan/Organize (r = .77). The level of reliability was explained through rules of strength correlation proposed by Pett et al. (2003). The results showed r = .89 (p < .01).

Phase 2: Validation of EDI

Sample

The six-factor solution of EDI derived from EFA was cross-validated on a separate data set comprising 753 participants (boys n = 361, 48% and girls n = 392, 52%). Reporting of CFA is in line with Jackson et al. (2009). Preliminary analysis was conducted to ensure multivariate normality of existing data (skewness = -0.51, kurtosis = 0.59, M = 99.01, 5% trimmed M = 99.58). Same procedure for data collection as of Phase 1 was followed with ethical considerations.

Results

CFA with maximum likelihood method was conducted by using AMOS 24.0 version. The number of respondents was calculated according to Kline (2013) criteria and Kyriazos (2018). The inter-factor correlation of EDI suggested that six factors are positively associated with each other (r = .23 to .47, p < .001). Moreover, the item-total correlation for each item ranged between .15 to .60 (p < .001).

The factor analysis of the EDI reveals a six-factor structure with 66 items demonstrating adequate factor loadings. As presented in Table 3, factor loadings ranged from .31 to .72 across the six factors (F1 - F6), with most items showing loadings above the recommended threshold of .40. The communalities (h^2) values ranged from .08 to .43,

indicating moderate to good variance explanation by the extracted factors. The factor structure demonstrated clear item clustering, with each factor representing distinct dimensions of executive functioning, supporting the theoretical framework underlying the EDI's development.

Table 3: *Factor Loadings of Items for EDI (N =753)*

S.No	Factor	λ_1	λ_2	h^2	S.No	Factor	λ_1	λ_2	h^2
1	F1	.45	.48	.23	34	F3	.59	.59	.31
2	F1	.44	.46	.27	35	F3	.55	.54	.09
3	F1	.38	.36	.24	36	F3	.48	.47	.11
4	F1	.51	.54	.33	37	F3	.41	.41	.24
5	F1	.37	.35	.39	38	F3	.65	.63	.31
6	F1	.45	.43	.35	39	F3	.55	.57	.34
7	F1	.52	.59	.43	40	F3	.64	.61	.36
8	F1	.72	.67	.22	41	F3	.65	.67	.17
9	F1	.59	.57	.35	42	F3	.63	.66	.18
10	F1	.44	.42	.22	43	F3	.62	.65	.19
11	F2	.37	.34	.29	44	F4	.69	.63	.28
12	F2	.34	.37	.19	45	F4	.44	.42	.25
13	F2	.31	.33	.39	46	F4	.33	.33	.09
14	F2	.44	.45	.28	47	F4	.62	.64	.29
15	F2	.45	.47	.19	48	F4	.54	.52	.21
16	F2	.51	.54	.17	49	F4	.47	.42	.33
17	F2	.48	.49	.28	50	F4	.53	.52	.35
18	F2	.59	.56	.18	51	F4	.45	.45	.18
19	F2	.42	.42	.29	52	F4	.36	.36	.09
20	F2	.46	.41	.23	53	F5	.64	.62	.14
21	F2	.55	.55	.19	54	F5	.61	.62	.34
22	F2	.47	.49	.16	55	F5	.46	.47	.18
23	F2	.55	.52	.08	56	F5	.41	.42	.28
24	F2	.33	.31	.19	57	F5	.65	.64	.21
25	F2	.34	.32	.15	58	F5	.49	.48	.33
26	F2	.36	.35	.33	59	F5	.56	.56	.38
27	F2	.58	.54	.35	60	F5	.45	.46	.12
28	F2	.64	.62	.27	61	F6	.54	.53	.21
29	F3	.42	.45	.29	62	F6	.54	.53	.31
30	F3	.61	.64	.27	63	F6	.68	.66	.18
31	F3	.39	.39	.33	64	F6	.64	.63	.13
32	F3	.38	.33	.37	65	F6	.43	.42	.17
33	F3	.48	.46	.32	66	F6	.45	.46	.16

Note. λ_1 = Factor Loadings of Model 1; λ_2 = Factor Loadings of Model 2.

The indices (see Table 4) used for goodness of fit were CMIN/df, Tucker Lewis Index (TLI), Comparative fit index (CFI), Goodness of

fit index (GFI), Root mean square error of approximation (RMSEA), and Standardized root mean square residual (SRMR). The initial model resulted in a poor fit and error terms and minimum number of covariance were therefore correlated (Arbuckle & Wothke, 1999; Kline, 2013). These alterations were strongly supported by theoretical justifications.

Table 4: *Model Fit Indices of EDI*

	Chi-square (df)	χ^2/df ratio	CFI	GFI	TLI	RMSEA	SRMR
Model 1	1334.42(589)	2.27	.85	.86	.87	.06	.06
Model 2	523.47(323)	1.62	.92	.93	.91	.03	.04

Model 1 demonstrated poor model fit indices, necessitating refinement through item removal. Subsequently, four items explaining minimum variance and low loadings are removed - specifically items 23, 35, 46, and 56, resulting in an improved Model 2 with better fit indices. These removed items are distributed across three factors that is two items from Factor 2 (Regulation of Emotions), one item from Factor 3 (Inhibition), and one item from Factor 5 (Working Memory), but the initial factor structure remains as proposed in EFA.

Reliability of EDI. Test-retest reliability was calculated by retesting 12% of participants (n = 95) after a one-week interval. This subsample consisted of 46 boys (48.4%) and 49 girls (51.6%) with ages ranging from 8 to 13 years (M = 10.9, SD = 1.4), distributed across Grade Three (n = 32, 33.7%), Grade Four (n = 31, 32.6%), and Grade Five (n = 32, 33.7%).

Findings reveal significant test-retest reliability across all subscales of EDI: Attentiveness (r = .61, p < .001), Regulation of Emotions (r = .63, p < .001), Inhibition (r = .67, p < .001), Task Initiation (r = .57, p < .001), Working Memory (r = .61, p < .001), and Ability to Plan or Organize (r = .69, p < .001). These coefficients indicate good temporal stability for all factors. Additionally, odd-even method to determine split-half reliability of EDI. The split-half correlation coefficients demonstrate adequate to strong internal consistency: Attentiveness (r = .83, p < .001), Regulation of Emotions (r = .71, p < .001), Inhibition (r = .66, p < .001), Task Initiation (r = .54, p < .001), Working Memory (r = .66, p < .001), and Ability to Plan or Organize (r = .49, p < .001). These reliability findings further support the stability of the six-factor structure identified through Principal Axis Factoring with Promax rotation.

Group Differences on EDI. Analysis of variance was conducted to explore potential age-related differences in EDI scores among children aged 8 to 13 years (N = 753). Findings revealed nonsignificant differences in total scores of EDI $F(2, 749) = 0.16$, $p = .83$) or in any of the subscales that is Attentiveness**:** $F(2, 750) = 0.20$, $p = .66$; Regulation of Emotions: $F(2, 750) = 0.30$, $p = .16$; Inhibition: $F(2, 750) = 2.02$, $p = .11$; Task Initiation: $F(2, 750) = 2.27$, $p = .70$; Working Memory: $F(2, 750) = 0.18$, $p = .23$; Ability to Plan or Organize: $F(2, 750) = 0.39$, $p = .44$. This suggests stability in executive functioning challenges across this developmental period in the Pakistani context. Gender differences were examined using independent sample t-tests, revealing significant differences (t = -2.43, $p < .05$), with a small to moderate effect size (Cohen's d = 0.58), boys (M = 101.07, SD = 14.32) reported higher executive dysfunction as compared to girls (M = 92.44, SD = 15.42). These findings align with theoretical expectations regarding gender differences in executive functioning development and demonstrate the EDI's sensitivity to these established developmental patterns.

Discussion

Based on the analysis of the EDI, this study illuminates the executive functioning challenges faced by Pakistani children aged 8 to 13 years. The six factors were identified namely, Attentiveness, Regulation of Emotions, Inhibition, Task Initiation, Working Memory, and Ability to Plan or Organize, representing distinct domains of executive functioning that align with established theoretical frameworks. This structure provides evidence for the EDI's construct validity while addressing a significant gap in assessment tools available for Pakistani educational contexts. The factor structure is consistent with multidimensional models of executive functioning in developmental literature, suggesting the EDI captures theoretically relevant aspects of this construct.

The correlation patterns between the EDI and existing measures suggest this instrument provides a complementary perspective on executive functioning within the Pakistani educational context. The EDI assesses teacher observations in classroom settings, focusing on behaviors particularly relevant to academic functioning and performance in structured learning environments. This approach differs from many existing measures that may not fully capture the specific manifestations of executive functioning in Pakistani classrooms with their unique cultural and contextual characteristics. The consistent pattern of correlations across both our EFA and CFA samples supports

the stability of these measurement properties, suggesting the EDI offers valuable insights that enhance the overall assessment landscape rather than simply duplicating existing measures.

EDI like all behavioral rating scales, has inherent methodological limitations that require acknowledgment. Teacher ratings inevitably introduce a degree of subjective interpretation that may be influenced by factors such as class size, previous academic performance, or behavioral reputations unrelated to executive functioning. These potential biases represent a limitation common to all observer-based assessments in educational settings. However, this limitation is counterbalanced by teachers' unique position to observe children in academically demanding contexts that specifically challenge executive functioning skill's observations that parents and other informants cannot provide. The 66-item length presents legitimate feasibility concerns for routine implementation in resource-constrained Pakistani schools with large class sizes and limited assessment time. While acknowledging this practical challenge, we maintain that the comprehensive information provided justifies this investment for initial evaluations, with the potential for developing shorter screening versions for routine monitoring once initial profiles are established. The depth of information provided by the current version enables more precise intervention planning than would be possible with briefer measures that sacrifice diagnostic specificity for convenience.

The psychometric properties of the EDI demonstrate both strengths and areas for future development. The inter-factor correlations reflect theoretical models of executives functioning as an integrated system with related but distinct components. This interconnectedness aligns with contemporary understanding of executive functions, supporting our multifactorial structure while explaining the observed correlations between factors. The internal consistency of the EDI subscales ranges from acceptable to excellent ($\alpha = .77 – .89$), supporting the reliability of the instrument for research and assessment purposes. While the Regulation of Emotions subscale contains 18 items, potentially suggesting some redundancy, this comprehensive coverage reflects the complex nature of emotional regulation in educational contexts. Some items demonstrated cross-loadings across factors, representing the reality that certain behaviors involve multiple executive processes simultaneously. These psychometric characteristics provide a foundation for continued refinement while supporting the current version's utility for understanding executive functioning profiles in Pakistani children.

Our results align with international research regarding the patterns of executive functioning challenges in middle childhood (Schutte et al.,

2017; Wang et al., 2016; Xu et al., 2013). The distributions observed across severity categories for factors such as "Regulation of Emotions" and "Working Memory" parallel findings from diverse cultural contexts (Diamond et al., 2013), providing evidence for cross-cultural consistency in certain aspects of executive functioning development. The absence of significant age-related differences presents an interesting finding that warrants further investigation, it may reflect genuine development patterns in this population related to educational contexts, socioeconomic factors, or cultural differences in expectations and supports for executive functioning development. This finding highlights the importance of developing culturally informed assessment approaches rather than assuming universal developmental trajectories.

The gender differences observed, with boys showing higher executive dysfunction than girls, align with international literature (Hughes & McCabe, 2006; Torske et al., 2022; van Rijn & Swaab, 2015). These consistent patterns across cultural contexts suggest the EDI is capturing meaningful developmental differences consistent with established research. Our predominantly urban sample provides valuable baseline data in settings where such information has been lacking, while acknowledging the need for broader sampling in future research. This limitation in geographical diversity should be understood within the context of Pakistan's educational landscape, where significant differences exist between urban and rural settings. Nevertheless, the current sampling provides crucial initial data in contexts where executive functioning assessment has been notably absent, establishing an important foundation for expanded research.

The EDI addresses important contextual challenges specific to Pakistani educational settings that existing measures often overlook. Issues such as linguistic diversity, overcrowded classrooms, and resource limitations shape how executive functioning challenges manifest and are observed in these environments. The focus on ages 8 to 13 addresses a critical developmental period where executive functioning increasingly influences academic outcomes. The EDI represents a valuable contribution to educational psychology in Pakistan by providing a culturally-informed assessment approach rather than simply translating Western instruments without adaptation. While acknowledging the need for additional validation against external behavioral measures or academic outcomes, the EDI's current development already represents a significant advancement in culturally appropriate assessment for Pakistani educational settings.

Future research can build upon this foundation through several approaches that would further enhance the EDI's utility. Expanded validation studies would strengthen the instrument's scientific

foundation and broaden its applications. Examining relationships with academic achievement metrics would demonstrate ecological validity and enhance practical utility in educational settings. Developing implementation guidelines would support appropriate use in diverse settings. Longitudinal studies examining the EDI's sensitivity to developmental changes and intervention effects would further establish its utility as both an assessment and monitoring tool. These directions for future research provide concrete pathways for enhancing the EDI's scientific and practical value while building upon its current strengths.

In conclusion, the EDI represents a meaningful contribution to executive functioning assessment in Pakistani educational contexts. Despite acknowledged limitations that characterize any developing assessment tool, the EDI addresses a critical gap in culturally appropriate assessment resources for Pakistani children. The current study establishes a foundation that addresses an important need while suggesting valuable directions for continued research and development. By pursuing these research directions, the EDI can further evolve as an instrument that advances understanding of executive functioning development in Pakistani children while supporting evidence-based educational practices. This study demonstrates the potential of culturally informed assessment development to enhance our understanding of cognitive development across diverse contexts and populations, with the EDI representing a significant step forward in this important endeavor.

Limitations and Suggestions

EDI, like all behavioral rating scales, has inherent methodological limitations that require acknowledgment. Teacher ratings inevitably introduce subjective interpretation influenced by factors such as class size, previous academic performance, or behavioral reputations unrelated to executive functioning. The 66-item length presents feasibility concerns for routine implementation in resource-constrained Pakistani schools with large class sizes and limited assessment time. Our predominantly urban sample limits generalizability across Pakistan's diverse educational landscape, where significant differences exist between urban and rural settings. Future research should expand validation studies to include broader geographical sampling, examine relationships with academic achievement metrics, develop implementation guidelines for diverse settings, and conduct longitudinal studies to establish the EDI's sensitivity to developmental changes and intervention effects.

Implications

The EDI represents a meaningful contribution to executive functioning assessment in Pakistani educational contexts by addressing critical gaps in culturally appropriate assessment resources. Rather than simply translating Western instruments, the EDI provides a culturally informed assessment approach that captures the specific manifestations of executive functioning in Pakistani classrooms with their unique cultural and contextual characteristics. The instrument's comprehensive coverage enables precise intervention planning and supports evidence-based educational practices in settings where such tools have been notably absent. This development demonstrates the potential of culturally informed assessment to enhance understanding of cognitive development across diverse contexts and populations. The EDI establishes an important foundation for advancing educational psychology in Pakistan while supporting more effective identification and intervention for children experiencing executive functioning challenges.

Conclusion

This research has yielded significant contributions to the field of educational and psychological assessment, particularly within the context of elementary school children. The development and validation of the EDI represent a pivotal step forward in addressing the pressing need for culturally adapted and contextually relevant tools for assessing executive functioning challenges. The six-factor structure identified through exploratory and confirmatory factor analyses underscores the multifaceted nature of executive functioning challenges faced by these children, encompassing factors such as attention, emotion regulation, impulse control, task initiation, working memory, and organizational abilities. Importantly, the EDI's confirmation of these factors in CFA reaffirms its validity as a reliable assessment tool tailored to this population.

References

Arbuckle, J. L., & Wothke, W. (1999). *AMOS 4.0 user's guide*. Small Waters Corporation.

Best, J. R., & Miller, P. H. (2010). A developmental perspective on executive function. *Child Development, 81*(6), 1641-1660. https://doi.org/10.1111/j.1467-8624.2010.01499.x

Casey, B., Giedd, J. N., & Thomas, K. M. (2000). Structural and functional brain development and its relation to cognitive development. *Biological*

Psychology, 54(3), 241-257. https://doi.org/10.1016/S0301-0511(00)00 058-2

Cheung, S. K., Zhang, J., & Wu, C. (2023). Children's performance on untimed and timed algorithmic computation tasks: The roles of executive functioning, maths test anxiety and basic maths fact fluency. *Educational Psychology*. Advance online publication. https://doi.org/10.1080/014434 10.2023.2225804

Creswell, J. W. (2009). Mapping the field of mixed methods research. *Journal of Mixed Methods Research, 3*(2), 95-108. https://doi.org/10.1177/1558689 808330883

Denervaud, S., Knebel, J.-F., Hagmann, P., & Gentaz, E. (2019). Beyond executive functions, creativity skills benefit academic outcomes: Insights from Montessori education. *PLOS ONE, 14*(11), e0225319. https://doi.org/ 10.1371/journal.pone.0225319

Diamond, A. (2016). Why improving and assessing executive functions early in life is critical. *Policy Insights from the Behavioral and Brain Sciences, 3*(1), 11-18.

Diamond, K. E., Justice, L. M., Siegler, R. S., & Snyder, P. A. (2013). *Synthesis of IES research on early intervention and early childhood education*. National Center for Special Education Research.

Drigas, A., & Karyotaki, M. (2019). Executive functioning and problem solving: A bidirectional relation. *International Journal of Engineering Pedagogy, 9*(3), 76-98.

Fatima, S., Sheikh, H., & Ardila, A. (2016). Association of parent–child relationships and executive functioning in South Asian adolescents. *Neuropsychology, 30*(1), 65–74. https://doi.org/10.1037/neu0000216

Gago, L. G., De Grandis, M. C., Clerici, G. D., Mustaca, A. E., Miller, S. E., & Elgier, A. M. (2019). Regulation during the second year: Executive function and emotion regulation links to joint attention, temperament, and social vulnerability in a Latin American sample. *Frontiers in Psychology, 10*, 1473. https://doi.org/10.3389/fpsyg.2019.01473

Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L. (2000). *Behavior Rating Inventory of Executive Function*. Psychological Assessment Resources.

Goldstein, S., & Naglieri, J. A. (Eds.). (2014). *Handbook of executive functioning*. Springer.

Grant, D. A., & Berg, E. A. (1993). *Wisconsin Card Sorting Test manual*. Psychological Assessment Resources.

Guo, Q., Zhou, T., Li, W., Dong, L., Wang, S., & Zou, L. (2017). Single-trial EEG-informed fMRI analysis of emotional decision problems in hot executive function. *Brain and Behavior, 7*(7), e00728

Hania, A., Orcullo, D. J. C., & Salim, A. Z. (2019). The impact of executive functioning on academic performance of students in mathematics and science. *Malaysian Journal of Social Sciences and Humanities, 4*(1), 15-

21.https://media.neliti.com/media/publications/322584-the-impact-of-executive-functioning-on-a-ef799b76.pdf

Howey, K. R., & Zimpher, N. L. (1989). Preservice teacher educators' role in programs for beginning teachers. *The Elementary School Journal, 89*(4), 451-470. https://doi.org/10.1086/461586

Hughes, J. M. C., & McCabe, D. L. (2006). Understanding academic misconduct. *Canadian Journal of Higher Education, 36*(1), 49-63.

Jackson, D. L., Gillaspy, J. A., Jr., & Purc-Stephenson, R. (2009). Reporting practices in confirmatory factor analysis: An overview and some recommendations. *Psychological Methods, 14*(1), 6-23. https://doi.org/10.1037/a0014699

Jensen, A. R. (1965). Scoring the Stroop test. *Acta Psychologica, 24*(5), 398-408. https://doi.org/10.1016/0001-6918(65)90011-9

Kelkar, A. S., Hough, M. S., & Fang, X. (2013). Do we think alike? A cross-cultural study of executive functioning. *Culture and Brain, 1*(2), 118-137.

Klenberg, L., Korkman, M., & Lahti-Nuuttila, P. (2001). Differential development of attention and executive functions in 3- to 12-year-old Finnish children. *Developmental Neuropsychology, 20*(1), 407-428. https://doi.org/10.1207/S15326942DN2001_6

Kline, R. B. (2013). Exploratory and confirmatory factor analysis. In Y. Petscher, C. Schatschneider, & D. L. Compton (Eds.), *Applied quantitative analysis in social sciences* (pp. 171-207). Routledge.

Kyriazos, T. A. (2018). Applied psychometrics: Sample size and sample power considerations in factor analysis and SEM in general. *Psychology, 9*(8), 2207-2230. https://doi.org/10.4236/psych.2018.98126

Lester, P. E., & Bishop, L. K. (2000). *Handbook of tests and measurement in education and the social sciences* (2nd ed.). Scarecrow Press.

Malrieu, P., & Malrieu, S. (1969). Mémoire et intelligence d'après. *Journal of Abnormal Psychology and Psychopathology, 1*(1), 83-100.

Miyake, A., Emerson, M. J., & Friedman, N. P. (2000). Assessment of executive functions in clinical settings: Problems and recommendations. *Seminars in Speech and Language, 21*(2), 169-183. https://doi.org/10.1037/edu000 0397

Moffett, L., & Morrison, F. J. (2020). Off-task behavior in kindergarten: Relations to executive function and academic achievement. *Journal of Educational Psychology, 112*(5), 938-955. https://doi.org/10.1037/edu000 0397

Obradović, J., & Willoughby, M. T. (2019). Studying executive function skills in young children in low- and middle-income countries: Progress and directions. *Child Development Perspectives, 13*(4), 227-234. https://doi.org/10.1111/cdep.12349

Pett, M. A., Lackey, N. R., & Sullivan, J. J. (2003). *Making sense of factor analysis: The use of factor analysis for instrument development in health care research*. Sage. https://doi.org/10.4135/9781412984898

Piaget, J., & Inhelder, B. (1969). *The psychology of the child*. Basic Books.

Robbins, T. W., James, M., Owen, A. M., Sahakian, B. J., McInnes, L., & Rabbitt, P. (1994). Cambridge Neuropsychological Test Automated Battery (CANTAB): A factor analytic study of a large sample of normal elderly volunteers. *Dementia and Geriatric Cognitive Disorders, 5*(5), 266-281. https://doi.org/10.1159/000106735

Schirmbeck, K., Rao, N., & Maehler, C. (2020). Similarities and differences across countries in the development of executive functions in children: A systematic review. *Infant and Child Development, 29*(1), e2164. https://doi.org/10.1002/icd.2164

Schutte, A. R., Torquati, J. C., & Beattie, H. L. (2017). Impact of urban nature on executives functioning in early and middle childhood. *Environment and Behavior, 49*(1), 3-30. https://doi.org/10.1177/0013916515603095

Spruijt, A. M., Dekker, M. C., Ziermans, T. B., & Swaab, H. (2020). Educating parents to improve parent–child interactions: Fostering the development of attentional control and executive functioning. *British Journal of Educational Psychology, 90*(S1), 158-175. https://doi.org/10.1111/bjep.12312

Thorell, L. B., & Nyberg, L. (2008). The Childhood Executive Functioning Inventory (CHEXI): A new rating instrument for parents and teachers. *Developmental Neuropsychology, 33*(4), 536-552. https://doi.org/10.1080/87565640802101516

Toor, H. K., & Hanif, R. (2022). Executive Function Touch battery: Translation and preliminary measure validation for Pakistani preschoolers. *PLOS ONE, 17*(9), e0274431. https://doi.org/10.1371/journal.pone.0274431

Torske, T., Nærland, T., Quintana, D. S., Hypher, R. E., Kaale, A., Høyland, A. L., Hope, S., Johannessen, J., Øie, M. G., & Andreassen, O. A. (2022). Sex as a moderator between parent ratings of executive dysfunction and social difficulties in children and adolescents with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 53*, 1302-1313. https://doi.org/10.1007/s10803-022-05629-5

Van Rijn, S., & Swaab, H. (2015). Executive dysfunction and the relation with behavioral problems in children with 47, XXY and 47, XXX. *Genes, Brain and Behavior, 14*(2), 200-208. https://doi.org/10.1111/gbb.12203

Wang, Z., Devine, R. T., Wong, K. K., & Hughes, C. (2016). Theory of mind and executive function during middle childhood across cultures. *Journal of Experimental Child Psychology, 149*, 6-22. https://doi.org/10.1016/j.jecp.2015.09.028

Waters, N. E., Ahmed, S. F., Tang, S., Morrison, F. J., & Davis-Kean, P. E. (2021). Pathways from socioeconomic status to early academic

achievement: The role of specific executive functions. *Early Childhood Research Quarterly, 54*, 321-331. https://doi.org/10.1016/j.ecresq.2020.09.008

Worthington, R. L., & Whittaker, T. A. (2006). Scale development research: A content analysis and recommendations for best practices. *The Counseling Psychologist, 34*(6), 806-838. https://doi.org/10.1177/0011000006288127

Xu, F., Han, Y., Sabbagh, M. A., Wang, T., Ren, X., & Li, C. (2013). Developmental differences in the structure of executive function in middle childhood and adolescence. *PLOS ONE, 8*(10), e77770. https://doi.org/10.1371/journal.pone.0077770

Received 30 May 2024

Revision received 20 May 2025