Towards Developing an Appreciation of the Relationship of ADHD and Executive Functioning

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A D H D
T L V
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The International ADHD Congress

APSARD

What is/are Executive Function(s)

There is no formal excepted definition of EF

- We typically find a vague general statement of EF (e.g., goal-directed action, cognitive control, top-down inhibition, effortful processing, etc.).
- Or a listing of the constructs such as
  - Inhibition,
  - Working Memory,
  - Planning,
  - Problem-Solving,
  - Goal-Directed Activity,
  - Strategy Development and Execution,
  - Emotional Self-Regulation,
  - Self-Motivation

What Neural Activities Require EF?

- Those that involve planning or decision making.
- Those that involve error correction or troubleshooting.
- Situations when responses are not well-rehearsed or contain novel sequences of actions.
- Dangerous or technically difficult situations.
- Situations that require the overcoming of a strong habitual response or resisting temptation.
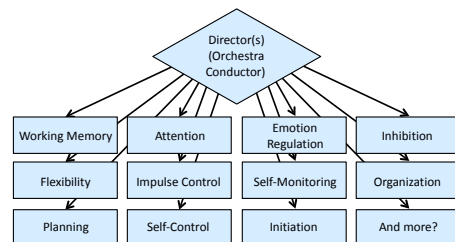
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What Neuronal Structures are Implicated in EF?

➢ Prefrontal

➢ Rich cortical, sub-cortical and brain stem connections.

➢ The dorsolateral prefrontal cortex (DLPFC) is involved with integrating different dimensions of cognition and behavior.

➢ The anterior cingulate cortex (ACC) is involved in emotional

drives, experience and integration, inhibition of inappropriate

responses, decision making and motivation.

➢ The orbitofrontal cortex (OFC) plays a key role in impulse control, maintenance of set, monitoring ongoing behavior and socially appropriate behaviors.

Three Categories of EF Theories

➢ Regulators that control
➢ Abilities (cognitive processes)
➢ Behaviors

Director(s) (Orchestra Conductor)			
Working Memory	Attention	Emotion Regulation	Inhibition
Flexibility	Impulse Control	Self-Monitoring	Organization
Planning	Self-Control	Initiation	And more?

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Standardization Data From The Comprehensive Executive Function Inventory

➢ Sample was stratified by

• Sex, age, race/ethnicity, parental education level (PEL; for cases rated by parents), geographic region
• Race/ethnicity of the child (Asian/Pacific Islander, Black/African American/African Canadian, Hispanic, White/Caucasian, Multi-racial by the rater
• Parent (N=1,400), Teacher (N=1,400) and Self (N=700) ratings were obtained

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ITEM FACTOR ANALYSES – PART 1

➢ For the *first half* of the normative sample for Parent, Teacher and Self ratings' **item scores** (90 items) was analyzed using exploratory factor analysis

➢ The *scree plots* and the *very simple solution* criterion both indicated that only **one factor**.

➢ The *ratio of the first and second eigenvalues* was greater than four for all three forms, which indicated a **one factor solution.**

Item Factor Analyses – Part 1

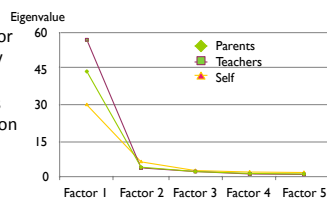- Item level factor analysis clearly indicted that one factor was the best solution

Eigenvalue chart with legend: Parents, Teachers, Self. Factor 1 – Factor 5.

Table 8.2. Eigenvalues from the Inter-Item Correlations

Form	Factor						
	1	2	3	4	5	6	7
Parent	43.7	4.1	2.3	1.5	1.3	1.3	1.0
Teacher	56.8	3.8	2.3	1.3	1.1	1.1	0.8
Self-Report	29.9	6.3	2.7	2.1	1.9	1.8	1.5

Note. Extraction ncipal Axis Factoring. Only the first 10 eigenvalues are presented.

SCALE FACTOR ANALYSES – PART 2

➢ Using the *second half* of the normative sample EFA was conducted using raw scores for the Attention, Emotion Regulation, Flexibility, Inhibitory Control, Initiation, Organization, Planning, Self-Monitoring, and Working Memory scales

➢ Both the Kaiser rule (eigenvalues > 1) *and* the Eigenvalue Ratio criterion (> 4) unequivocally indicated **one factor**.

Item Factor Analyses – Part 1

- Scale level factor analysis clearly indicted that one factor was the best solution
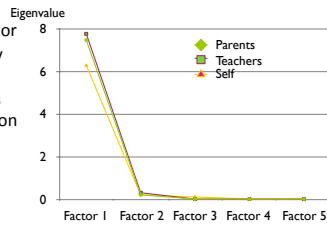
Eigenvalue

Table 8.4. Eigenvalues of the CEFI Scales Correlations

Form	Factor						
	1	2	3	4	5	6	7
Parent	7.5	0.2	0.0	0.0	0.0	0.0	0.0
Teacher	7.8	0.3	0.0	0.0	0.0	0.0	0.0
Self-Report	6.3	0.2	0.1	0.0	0.0	0.0	-0.1

Note. Extraction method: Prg.

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EXPLORATORY FACTOR ANALYSES

➢Conclusions

- When using parent (N = 1,400), teacher (N = 1,400), or self-ratings (N = 700) based on behaviors observed and reported for a nationally representative sample (N = 3,500) aged 5 to 18 years Executive Function *not* function**s** is the best term to use.

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Our Conclusion. . .

The concept of Executive Function is best defined as a unitary construct….how you do what you do.

He got in it and he drew up the covers.

CEFI, WISC-IV, CAS, Achievement

| Table 8.27 CEFI Manual Other Measure		Corrected r	N	CEFI Full Scale		CAS, WISC-IV, or WJ III ACH	
				M	SD	M	SD
WISC-IV	Full Scale	.39*	41	93.1	12.0	95.5	18.1
	Working Memory	.30	42	93.0	11.9	92.6	17.5
	Verbal Comprehension	.44**	42	93.0	11.9	96.8	14.7
	Perceptual Reasoning	.27	42	93.0	11.9	101.5	17.5
	Processing Speed	.34*	42	93.0	11.9	90.7	19.4
CAS	Full Scale	.45**	60	91.4	13.2	95.8	17.1
	Attention	.37**	60	91.4	13.2	96.5	15.1
	Planning	.49**	60	91.4	13.2	92.4	14.5
	Simultaneous	.43**	60	91.4	13.2	101.6	17.0
	Successive	.32*	60	91.4	13.2	98.0	14.6
WJ III ACH	Total Achievement	.51**	40	93.4	12.1	96.6	16.8
	Broad Reading	.48**	54	91.9	12.4	98.1	14.2
	Broad Math	.49**	53	92.0	11.9	97.7	16.9
	Broad Written Language	.47**	41	93.5	12.3	94.9	16.8

Group Differences: ADHD
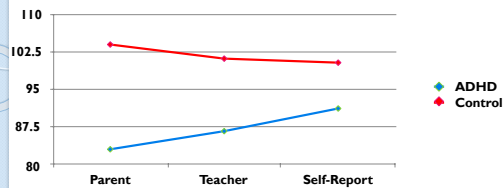
Table 8.19 Differences Between ADHD and Matched General Population Samples: CEFI Full Scale

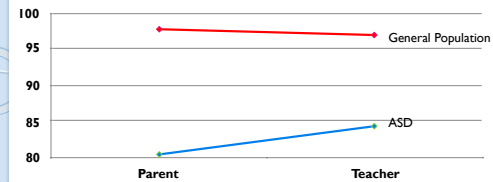| Form		ADHD	Matched Gen. Pop.	d-ratio	F (df)	P
Parent	M	83.1	103.9	-1.59	216.56 (1, 340)	< .001
	SD	13.0	13.0			
	N	171	171			
Teacher	M	86.7	101.1	-1.07	79.93 (1, 278)	< .001
	SD	13.5	13.5			
	N	138	142			
Self-Report	M	91.2	100.3	-0.62	22.21 (1, 232)	< .001
	SD	14.7	14.7			
	N	117	117			

Group Differences: ASD

Table 8.20 Differences Between ASD and Matched General Population Samples: CEFI Full Scale

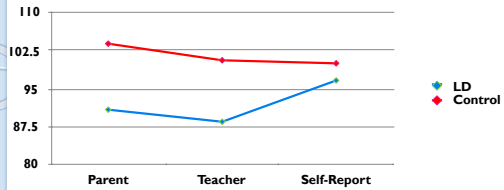| Form		ASD	Matched Gen. Pop.	d-ratio	F (df)	P
Parent	M	80.4	97.7	-1.41	48.96 (1, 96)	< .001
	SD	12.2	12.2			
	N	48	50			
Teacher	M	84.3	96.9	-0.99	23.11 (1, 92)	< .001
	SD	12.7	12.7			
	N	47	47			

Group Differences: Learning Disabilities

Table 8.22 Differences Between LD and Matched General Population Samples: CEFI Full Scale

Form		LD	Matched Gen. Pop.	d-ratio	F (df)	p
Parent	M	90.8	103.9	-0.92	19.89 (1, 93)	< .001
	SD	14.4	14.4			
	N	47	48			
Teacher	M	88.4	100.6	-0.91	37.29 (1, 178)	< .001
	SD	13.4	13.4			
	N	90	90			
Self-Report	M	96.6	100.0	-0.21	1.45 (1, 126)	0.231
	SD	15.9	15.9			
	N	64	64			

Group Differences: Mood Disorders

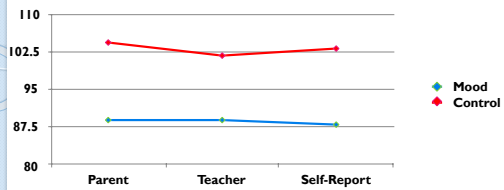
Table 8.21 Differences Between Mood Disorder and Matched General Population Samples: CEFI Full Scale

Form		Mood Disorder	Matched Gen. Pop.	d-ratio	F (df)	p
Parent	M	88.9	104.3	-1.11	22.66 (1, 71)	< .001
	SD	13.8	13.8			
	N	36	37			
Teacher	M	88.9	101.7	-1.01	14.9 (1, 57)	< .001
	SD	12.8	12.8			
	N	29	30			
Self-Report	M	88.0	103.1	-1.09	16.34 (1, 53)	< .001
	SD	13.9	13.9			
	N	27	28			

CEFI Gender Differences: Parent Raters

➤ Girls are Smarter than Boys

Parents	N	Mn	SD	N	Mn	SD	ES
Ages 5-18	700	98.1	14.9	699	101.8	15.0	-0.25
Ages 5-11	350	98.2	14.3	349	101.6	15.6	-0.22
Ages 12-18	350	97.9	15.4	350	102.0	14.4	-0.28

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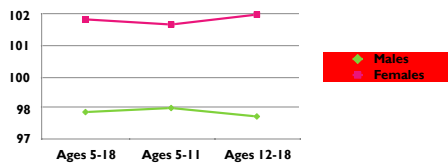
CEFI Gender Differences: Teacher Raters

➢Girls are Smarter than Boys

Teachers	N	Mn	SD	N	Mn	SD	ES
Ages 5-18	700	**96.7**	14.4	700	**103.2**	15.0	**-0.44**
Ages 5-11	350	**96.4**	14.5	350	**103.5**	14.9	**-0.49**
Ages 12-18	350	**97.0**	14.4	350	**102.9**	15.0	**-0.40**
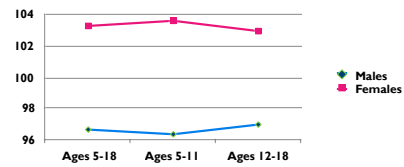
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TEDx

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The Power Of Resilience
https://www.youtube.com/watch?v=isfw8JJ-eWM&feature=youtube_gdata