

**The Science of Executive Functioning:
New Ideas, New Data, and Practical Applications**



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Relevant Disclosure

- Co-author of
 - Comprehensive Executive Functioning Inventory- Child and Adult
 - Cognitive Assessment System –Second Edition
 - Co-Editor Handbook of Executive Functioning
 - Co-Editor Handbook of Intelligence and Achievement Testing
 - Compensated Speaker through MHS

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Goals for This Presentation

- Historical Perspective and Need
- Definitions of Executive Function
- Executive Function or Functions?
- Rating Scales for EF
- Comprehensive Executive Function Inventory (CEFI)
 - Structure – Normative Sample
 - Reliability
 - Interpretation
 - Validity
- EF and instruction

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The Five Student Challenge

What variables predict the capacity to learn and the quality of performance?

How do we help children be skillful?



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A Bit of EF Neuroanatomy

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



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What do we mean by the term Executive Function(s)?

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Executive Function (s)

- In 1966 Alexandr Luria first wrote and defined the concept of Executive Function (EF)
- He credited Bianchi (1895) and Bekhterev (1905) with the initial definition of the process



1902 - 1977 7

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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 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



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Does Experience Shape EF?

- The Family Life Project has demonstrated that poverty is associated with elevated cortisol in infancy and early childhood.
- This association is mediated through characteristics of the household.
- Parenting sensitivity mediates the relationship between poverty and stress physiology.
- In combination parenting sensitivity and elevated cortisol mediate the association between poverty and poor EF in children.



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Goldstein, Naglieri, Princiotta, & Otero (2013)



- We found more than 30 definitions of EF(s).
- Executive function(s) has come to be an umbrella term used for many different abilities, including planning, working memory, attention, inhibition, self-monitoring, self-regulation and initiation carried out by pre-frontal areas of the frontal lobes.

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What is Executive Function(s)

1. Barkley (2011): "EF is thus a **self-directed set of actions**" (p. 11).
2. Dawson & Guare (2010): "Executive skills allow us to **organize our behavior over time**" (p. 1).
3. Delis (2012): "Executive functions reflect the **ability to manage and regulate one's behavior** (p. 14).

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What is Executive Function(s)

- 4. Denckla (1996): "EF (is) a set of **domain-general control processes...**" (p. 263).
- 5. Gioia, Isquith, Guy, & Kenworthy (2000): "**a collection of processes that are responsible for guiding, directing, and managing cognitive, emotional, and behavioral functions**" (p. 1).

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What is Executive Function(s)

- 6. Pribram (1973): "**executive programmes ...to maintain brain organization**" (p. 301).
- 7. Roberts & Pennington (1996): EF "**a collection of related but somewhat distinct abilities such as planning, set maintenance, impulse control, working memory, and attentional control**" (p. 105).

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What is Executive Function(s)

- 6. Stuss & Benson (1986): "**a variety of different capacities that enable purposeful, goal-directed behavior, including behavioral regulation, working memory, planning and organizational skills, and self-monitoring**" (p. 272).
- 7. Welsh and Pennington (1988): "**the ability to maintain an appropriate problem-solving set for attainment of a future goal**" (p. 201).

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What is Executive Function(s)

10. McCloskey (2006): "a diverse group of highly specific cognitive processes collected together to direct cognition, emotion, and motor activity, including ...the ability to engage in purposeful, organized, strategic, self-regulated, goal directed behavior" (p. 1)

"think of executive functions as a set of independent but coordinated processes rather than a single trait" (p. 2).

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What is Executive Function(s)

10. Lezak (1995): "a collection of interrelated cognitive and behavioral skills that are responsible for purposeful, goal-directed activity," ...

11. "how and whether a person goes about doing something" (p. 42).

12. Luria (1966): "... ability to correctly evaluate their own behavior and the adequacy of their actions" (p. 227).

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Executive Functions

The screenshot shows a Wikipedia article titled "Executive functions". A text box highlights the following text: "The executive system is a theorized cognitive system in psychology that controls and manages other cognitive processes. It is also referred to as the executive function, executive functions, supervisory attentional system, or cognitive control. The concept is used by psychologists and neuroscientists to describe a loosely defined collection of brain processes which are responsible for planning, cognitive flexibility, abstract thinking, rule acquisition, initiating appropriate actions and inhibiting inappropriate actions, and selecting relevant sensory information."

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EF and ADHD

EF deficits are not necessarily unique to ADHD. They are neither necessary nor sufficient to make a diagnosis of ADHD. When EF impairments are measured in children with ADHD they tend to reflect specific rather than global impairments.

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EF and Other Disruptive Disorders (ODD & CD)

Early reviews reported that EF deficits were not characteristic of children and adolescents with ODD and CD after comorbid ADHD was factored out. More recent studies, however, suggest that inhibition deficits may be characteristic of both ADHD and CD but whether children with CD display impairments on additional EF measures is equivocal.

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EF and Tourette's

Distinct and robust impairments in EF do not appear to be characteristic of children with TD.

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EF and Anxiety Disorders

EF deficits in set-shifting, cognitive flexibility, concept formation, interference control, and verbal fluency have been documented among children with separation anxiety disorder, overanxious disorder, and PTSD. EF in OCD has not been well addressed.

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EF and Depression

Scant research has been conducted on the EF abilities among youth with depression. Studies that have included older adolescents have suggested some degree of sensitivity of EF tasks in identifying unipolar depression, but less specificity.

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EF and Bi-Polar Disorder

There is a growing consensus about the nature of BD among children. Several studies have targeted its EF concomitants. Although results often have been confounded with significant co-morbidity issues, children and adolescents with BD reliably have demonstrated impairments relative to those without any history of mood disorders on several EF measures (e.g. working memory, set shifting).

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EF and Traumatic Brain Injury

Deviant Neuropsychol 2011; December; 5(4):337-345

Original Article

Pragmatic and executive functions in traumatic brain injury and right brain damage

An exploratory comparative study

Nicolle Zimmermann¹, Gislaine Gindri¹,
Camila Rosa de Oliveira¹, Rochelle Paz Fonseca²

Abstract - Objective: To describe the frequency of pragmatic and executive deficits in right brain damaged (RBD) and in traumatic brain injury (TBI) patients, and to verify possible dissociations between pragmatic and executive functions in these two groups. Methods: The sample comprised 7 cases of TBI and 7 cases of RBD. All participants were assessed by means of tasks from the Montreal Communication Evaluation Battery and executive functions tests including the Trail Making Test, Hooper Task, Wisconsin Card Sorting Test, semantic and phonemic verbal fluency tasks and working memory tasks from the Brazilian Brief Neuropsychological

TBI individuals again exhibited a general profile of executive dysfunction, affecting mainly working memory, initiation, inhibition, planning and switching. Pragmatic and executive deficits were generally associated upon comparisons of RBD patients and TBI cases, except for two simple dissociations: two post-TBI cases showed executive deficits in the absence of pragmatic deficits. Discussion: Pragmatic and executive deficits can be very

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EF Deficits and ASD

J Child Psychol Psychiatr. Vol. 51, No. 1, pp. 1081-1105, 1991

001-0505/91 \$1.00 + 0.00

Printed in Great Britain

© 1991 Association for Child Psychology and Psychiatry

Executive Function Deficits in High-Functioning Autistic Individuals: Relationship to Theory of Mind

Sally Ozonoff,* Bruce F. Pennington* and Sally J. Rogers†

Abstract—A group of high-functioning autistic individuals was compared to a clinical control

on spatial or other control measures. Second-order theory of mind and executive function deficits were widespread among the autistic group, while first-order theory of mind deficits were found in only a subset of the sample. The relationship of executive function and theory of mind deficits to each other, and their primacy to autism, are discussed.

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EF and Learning Disabilities

Working Memory Impairments in Children with Specific Arithmetic Learning Difficulties

Janet F. McLean, Graham J. Hitch

Lancaster University, Lancaster, United Kingdom

https://doi.org/10.1080/10682016.10885216. How to Cite or Link Using DOI

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Abstract

Working memory impairments in children with difficulties in arithmetic have previously been investigated using questionnaire selection techniques and control groups, leading to problems concluding where deficits may occur. The present study attempted to overcome these criticisms by assessing 8-year-old children with difficulties specific to arithmetic, as indicated by normal reading, and comparing them with both non-dyscalculic and ability-matched controls. A battery of 20 tasks was used to measure different aspects of

and some aspects of executive processing. Compared to ability-matched controls, they were impaired only on one task designed to assess executive processes for holding and manipulating information in long-term memory. These deficits in executive and spatial aspects of working memory seem likely to be important factors in poor arithmetical attainment.

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If all of these conditions are statistically related to behaviors and abilities reflecting EF than a common denominator must exist.

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Impaired Behavior Associated With Poor EF Can Result From:

- Lack of ability.
- Lack of knowledge.
- Lack of motivation.
- Internalizing symptoms.
- Externalizing symptoms.
- Poor impulse control.

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Executive Function(s)

- Given all these definitions of EF(s) we wanted to address the question...
Executive Functions ... or
Executive Function?

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Executive Function(s)

- One way to examine this issue is to research the factor structure of behaviors related to EF(s)
- To do so, we examined the factor structure of the Comprehensive Executive Function Inventory (CEFI)
- We conducted a series of research studies to answer the following question:
 - What is the underlying structure of the behaviors assessed on the CEFI?
 - Is there is just one underlying factor called executive function), or do the behaviors group together into different constructs suggesting a multidimensional structure?

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EXPLORATORY FACTOR ANALYSES

- The normative samples for parents, teacher, and self ratings were randomly split into two samples and EFA conducted using
 - the item raw scores
 - nine scales' raw scores
- The sample ...

CEFI Scales
 Attention
 Emotion Regulation
 Flexibility
 Inhibitory Control
 Initiation
 Organization
 Planning
 Self-Monitoring
 Working Memory

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CEFI Standardization Samples

- 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**.

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Item Factor Analyses – Part 1

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

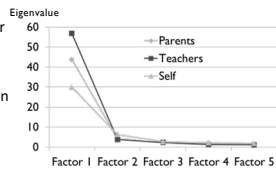


Table 8.2. Eigenvalues from the Inter-Item Correlations

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 method: Principal Component Analysis. Only the first 10 eigenvalues are presented.

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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**.

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Item Factor Analyses – Part 1

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

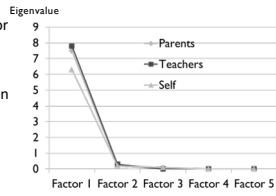


Table 8.4. Eigenvalues of the CEFI Scales Correlations

Form	Factor						
	1	2	3	4	5	6	7
Parent	8.5	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

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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.

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Naglieri & Goldstein, 2012

Executive Function is how efficiently you do what you decide to do.



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EF as a Mediator of Ability and Knowledge

- Ability: The skills we use to acquire and manipulate knowledge to solve problems. Also referred to as intelligence.
- Knowledge: Everything we learn in life. Also referred to as achievement.
- Executive Function: How efficiently or skillfully you do what you decide to do.

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In general single EF tests share at most 10% of the variance with EF ratings and observations of everyday behavior.

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Batteries of combined EF tests fare a bit better sharing up to 20% of the variance with observation and reported behavior.

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The more tests in an EF battery the more factors identified in both exploratory and confirmatory studies.

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Comprehensive Executive Function Inventory (CEFI)

Jack A. Naglieri
Sam Goldstein

A rating scale designed to measure behaviors association with Executive Function for ages 5-18 years rated by a parent, teacher, or the child/youth.



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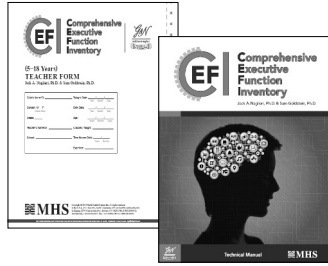
CEFI

- The Comprehensive Executive Function Inventory (CEFI) is a rating scale designed to measure behaviors that are associated with Executive Function (EF) for children and youth aged 5 through 18 years.
- The rating scale can be completed by a parent, teacher, or the child/youth.
- The CEFI is composed of items evaluating behaviors associated with to attention, emotion regulation, flexibility, inhibitory control, initiation, organization, planning, self-monitoring, and working memory.
- The rating scale has been developed to demonstrate the highest psychometric qualities.

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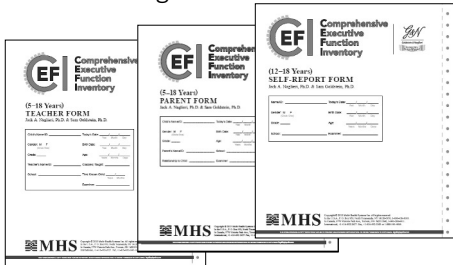
45

CEFI (Naglieri & Goldstein, 2012)



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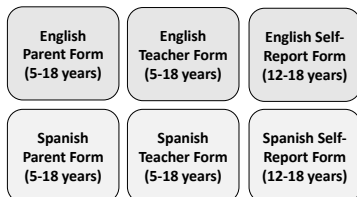
Three CEFI Rating Forms



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CEFI Forms

- Each 100-item form yields scales set at a mean of 100 and SD of 15



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CEFI Scales

Each form yields a **Full Scale score** and 9 separate content scales which contain items as follows...

- Consistency Index
- Negative Impression Scale
- Positive Impression Scale
- Full Scale
- CEFI Scales
 - Attention
 - Emotion Regulation
 - Flexibility
 - Inhibitory Control
 - Initiation
 - Organization
 - Planning
 - Self-Monitoring
 - Working Memory

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Executive Function Full Scale

Attention
Measures how well a youth can avoid distractions, concentrate on tasks, and sustain attention

Inhibitory Control
Reflects a youth's control over behavior or impulses

Planning
Reflects how well a youth develops and implements strategies to accomplish tasks

Emotion Regulation
Measures a youth's control and management of emotions

Initiation
Describes a youth's ability to begin tasks or projects without being prompted

Self-Monitoring
Describes a youth's self-evaluation of his/her performance or behavior

Flexibility
Describes how well a youth can adjust to circumstances, including problem-solving ability

Organization
Describes how well a youth manages personal effects, work, or multiple tasks

Working Memory
Describes how well a child youth can keep information in mind that's required for knowing what to do and how to do it, including remembering important things, instructions, & steps

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CEFI Items by Scale

Table C.4. Attention (12 Items)		
Item #	Parent/Teacher Item During the past 4 weeks, how often did the child...	Self-Report Item During the past 4 weeks, how often did you...
3	finish a boring task?	finish a boring task?
11	work well in a noisy environment?	work well in a noisy environment?
21	work well for a long time?	work well for a long time?
25	concentrate while reading?	concentrate while reading?
30	stay on topic when talking?	stay on topic when talking?

Table C.5. Emotion Regulation (9 Items)		
Item #	Parent/Teacher Item During the past 4 weeks, how often did the child...	Self-Report Item During the past 4 weeks, how often did you...
10	control emotions when under stress?	control emotions when under stress?
12	stay calm when handling small problems?	stay calm when handling small problems?
42	find it hard to control his/her emotions? (R)	find it hard to control your emotions? (R)
47	get upset when plans were changed? (R)	get upset when plans were changed? (R)
64	wait patiently?	wait patiently?

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CEFI Items by Scale

Table C.6. Flexibility (7 Items)

Item #	Parent/Teacher Item During the past 4 weeks, how often did the child...	Self-Report Item During the past 4 weeks, how often did you...
7	come up with a new way to reach a goal?	come up with a new way to reach a goal?
41	come up with different ways to solve problems?	come up with different ways to solve problems?
45	have many ideas about how to do things?	have many ideas about how to do things?

Table C.7. Inhibitory Control (10 Items)

Item #	Parent/Teacher Item During the past 4 weeks, how often did the child...	Self-Report Item During the past 4 weeks, how often did you...
1	think before acting?	think before acting?
19	find it hard to control his/her actions? (R)	find it hard to control your actions? (R)
32	think of the consequences before acting?	think of the consequences before acting?
38	maintain self-control?	maintain self-control?
49	have trouble waiting to get what he/she wanted? (R)	have trouble waiting to get what you wanted? (R)

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CEFI Items by Scale

Table C.8. Initiation (10 Items)

Item #	Parent/Teacher Item During the past 4 weeks, how often did the child...	Self-Report Item During the past 4 weeks, how often did you...
16	start something without being asked?	start something without being asked?
30	start conversations?	start conversations?
39	take on new projects?	take on new projects?
40	need others to tell him/her to get started on things? (R)	need others to tell you to get started on things? (R)
55	take initiative?	take initiative?
62	appear motivated?	appear motivated?

Table C.9. Organization (10 Items)

Item #	Parent/Teacher Item During the past 4 weeks, how often did the child...	Self-Report Item During the past 4 weeks, how often did you...
5	complete one task before starting a new one?	complete one task before starting a new one?
13	organize his/her thoughts well?	organize your thoughts well?
18	appear disorganized? (R)	appear disorganized? (R)
27	complete homework or tasks on time?	complete homework or tasks on time?
34	work neatly?	work neatly?
52	keep track of belongings?	keep track of belongings?

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CEFI Items by Scale

Table C.10. Planning (11 Items)

Item #	Parent/Teacher Item During the past 4 weeks, how often did the child...	Self-Report Item During the past 4 weeks, how often did you...
9	prepare for school or work?	prepare for school or work?
15	solve problems creatively?	solve problems creatively?
22	do things in the right order?	do things in the right order?
28	plan for future events?	plan for future events?

Table C.11. Self-Monitoring (10 Items)

Item #	Parent/Teacher Item During the past 4 weeks, how often did the child...	Self-Report Item During the past 4 weeks, how often did you...
6	ask for help when needed?	ask for help when needed?
14	fix his/her mistakes?	fix your mistakes?
17	change a plan that was not working?	change a plan that was not working?
29	learn from past mistakes?	learn from past mistakes?

Table C.12. Working Memory (11 Items)

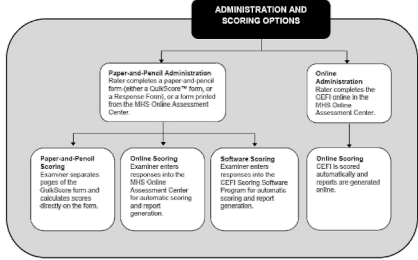
Item #	Parent/Teacher Item During the past 4 weeks, how often did the child...	Self-Report Item During the past 4 weeks, how often did you...
4	forget instructions? (R)	forget instructions? (R)
8	remember how to do something?	remember how to do something?
23	forget instructions with many steps? (R)	forget instructions with many steps? (R)
26	remember many things at one time?	remember many things at one time?

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CEFI Administration & Scoring

Figure 3.1. Overview of Administration and Scoring Options



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CEFI Rating Form

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CEFI Rating Form

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CEFI Rating Form

This is a screenshot of the CEFI Rating Form for ages 12-18. It features a grid of 100 items, each with a corresponding response option (e.g., 'Not at all', 'A little', 'Somewhat', 'Quite a bit', 'Very much'). The items are organized into sections such as 'Social Skills', 'Emotional Regulation', and 'Problem Solving'. The form includes instructions for how to use the grid and how to calculate scores for various subscales.

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CEFI Rating Form

This is a screenshot of the CEFI Rating Form for ages 12-18, showing a different section of the grid. It includes instructions for how to use the grid and how to calculate scores for various subscales. The items are organized into sections such as 'Social Skills', 'Emotional Regulation', and 'Problem Solving'.

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CEFI Rating Form

This is a screenshot of the CEFI Rating Form for ages 12-18, showing a different section of the grid. It includes instructions for how to use the grid and how to calculate scores for various subscales. The items are organized into sections such as 'Social Skills', 'Emotional Regulation', and 'Problem Solving'.

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CEFI Normative Samples

- 1,400 ratings by Parents for children aged 5-18 years
- 1,400 ratings by Teachers for children aged 5-18 years
- 700 ratings from the self-report form for those aged 12-18 years
- There were equal numbers of ratings of or by males and females

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CEFI Normative Samples

- Stratified according to the 2009 US Census by race/ethnicity, parental education, region, age, and sex
- The samples included students in special education

Table 6.15. Categories of Eligibility to Receive Educational Services across Normative Samples

Eligibility/Diagnostic Category	Parent		Teacher		Self-report		% Dept. Education ^a
	N	%	N	%	N	%	
ADHD	62	4.4	55	3.9	43	6.1	4.7
Autism Spectrum Disorder	9	0.6	6	0.4	0	—	0.7
Communication ^b	13	0.9	20	1.4	0	—	2.9
Emotional	8	0.6	16	1.1	7	1.0	0.9
Hearing	0	—	5	0.4	0	—	0.2
Intellectual	2	0.1	6	0.4	0	—	1.0
Specific Learning	56	4.0	67	4.8	18	2.6	5.0
Traumatic Brain Injury	2	0.1	2	0.1	0	—	0.1
Visual	1	0.1	1	0.1	0	0.0	0.1
Other	9	0.6	15	1.1	0	0.0	—
TOTAL	162	10.9	199	14.7	68	9.7	—

^a SOURCE: for all disorders except ADHD, Digest of Education Statistics, National Center for Education Statistics. SOURCE for ADHD: National Center for Education Statistics.

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Age x (Race/Ethnicity) x Gender

Table 6.2. Age x Race/Ethnicity x Gender Distribution: CEF Parent Normative Sample

Age	Hispanic				Black				White				Total	Other
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male		
5	11	7	1	2	11	7	1	2	11	7	1	2	33	4
6	11	7	1	2	11	7	1	2	11	7	1	2	33	4
7	11	7	1	2	11	7	1	2	11	7	1	2	33	4
8	11	7	1	2	11	7	1	2	11	7	1	2	33	4
9	11	7	1	2	11	7	1	2	11	7	1	2	33	4
10	11	7	1	2	11	7	1	2	11	7	1	2	33	4
11	11	7	1	2	11	7	1	2	11	7	1	2	33	4
12	11	7	1	2	11	7	1	2	11	7	1	2	33	4
13	11	7	1	2	11	7	1	2	11	7	1	2	33	4
14	11	7	1	2	11	7	1	2	11	7	1	2	33	4
15	11	7	1	2	11	7	1	2	11	7	1	2	33	4
16	11	7	1	2	11	7	1	2	11	7	1	2	33	4
17	11	7	1	2	11	7	1	2	11	7	1	2	33	4
18	11	7	1	2	11	7	1	2	11	7	1	2	33	4
TOTAL	110	70	10	20	110	70	10	20	110	70	10	20	330	40

Note: U.S. Population data are from the American Community Survey, 2008.

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Table 6.3. Age x Race/Ethnicity x Gender Distribution: CEF Teacher Normative Sample

Age	Hispanic				Black				White				Total	Other
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male		
5	11	7	1	2	11	7	1	2	11	7	1	2	33	4
6	11	7	1	2	11	7	1	2	11	7	1	2	33	4
7	11	7	1	2	11	7	1	2	11	7	1	2	33	4
8	11	7	1	2	11	7	1	2	11	7	1	2	33	4
9	11	7	1	2	11	7	1	2	11	7	1	2	33	4
10	11	7	1	2	11	7	1	2	11	7	1	2	33	4
11	11	7	1	2	11	7	1	2	11	7	1	2	33	4
12	11	7	1	2	11	7	1	2	11	7	1	2	33	4
13	11	7	1	2	11	7	1	2	11	7	1	2	33	4
14	11	7	1	2	11	7	1	2	11	7	1	2	33	4
15	11	7	1	2	11	7	1	2	11	7	1	2	33	4
16	11	7	1	2	11	7	1	2	11	7	1	2	33	4
17	11	7	1	2	11	7	1	2	11	7	1	2	33	4
18	11	7	1	2	11	7	1	2	11	7	1	2	33	4
TOTAL	110	70	10	20	110	70	10	20	110	70	10	20	330	40

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Other Tables of Demographics (N=12)

Table 6.5. Age x Region x Race/Ethnicity: CEFI Parent Normative Sample (5-11 Year-Olds)

Age	Region	Race/Ethnicity	Sample Size		Mean		SD		Population (%)
			N	%	M	SD	M	SD	
5-11	North	White	2	2	10	10	10.4	17.9	77.9
		Black	1	1	10	10	10.4	17.9	22.1
	South	White	10	10	10	10	10.4	17.9	77.9
		Black	2	2	10	10	10.4	17.9	22.1
	West	White	10	10	10	10	10.4	17.9	77.9
		Black	2	2	10	10	10.4	17.9	22.1
Total									
			20	20	10	10	10.4	17.9	100.0

Table 6.11. Age x PEI x Race/Ethnicity: CEFI Parent Normative Sample (12-18 Year-Olds)

Age	Region	Race/Ethnicity	Sample Size		Mean		SD		Population (%)
			N	%	M	SD	M	SD	
12-18	North	White	4	4	10	10	10.4	17.9	77.9
		Black	1	1	10	10	10.4	17.9	22.1
	South	White	10	10	10	10	10.4	17.9	77.9
		Black	2	2	10	10	10.4	17.9	22.1
	West	White	10	10	10	10	10.4	17.9	77.9
		Black	2	2	10	10	10.4	17.9	22.1
Total									
			20	20	10	10	10.4	17.9	100.0

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CEFI Scale Reliabilities

Table 7.1. Cronbach's Alpha: CEFI Normative and Clinical/Educational Samples

Scale	Number of Items	Parent			Teacher			Self-Report	
		Normative Samples 5-11 Years N = 682- 698	Clinical/ Educational Sample N = 250- 331	Normative Samples 5-11 Years N = 690- 700	Clinical/ Educational Sample N = 682- 700	Normative Samples 12-18 Years N = 232- 325	Clinical/ Educational Sample N = 667- 700	Normative Sample N = 148- 205	Clinical/ Educational Sample
Full Scale	50	.98	.99	.97	.99	.99	.97	.97	.97
Attention	12	.92	.93	.87	.96	.96	.94	.86	.86
Emotion Regulation	9	.88	.90	.87	.93	.93	.93	.78	.83
Flexibility	7	.84	.85	.78	.90	.90	.86	.77	.72
Inhibitory Control	10	.89	.90	.87	.94	.94	.91	.80	.80
Initiation	10	.88	.90	.84	.92	.93	.91	.80	.70
Organization	10	.89	.92	.85	.93	.94	.91	.85	.84
Planning	11	.91	.93	.88	.95	.96	.93	.85	.82
Self-Monitoring	10	.85	.89	.78	.91	.92	.86	.78	.74
Working Memory	11	.88	.89	.86	.94	.94	.91	.83	.81

Note: Sample sizes vary due to omitted items.

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Inter-Rater Reliability

- Parent Form (5-18 yrs) shows very good consistency and similar mean scores

Scale	Obtained r	Corrected r	N	Parent 1		Parent 2		d-ratio
				M	SD	M	SD	
Full Scale	.83	.88	100	96.5	13.4	97.6	13.2	0.08
Attention	.79	.86	100	97.8	13.3	98.1	12.8	0.03
Emotion Regulation	.65	.73	98	94.7	13.5	95.6	13.4	0.07
Flexibility	.64	.76	99	97.8	13.0	97.9	12.3	0.01
Inhibitory Control	.80	.84	100	95.9	14.6	97.6	13.8	0.12
Initiation	.78	.84	100	96.8	13.7	98.8	13.3	0.15
Organization	.81	.86	99	96.5	13.2	97.9	13.9	0.10
Planning	.78	.85	100	98.0	13.6	98.4	13.0	0.03
Self-Monitoring	.70	.80	100	96.5	13.0	96.7	12.9	0.02
Working Memory	.81	.82	100	97.4	15.1	99.2	14.5	0.12

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Inter-Rater Consistency

- Teacher Form (5-18 yrs) shows good consistency and similar mean scores

Scale	Obtained <i>r</i>	Corrected <i>r</i>	<i>N</i>	Teacher 1		Teacher 2		<i>d</i> -ratio
				<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Full Scale	.70	.68	98	94.4	17.0	96.8	13.8	0.16
Attention	.64	.63	98	93.5	16.8	96.4	13.9	0.19
Emotion Regulation	.56	.54	98	97.6	16.1	98.4	14.7	0.05
Flexibility	.66	.63	98	94.7	17.2	97.1	13.9	0.15
Inhibitory Control	.64	.64	98	96.5	16.0	98.2	14.2	0.11
Initiation	.64	.57	98	93.9	18.3	97.5	14.7	0.22
Organization	.67	.67	96	94.4	16.6	96.4	13.6	0.13
Planning	.70	.68	98	94.4	17.0	97.0	13.7	0.17
Self-Monitoring	.68	.68	98	94.4	16.4	96.1	13.7	0.11
Working Memory	.65	.61	98	94.3	18.0	97.2	13.9	0.18

Note. All *r*s significant. Pair-wise deletion of missing cases was used.

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Intra-Rater Consistency

- Self-Rating Form (12-18 yrs) two ratings over time shows very good consistency and similar means

Scale	Obtained <i>r</i>	Corrected <i>r</i>	<i>N</i>	Time 1		Time 2		<i>d</i> -ratio
				<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Full Scale	.78	.77	200	101.9	15.1	101.8	15.6	0.01
Attention	.74	.74	200	100.7	14.8	100.7	15.0	0.00
Emotion Regulation	.71	.74	200	100.7	14.2	102.6	14.6	0.13
Flexibility	.86	.86	200	101.9	14.4	101.3	15.1	0.04
Inhibitory Control	.77	.79	200	103.2	14.2	101.7	14.8	0.10
Initiation	.77	.79	200	101.7	14.8	100.7	14.2	0.07
Organization	.85	.86	200	101.7	14.0	101.1	14.9	0.04
Planning	.80	.82	200	101.7	14.1	101.2	14.4	0.03
Self-Monitoring	.74	.74	200	101.5	14.7	100.1	15.1	0.09
Working Memory	.75	.79	200	101.8	14.3	100.8	14.2	0.07

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CEFI Interpretation

- Step 1: Examine Quality of the Ratings: Consistency, Positive and Negative Impression
- Step 2: Interpret Scale Scores
- Step 3: Compare CEFI Scale Scores
- Step 4: Examine Item-Level Responses
- Step 5: Compare Results Across Raters
- Step 6: Compare Results Over Time

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Step 1: Consistency Index

- The Consistency Index provides information about whether the rater responded to similar items differently.
- Inconsistent responding can occur intentionally or unintentionally, and could be due to deliberate non-compliance, fatigue, a misunderstanding of the items or instructions, inattention, disinterest, or a lack of motivation

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Step 1: Impression Scales

- The Negative Impression scale evaluates the likelihood that the rater underestimated the individual's functioning.
- The Positive Impression scale evaluates the likelihood that the rater overestimated the individual's functioning.

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Step 1: Impression Scales

- Negative and Positive Impression Scale Items

Table 5.3. CEFI Negative Impression Scale and Positive Impression Scale Items

Negative Impression Scale	Positive Impression Scale
Item	Item
2. have good thoughts about everyone? (R)	2. have good thoughts about everyone?
20. only care about what is best for others? (R)	20. only care about what is best for others?
24. get bothered by something?	24. get bothered by something? (R)
33. have a bad day?	33. have a bad day? (R)
46. do things the wrong way?	46. do things the wrong way? (R)
54. get embarrassed?	54. get embarrassed? (R)
61. do things perfectly? (R)	61. do things perfectly?
66. like everyone he/she met? (R)	66. like everyone he/she met?
77. know the right answer? (R)	77. know the right answer?
95. get upset?	95. get upset? (R)

Note. (R) = Reverse scored item.

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Step 1: Impression Scales

- A particular response style is indicated if the standard score is less than 76 (< 5% of the normative sample).

Scale	Interpretive Text	
	Standard Score < 75	Standard Score > 75
Consistency Index	The rater responded in a different way to similar items. This rating pattern is not typical and should be further investigated.	The pattern of ratings is typical.
Negative Impression Scale	The pattern of ratings may underestimate the child's behavior rating pattern is not typical and should be further investigated.	The pattern of ratings is typical.
Positive Impression Scale	The pattern of ratings may overestimate the child's behavior rating pattern is not typical and should be further investigated.	The pattern of ratings is typical.
Time to Completion	The rater spent considerably less time than is usual completing the CEFI.	The time the rater took to complete the CEFI was typical.

Time to Completion is only for online administration

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CEFI Interpretation

- Step 1: Examine Quality of the ratings: Consistency, Positive and Negative Impression
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- Step 6: Compare Results Over Time

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Step 2: Interpret Scale Scores

- All scales are set at mean of 100, SD of 15
- Low scores mean poor EF

Table 4.3. Interpretation Guidelines for Examining Scale Scores

Scale	Interpretation Guidelines
Full Scale	Reflects overall executive function. The Full Scale score is made up of 90 items from nine different areas that are conceptually related to executive function (i.e., Attention, Emotion Regulation, Flexibility, Inhibitory Control, Initiation, Organization, Planning, Self-Monitoring, and Working Memory). The CEFI Scales describe the content of the items for intervention purposes. If there is significant variation among the CEFI Scales, the Full Scale score will sometimes be higher and other times lower than scores on these scales. However, the Full Scale score is a good description of a child's/youth's executive function behaviors if there is no significant variation among the CEFI Scales.
Attention	Describes how well a child/youth can avoid distractions, concentrate on tasks, and sustain attention.
Emotion Regulation	Indicates the child's/youth's control and management of emotions, including staying calm when handling small problems and reacting with the right level of emotion.
Flexibility	Reflects a child's/youth's skill at adjusting behavior to meet circumstances, including coming up with different ways to solve problems, having many ideas about how to do things, and being able to solve problems using different approaches.

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Step 2: Interpret Scale Scores

Table 4.3. Interpretation Guidelines for Examining Scale Scores

Scale	Interpretation Guidelines
Inhibitory Control	Describes the child's/youth's ability to control behavior or impulses, including thinking about consequences before acting, maintaining self-control, and keeping commitments.
Initiation	Indicates a child's/youth's skill at beginning tasks or projects on his/her own including starting tasks easily, being motivated, and taking the initiative when needed.
Organization	Reflects the child's/youth's ability to manage personal effects, work, or multiple tasks, including organizing tasks and thoughts well, managing time effectively, and working neatly.
Planning	Describes how well a child/youth can develop and implement strategies to accomplish tasks, including planning ahead and making good decisions.
Self-Monitoring	Indicates the child's/youth's ability to evaluate his/her own behavior in order to determine when a different approach is necessary, including noticing and fixing mistakes, knowing when help is required, and understanding when a task is completed.
Working Memory	Reflects how well a child/youth can keep information in mind that is important for knowing what to do and how to do it, including remembering important things, instructions, and steps.

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Classification of Standard Scores

Standard Score	Percentile Rank	Classification
≥ 130	≥ 98	Very Superior
120–129	91–97	Superior
110–119	75–90	High Average
90–109	25–73	Average
80–89	9–23	Low Average
70–79	2–8	Below Average
≤ 69	≤ 2	Well Below Average

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Step 2: Interpret Estimated True Score Based Confidence Intervals

TABLE B.1. CEFTI (5–18 Years) Parent Form: 90% Confidence Intervals for 5–11-Year-Olds

Standard Score	Full Scale	Attention (AT)	Reaction Time (RT)	Flexibility (FL)	Inhibitory Control (IC)	Initiation (IT)	Organization (OC)	Planning (PL)	Self-Monitoring (SM)	Working Memory (WM)	Standard Score
145											145
144											144
143	139-145										143
142	138-144										142
141	137-143										141
140	136-142										140
139	135-141	130-143	136-144								139
138	134-140	128-142	125-141								138
137	133-140	127-141	124-140	125-141							137
136	132-139	127-140	121-139	124-140	124						136
135	131-138	126	125-139	120-138	123-139	123-124					135
134	130-137		122-138	120-138	122-138	122-138	118	124-138	120-138	122-138	134
133	129-136	125-137	122-137	119-137	122-137	120-137	117	123-137	119-137	122-137	133
132	128	123-136	120-136	118-136	121-136	120-136	116	122-136	118-136	120-136	132
131	127	122-135	119-135	117-135	120-135	119-135	115	121-135	118-135	119-135	131
130	126-133	121-134	118-134	116-134	119-134	118-134	114	120-134	117-134	116-134	130
129	125-132	120-133	117-133	115-133	118-134	118-134	113	119-133	116-133	115-133	129
128	124-131	119-132	116-133	114-133	117-133	117-133	112	118-133	115-133	117-133	128
127	123-130	118-131	116-132	114-132	116-132	116-132	111	118-132	114-132	116-132	127
126	122-129	117-131	115-131	113-131	115-131	115-131	110	117-131	113-131	115-131	126

The Confidence Interval for a score of 130 in Planning is 120 (-10) to 134 (+4)

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Step 2: Interpret Scale Scores Using the Prorating Tables

- If items are not completed by the rater, you can prorate the scores

TABLE A.1. CEFI Full Scale Prorated Values: 1 to 5 Omitted Items

Raw Score	Prorated Values					Raw Score
	1 Omitted Item	2 Omitted Items	3 Omitted Items	4 Omitted Items	5 Omitted Items	
435	450					440
444	440					444
443	448					443
442	447					442
441	446					441
440	445	450				440
439	444	440				439
439	443	448				438
437	442	447				437
436	441	446				436
435	440	445	450			435

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Step 2: Interpret Scale Scores Using the Prorating Tables

- If 1 item on each scale is not completed by the rater, you can prorate that scale's score

TABLE A.2. CEFI Scales Prorated Values: 1 Omitted Item

Raw Score	Prorated Values								Raw Score	
	Attention (AT)	Emotion Regulation (ER)	Flexibility (FL)	Inhibitory Control (IC)	Initiation (IT)	Organization (OG)	Planning (PL)	Self-Monitoring (SM)		Working Memory (WM)
27	29	29	31	30	29	30	30	30	29	27
28	28	29	30	29	29	29	29	29	29	28
29	27	29	29	29	29	28	28	28	28	29
28	26	27	28	27	27	27	26	27	26	28
23	25	26	27	26	26	26	25	26	25	23
24	24	25	26	24	24	24	24	24	24	24
21	23	24	25	23	23	23	23	23	23	21
20	21	22	23	22	22	22	22	22	22	20
19	21	21	22	21	21	21	21	21	21	19
17	20	20	21	20	20	20	20	20	20	17
17	19	19	20	19	19	19	19	19	19	17
16	17	18	19	18	18	18	18	18	18	16
15	16	17	18	17	17	17	17	17	17	15
14	15	16	16	16	16	16	15	16	15	14

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CEFI Interpretation

- Step 1: Examine Quality of the ratings: Consistency, Positive and Negative Impression
- Step 2: Interpret Scale Scores
- Step 3: Compare CEFI Scale Scores
- Step 4: Examine Item-Level Responses
- Step 5: Compare Results Across Raters
- Step 6: Compare Results Over Time

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Step 3: Compare CEFI Scale Scores

Compare CEFI Scales to the child's mean **and** the normative mean.

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Step 3: Compare CEFI Scale Scores

Table 3.4. Critical Values for Significance Testing (at $p \leq .05$ and $p \leq .10$) when Comparing CEFI Scale Standard Scores with Individual's Average CEFI Scale Standard Score

Scale	Parent Form		Teacher Form				Self-Report Form			
	5-11 Years $p \leq .05$	12-18 Years $p \leq .10$	5-11 Years $p \leq .05$	12-18 Years $p \leq .10$	5-11 Years $p \leq .05$	12-18 Years $p \leq .10$	5-11 Years $p \leq .05$	12-18 Years $p \leq .10$		
Attention	5.1	7.6	8.5	7.1	6.6	5.5	6.8	5.5	11.8	9.9
Emotional Regulation	11.0	9.3	10.0	8.4	8.4	7.0	8.3	7.0	14.4	12.1
Flexibility	12.3	10.3	11.8	9.9	9.9	8.3	9.8	8.2	14.8	12.5
Inhibitory Control	10.6	8.9	10.0	8.4	8.0	6.7	7.9	6.6	13.9	11.7
Initiation	10.9	9.1	10.0	8.4	8.8	7.4	8.6	7.2	14.1	11.8
Organization	10.3	8.7	9.0	7.5	8.3	7.0	8.1	6.8	12.3	10.3
Planning	9.6	8.0	8.7	7.3	7.2	6.1	6.9	5.8	12.3	10.3
Self-Monitoring	11.9	10.0	10.5	8.8	9.4	7.9	9.0	7.6	14.6	12.2
Working Memory	10.8	9.1	10.2	8.5	7.8	6.6	8.0	6.7	13.1	11.0

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Step 3: Compare CEFI Scale Scores

Figure 4.1. Illustration of Executive Function Weakness and Strengths on the CEFI (5-18 Years) Teacher Form

CEFI Scales	Standard Score	Difference From Youth's Average	Statistically Significant (Yes/No)	Executive Function Strength/Weakness	90%/95% Confidence Interval	Percentile Rank	Classification
Attention (AT)	95	-6.7	Yes	—	—90 to -100	37	Average
Emotion Regulation (ER)	82	-19.7	Yes	Weakness	-77 to -90	12	Low Average
Flexibility (FX)	112	10.3	Yes	Strength	103 to 118	79	High Average
Inhibitory Control (IC)	99	-2.7	No	—	—93 to -105	47	Average
Initiation (IT)	120	18.3	Yes	Strength	112 to 126	91	Superior
Organization (OG)	99	-2.7	No	—	—93 to -105	47	Average
Planning (PT)	101	-0.7	No	—	—96 to -106	53	Average
Self-Monitoring (SM)	102	0.3	No	—	—95 to -109	55	Average
Working Memory (WM)	105	3.3	No	—	—99 to -111	63	Average
Sum of Standard Scores	915				101.7		Youth's Average

Note. Differences from the Child's Youth's Average are significant at $p < .10$.

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Step 4: Examine Item-Level Scores

Table C.1. CEFI (5-18 Years) Parent Form: Item-Level Classifications for 5-11-Year-Olds

Item	Item Score					Scale	
	0	1	2	3	4		5
1 think before acting?	Below Average	Below Average	Average	Average	Above Average	Above Average	K
2 finish a boring task?	Below Average	Below Average	Average	Average	Above Average	Above Average	AI
4 forget instructions?	Below Average	Below Average	Below Average	Average	Average	Above Average	WM
5 complete one task before starting a new one?	Below Average	Below Average	Average	Average	Above Average	Above Average	DS
6 ask for help when needed?	Below Average	Below Average	Average	Average	Above Average	Above Average	SA
7 come up with a new way to reach a goal?	Below Average	Below Average	Average	Average	Above Average	Above Average	FK
8 remember how to do something?	Below Average	Below Average	Average	Average	Above Average	Above Average	WM
9 prepare for school or work?	Below Average	Below Average	Average	Average	Above Average	Above Average	FL
10 control emotions when under stress?	Below Average	Below Average	Average	Average	Above Average	Above Average	ER
11 work well in a noisy environment?	Below Average	Below Average	Average	Average	Above Average	Above Average	AI
12 stay calm when handling small problems?	Below Average	Below Average	Average	Average	Above Average	Above Average	ES
13 organize his/her thoughts well?	Below Average	Below Average	Average	Average	Above Average	Above Average	DS
14 fix his/her mistakes?	Below Average	Below Average	Average	Average	Above Average	Above Average	SA
15 solve problems creatively?	Below Average	Below Average	Average	Average	Above Average	Above Average	FK

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CEFI Interpretation

- Step 1: Examine Quality of the ratings: Consistency, Positive and Negative Impression
- Step 2: Interpret Scale Scores
- Step 3: Compare CEFI Scale Scores
- Step 4: Examine Item-Level Responses
- Step 5: Compare Results Across Raters
- Step 6: Compare Results Over Time

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Step 5: Compare Results Across Raters

Table 4.5. Critical Values (p < .10) Denoting Statistically Significant Differences Between Raters

Scale	Parent to Parent		Teacher to Teacher		Parent to Self-Report		Teacher to Self-Report	
	5-11 Years	12-18 Years	5-11 Years	12-18 Years	5-11 Years	12-18 Years	12-18 Years	12-18 Years
Full Scale	5	6	4	4	4	4	8	5
Attention	10	10	7	7	9	9	13	11
Emotion Regulation	13	12	10	10	11	11	15	14
Flexibility	14	14	12	12	13	13	15	15
Inhibitory Control	12	12	9	9	11	10	14	13
Initiation	13	12	10	10	12	11	14	14
Organization	12	10	10	9	11	10	12	12
Planning	11	10	8	8	10	9	13	11
Self-Monitoring	14	12	11	11	13	11	15	14
Working Memory	13	12	9	9	11	11	11	13

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CEFI Interpretation

- Step 1: Examine Quality of the ratings: Consistency, Positive and Negative Impression
- Step 2: Interpret Scale Scores
- Step 3: Compare CEFI Scale Scores
- Step 4: Examine Item-Level Responses
- Step 5: Compare Results Across Raters
- Step 6: Compare Results Over Time

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Step 6: Compare Results Over Time

- Determine if CEFI pre post scores differ significantly – but also if the post-test standard score is in the Average range or higher

Table 4.6. Critical Values Denoting Statistically Significant Change Over Time

Scale	Parent Form				Teacher Form				Self-Report Form	
	5-11 Years		12-18 Years		5-11 Years		12-18 Years		12-18 Years	
	p < .05	p < .10	p < .05	p < .10	p < .05	p < .10	p < .05	p < .10	p < .05	p < .10
Full Scale	6	5	5	5	4	4	4	4	8	6
Attention	12	10	11	10	9	7	9	7	16	13
Emotion Regulation	15	13	14	12	11	10	11	10	20	17
Flexibility	17	14	15	14	14	12	14	12	20	17
Inhibitory Control	15	12	14	12	11	9	11	9	19	16
Initiation	15	13	14	12	12	10	12	10	19	15
Organization	14	12	12	10	11	10	11	9	17	14
Planning	13	11	12	10	10	8	9	8	17	14
Self-Monitoring	17	14	14	12	13	11	12	11	20	17
Working Memory	15	13	14	12	11	9	11	9	18	15

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Validity of the CEFI Scales

- Factor analysis is a valuable tool to understand how items group.
- But we also need to know if the items have validity.
- Discriminating children with EF deficits from the regular population is important.
- Discriminating children with EF deficits from those who are not in the regular population and have other problems is very important.

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Content Validity

Table 8.1 Sample Items for Each CEFI Component

Component	CEFI Definition	Example Item Content
Attention	Describes how well a child/youth can avoid distractions, concentrate on tasks, and sustain attention.	focus on one thing? pay attention for a long time?
Emotion Regulation	Indicates control and management of emotions, including staying calm when handling small problems and reacting with the right level of emotion.	stay calm when handling small problems? respond calmly to delays?
Flexibility	Reflects how well a child/youth adjusts his/her behavior to meet circumstances, including coming up with different ways to solve problems, having many ideas about how to do things, and being able to solve problems using different approaches.	come up with different ways to solve problems? have many ideas about how to do things?
Inhibitory Control	Describes the ability to control behavior or impulses, including thinking about consequences before acting, maintaining self-control, and keeping commitments.	think of the consequences before acting? maintain self-control?
Initiation	Indicates how a child/youth begins tasks or projects on his/her own, including starting tasks easily, being motivated, and taking the initiative when needed.	appear motivated? start tasks easily?

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Content Validity

Table 8.1 Sample Items for Each CEFI Component

Component	CEFI Definition	Example Item Content
Organization	Reflects the ability to manage personal effects, work, or multiple tasks, including organizing tasks and thoughts well, managing time effectively, and working neatly.	organize tasks well? manage time effectively?
Planning	Describes how well a child/youth can develop and implement strategies to accomplish tasks, including planning ahead and making good decisions.	find a strategy that worked? plan ahead?
Self-Monitoring	Indicates the child's/youth's ability to evaluate his/her own behavior in order to determine when a different approach is necessary, including noticing and fixing mistakes, knowing when help is required, and understanding when a task is completed.	fix his/her/your mistakes? notice his/her/your mistakes?
Working Memory	Reflects how well a child/youth can keep information in mind that is important for knowing what to do and how to do it, including remembering important things, instructions, and steps.	remember many things at one time? remember important things?

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US vs Canada

- Samples were matched on age, gender, race/ethnicity, and parental education levels

Table 8.13. Differences Between Canadian and U.S. Matched Samples: CEFI Full Scale

Form		Canada	U.S.	d-ratio	F (df)	p
Parent	M	101.5	102.7	0.08	0.87 (1, 521)	0.351
	SD	15.5	15.0			
	N	263	263			
Teacher	M	98.3	100.5	0.16	1.75 (1, 272)	0.187
	SD	14.0	14.0			
	N	137	137			
Self-Report	M	102.0	101.4	-0.04	0.10 (1, 196)	0.750
	SD	15.4	14.9			
	N	101	101			

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CEFI Consistency Between Raters

- Comparisons across parent, teacher, and self-report ratings show good correlations and good mean score consistency

Table 8.16. Correlations Between CEFI Forms: CEFI Full Scale

Comparison	Obtained		N	Rater Type		M		SD		d-ratio
	r	Corrected r		Parent	Teacher	Parent	Teacher	Parent	Teacher	
Parent to Teacher	.719	.791	126	Parent	96.2	14.3	Teacher	97.2	12.6	-0.08
Parent to Self-Report	.669	.705	126	Parent	96.2	14.3	Self-Report	94.4	14.3	0.12
Teacher to Self-Report	.594	.679	126	Teacher	97.2	12.6	Self-Report	94.4	14.3	-0.21

Note. All is significant, $p < .001$.

100

100

CEFI Scores by Diagnosis

- We expected that individuals with ADHD, mood disorders, and Autism Spectrum Disorders might earn a low CEFI Full Scale score.
- We compared groups matched on gender, race/ethnicity, and parental education

Impairment in executive function is common in a number of internalizing and externalizing forms of psychopathology (Willcutt et al., 2005; see chapter 2, Theory and Research, for further discussion). For instance, research and theory has pointed to executive function deficits in Attention-Deficit/Hyperactivity Disorder (ADHD) and mood disorders (e.g., Weyandt et al., in press), as well as Autism Spectrum Disorders (ASD; e.g., Gilbert, Bird, Bincley, Frith, & Burgess, 2008; Gotlib, Kemerohy, Sirian, Black, & Wagner, 2002; Happé, Booth, Charlton, & Hughes, 2006; Ozonoff, Pennington, & Rogers, 1991; Solomon, Ozonoff, Utsu, Ravizza, Cummings, Ly, & Carter, 2009).

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Group Differences: ADHD

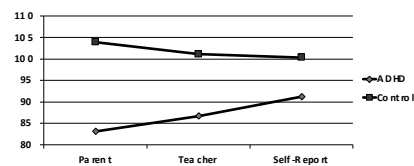


Table 8.19 Differences Between ADHD and Matched General Population Samples: CEFI Full Scale

Form		ADHD	Matched Gen. Pop.	d-ratio	Z(d)	p
Parent	M	85.1	100.9			
	SD	18.0	18.0	-1.99	216.56 (1,340)	< .001
	N	171	171			
Teacher	M	86.7	100.5			
	SD	13.5	13.5	-1.07	79.93 (1,278)	< .001
	N	118	117			
Self-Report	M	90.7	100.9			
	SD	14.7	14.7	-0.62	22.21 (1,282)	< .001
	N	117	117			

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Group Differences: ASD

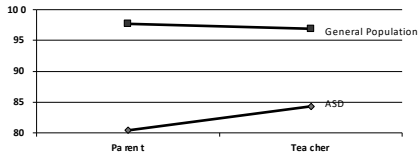


Table 8.20 Differences Between ASD and Matched General Population Samples: CEFI Full Scale

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			

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Group Differences: Learning Disabilities

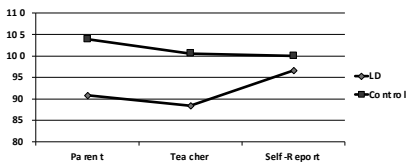


Table 8.22 Differences Between LD and Matched General Population Samples: CEFI Full Scale

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			

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Group Differences: Mood Disorders

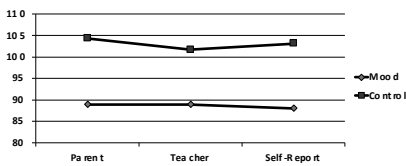


Table 8.21 Differences Between Mood Disorder and Matched General Population Samples: CEFI Full Scale

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			

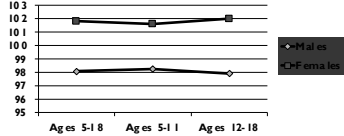
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CEFI Gender Differences: Parent Raters

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

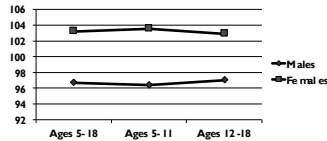


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CEFI Gender Differences: Teacher Raters

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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Gender Differences: Abilities Associated With EF

Journal of Educational Psychology, 2005, Vol. 93, No. 2, 406-417
 Copyright 2005 by the American Psychological Association, Inc. 0022-0665/05/\$12.00 DOI: 10.1037/0022-0665.93.2.406

Gender Differences in Planning, Attention, Simultaneous, and Successive (PASS) Cognitive Processes and Achievement

Jack A. Naglieri
George Mason University

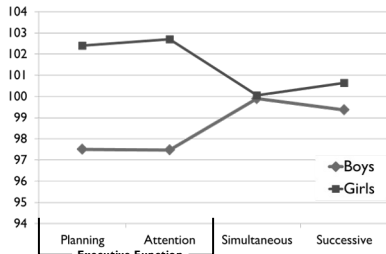
Johannes Rojahn
Ohio State University

Gender differences in ability and achievement have been studied for some time and have been conceptualized along verbal, quantitative, and visual-spatial dimensions. Researchers recently have called for a theory-based approach to studying these differences. This study examined 1,100 boys and 1,100 girls who matched the U.S. population using the Planning, Attention, Simultaneous, Successive (PASS) cognitive-processing theory, built on the neuropsychological work of A. R. Luria (1973). Girls outperformed boys on the Planning and Attention scales of the Cognitive Assessment System by about 5 points ($d = .30$ and $.35$, respectively). Gender differences were also found for a subsample of 1,266 children on the Woodcock-Johnson Revised Tests of Achievement Profiling ($d = .33$), Letter-Word Identification ($d = .22$), and Dictation ($d = .22$). The results illustrate that the PASS theory offers a useful way to examine gender differences in cognitive performance.

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Gender Differences: Abilities Associated With EF



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Computer Scored Printout

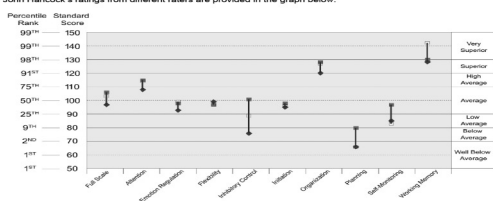
Classification: Well Below Average ≤ 69; Below Average = 70-79; Low Average = 80-89; Average = 90-109; High Average = 110-119; Superior = 120-129; Very Superior ≥ 130.

Score	10/15/2012	7/10/15/2012	5/8/10/15/2012	Significant Differences Between Raters
Full Scale				
Standard Score	108	97	103	p = T
95% CI	102-109	92-99	99-107	SR = Y
Percentile Rank	66	42	58	
CEEF Scales				
Score	10/15/2012	7/10/15/2012	5/8/10/15/2012	Significant Differences Between Raters
Attention				
Standard Score	115	108	114	
95% CI	106-120	102-112	106-121	
Percentile Rank	84	70	82	No significant differences
EFSEFW	84	70	82	
Strength				
Standard Score	88	83	89	
95% CI	81-100	77-100	86-100	No significant differences
Percentile Rank	45	32	47	
EFSEFW	45	32	47	
Emotion Regulation				
Standard Score	87	88	87	
95% CI	69-106	62-109	67-108	No significant differences
Percentile Rank	43	47	43	
EFSEFW	43	47	43	
Flexibility				
Standard Score	101	78	88	
95% CI	83-108	72-83	81-101	p = T
Percentile Rank	53	25	33	
EFSEFW	53	25	33	

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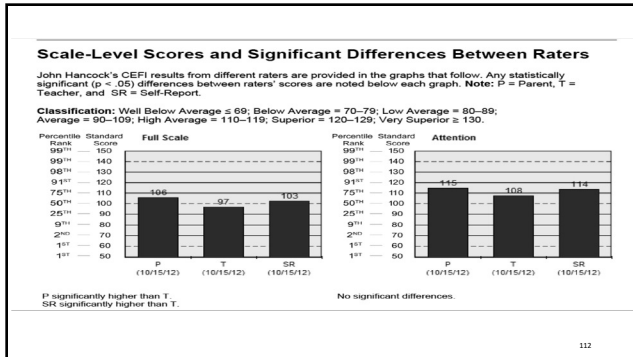
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Overview of Results Between Raters for John Hancock



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CEFI: WISC-IV, CAS, and WJ III

- Data from the Neurology, Learning and Behavior Center in Salt Lake City, UT
- Children given the CEFI, WISC-IV (N = 43), CAS (N = 62), and the WJIII achievement (N = 58) as part of a typical test battery.

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CEFI, WISC-IV, CAS, Achievement

Table 8.28. Demographic Characteristics of the CAS, WISC-IV, and WJ III ACH Validity Samples

Demographic	Sample					
	CAS		WISC-IV		WJ III ACH	
	N	%	N	%	N	%
Gender						
Male	38	61.3	29	67.4	36	62.1
Female	24	38.7	14	32.6	22	37.9
Race/Ethnic Group						
Hispanic	1	1.6	1	2.3	1	1.7
Asian	2	3.2	2	4.7	2	3.4
White	55	88.7	38	88.4	52	89.7
Other	4	6.5	2	4.7	3	5.2
High school diploma or less	1	1.6	0	0.0	1	1.7
Parental Education Level						
Some college or associate's degree	21	33.9	12	27.9	18	31.0
Bachelor's degree or higher	36	58.1	26	60.5	34	58.7
Missing information	4	6.5	5	11.6	5	8.6
ADHD	24	38.7	15	34.9	20	34.5
Anxiety	15	24.2	9	20.9	14	24.1
ASD	7	11.3	5	11.6	7	12.1
LD	3	4.8	3	7.0	3	5.2
Mood	4	6.5	3	7.0	5	8.6
Other	9	14.3	8	18.2	9	15.5
Total	62	100.0	43	100.0	58	100.0
Age M (SD)	10.4 (2.0)		10.2 (2.0)		10.5 (2.0)	

Note: ADHD = Attention-Deficit/Hyperactivity Disorder; Anxiety = Anxiety Disorder; ASD = Autism Spectrum Disorder; LD = Learning Disorder; Mood = Mood Disorder.

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CEFI (5-18 Years) Teacher Interpretive Report for John Hancock Admin Date: 10/15/2012

Comprehensive Executive Function Inventory (5-18 Years)
Teacher Feedback Report

Child's Name/ID: John Hancock	Teacher's Name/ID: Mr. Lincoln
Age: 6 years	Date of Assessment: October 16, 2012
Gender: Male	School: DC
Birth Date: October 15, 2006	Examiner:
Grade: 1	

Note: This feedback report is intended to provide a record of scores obtained on the CEFI. It does not replace a detailed explanation of the scores by the examiner, identified at the top of this report. If you have any questions or concerns regarding the material herein, please speak to the examiner.

About the CEFI
The Comprehensive Executive Function Inventory (CEFI) is a rating scale that is used to measure Attention, Emotion Regulation, Flexibility, Inhibitory Control, Initiation, Organization, Planning, Self-Monitoring, and Working Memory. The CEFI gives an overall score and scores on nine separate scales.

What CEFI Scores Mean
This report provides standard scores that are based on ratings of children in the normative sample (that is, children who represent the general population). The scores are set so that 100 is Average, and equal to the 50th percentile rank. This means that when a child obtains a score of 100, he did as well as or better than 50 percent of children his age. The Average category includes scores that range from 90 (20th percentile) to 109 (75th percentile). Scores below 90 may suggest difficulties in specific areas. Scores above 109 may suggest strengths in specific areas.

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EF Interventions

Can strategic, instructional interventions provide remedial and compensatory support for children with EF deficits?

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Cognitive Strategy = EF Instruction

- A strategy is a procedure that the learner uses to perform academic tasks
- Using a strategy means the child thinks about 'how you do what you do'
- Successful learners use many strategies.
- Some of these strategies include visualization, verbalization, making associations, chunking, questioning, scanning, using mnemonics, sounding out words, and self-checking and monitoring.

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Is broad or global EF training effectively transferred to the natural setting?

127

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Four current reviews converge concluding that the efficacy of global EF training (e.g. training of attention, working memory, behavioral inhibition, etc.) has not been established.

Cortese et. al., 2015; Melby-Lervag et. al.,2013; Rapport et. al., 2015; Shipstead et. al.,2012.

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These studies suggest that while training in game like activities improves performance on those tasks as well as related ones (near transfer) any transfer from these tasks to global functioning in natural settings (far transfer) remains unproven.

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Most treatment studies have focused on a single type of EF behavior (e.g. working memory). A recent study attempted to train multiple types of EF behaviors simultaneously. Their findings are similar to previous research. Near transfer effects do occur but transfer to the natural setting is limited.

Davis, et. al., 2015

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Is real world, content based EF instruction effective?

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Can strategic, direct instructional interventions provide remedial and compensatory support for children with EF deficits?

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A modest group of studies has demonstrated that setting and work modifications as well as strategy development and mastery improves quality of work in near and far term activities related to the work for which strategies were practiced.

Jang, Schunn, & Nokes, 2011; Alloway, 2011; Gathercole & Alloway, ; de Jong, 2010; McNamara & Scott, 2001

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My Granddaughter Hones Her EF Skills



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Practice Pays Off!



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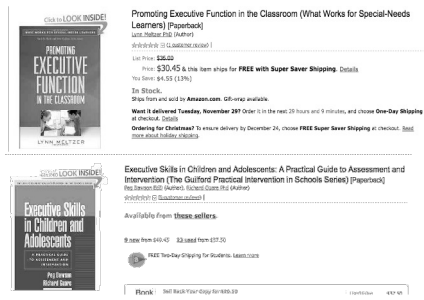
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Cognitive Instructional Methods

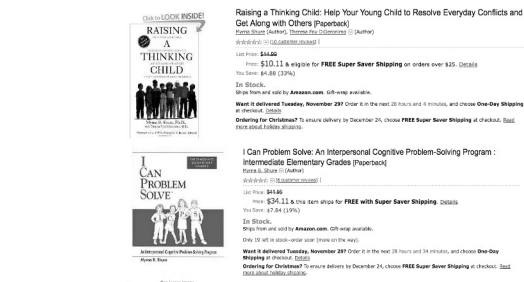


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EF Instruction

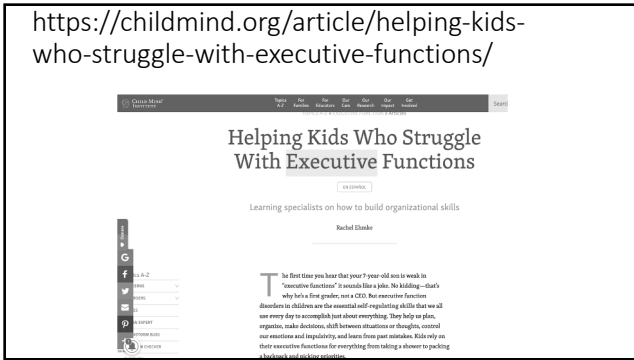


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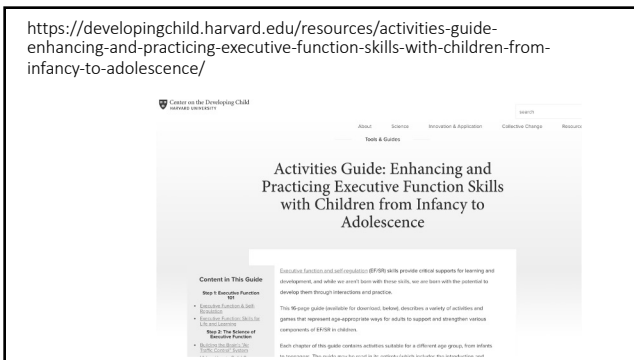
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<https://childmind.org/article/helping-kids-who-struggle-with-executive-functions/>



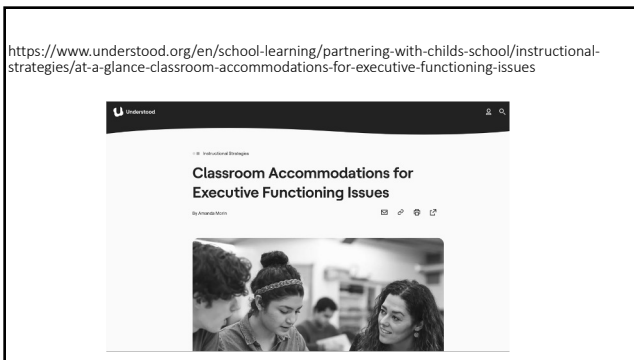
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<https://developingchild.harvard.edu/resources/activities-guide-enhancing-and-practicing-executive-function-skills-with-children-from-infancy-to-adolescence/>

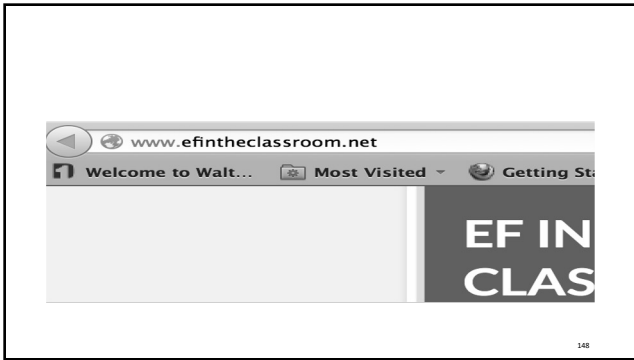


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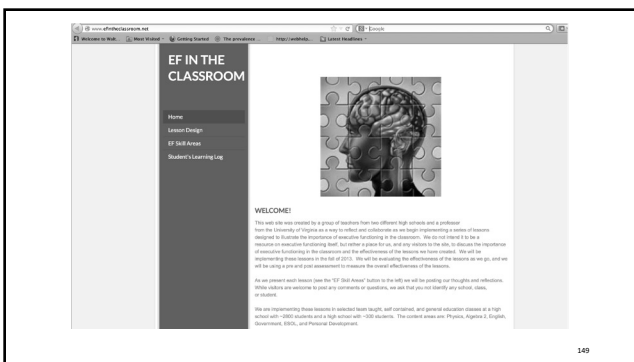
<https://www.understood.org/en/school-learning/partnering-with-childs-school/instructional-strategies/at-a-glance-classroom-accommodations-for-executive-functioning-issues>



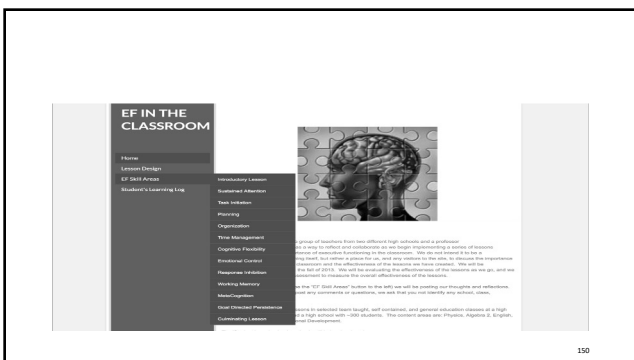
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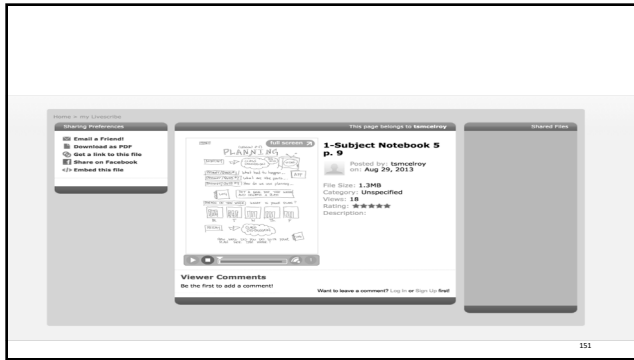
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Teaching Children to use EF

- Helping Children Learn Intervention Handouts for Use in School and at Home, *Second Edition* By Jack A. Nagleri, Ph.D., & Eric B. Pickering, Ph.D.,
- Spanish handouts by Tulio Otero, Ph.D., & Mary Moreno, Ph.D.

The book cover features a young boy's face and the text: 'Helping Children Learn Intervention Handouts for Use in School and at Home, 2nd Edition' by Jack A. Nagleri and Eric B. Pickering. It also includes a quote from 'The Reading Teacher' magazine.

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Four Ways to Think Smart!

Think smart and use a plan!

Think smart and look at the details!

Think smart and put the pieces together!

Think smart and follow the sequence!

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Steps to Strategic Instruction:

- **Describe the strategy.** Students obtain an understanding of the strategy and its purpose-why it is important, when it can be used, and how to use it.
- **Model its use.** The teacher models the strategy, explaining to the students how to perform it.
- **Provide ample assisted practice time.** The teacher monitors, provides cues, and gives feedback. Practice results in automaticity so the student doesn't have to "think" about using the strategy.
- **Promote student self-monitoring and evaluation of personal strategy use.** Students will likely use the strategy if they see how it works for them; it will become part of their learning schema.
- **Encourage continued use and generalization of the strategy.** Students are encouraged to try the strategy in other learning situations.

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Benefits of Strategy Instruction

- Students trust their minds
- Students know there is more than one right way to do things
- They acknowledge their mistakes and try to rectify them
- They evaluate their products and behavior
- Memories are enhanced
- Learning increases
- Self-esteem increases
- Students feel a sense of power
- Students become more responsible
- Work completion and accuracy improve
- Students develop and use a personal study process
- They know how to "try"
- On-task time increases: students are more "engaged"

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Conclusions

- The concept of EF is evolving.
- Data from the CEFI Standardization indicate that when measured using observable behaviors the term Executive Function is supported.
- The CEFI provides a well normed measure of EF that has demonstrated reliability & validity.
- There is emerging evidence that children can be taught to be more strategic – an important indication of good EF behavior and outcome.



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Continuing Education

CEFF® [Manual Quiz: 3 CE Credits]
The Comprehensive Executive Function Inventory™ is a comprehensive evaluation of executive function strengths and weaknesses in youth aged 5 to 18 years.

ASRS® [Manual Quiz: 4 CE Credits]
The Autism Spectrum Rating Scales™ identifies symptoms, behaviors, and associated features of Autism Spectrum Disorders in youth.

About the Assessment

RSI™
Rating Scale of Impairment™
Sam Goldstein, Ph.D.
Jack A. Naglieri, Ph.D.

Goldstein & Naglieri

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Dr. Sam Goldstein

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Test Developer - Educator

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Webinars from Dr. Goldstein

Sustaining Your Resilience in Stressful Times: Guidelines for Pediatric Mental Health Professionals

Webinar
Sustaining Your Resilience in Stressful Times Part 1: Guidelines for Pediatric Mental Health Professionals

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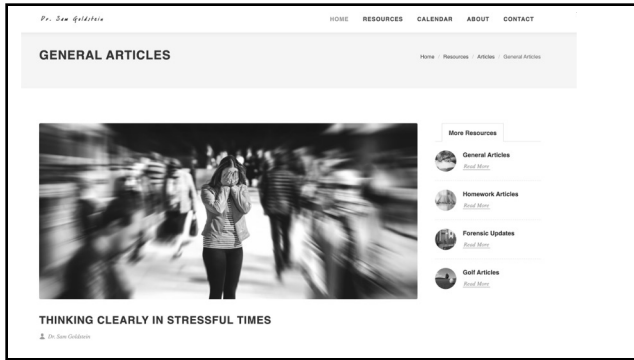
THE POWER OF RESILIENCE

The Power of Resilience

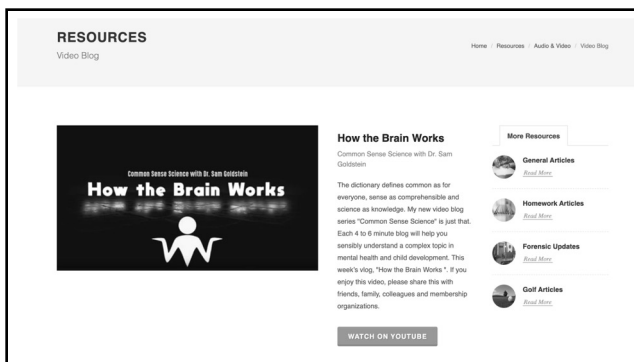
Sustaining Your Resilience in Stressful Times Part 2: Standing & Addressing the Cascade of Youth Risk

Webinar
Sustaining Your Resilience in Stressful Times Part 2: Standing & Addressing the Cascade of Youth Risk

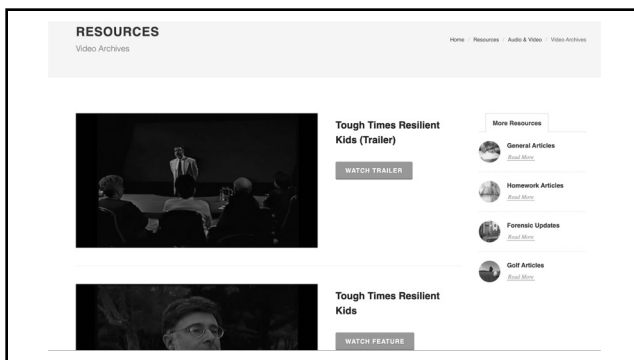
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 **Questions?** 

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TEDx: <https://www.youtube.com/watch?v=isfw8JJ-eWM>

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