Executive Function or Functions: An Empirically Derived Answer

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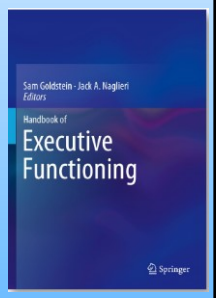
Goldstein, Naglieri, Princiotta, & Otero (2013)

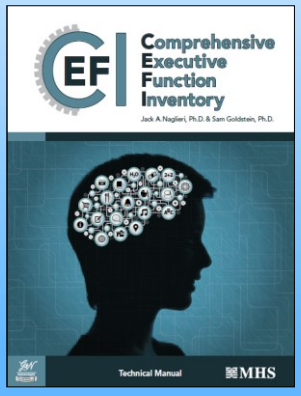
- Executive function(s) has come to be an umbrella term used for many different "abilities"-- planning, working memory, attention, inhibition, self-monitoring, self-regulation and initiation -- carried out by pre-frontal lobes.
- We found more than 30 definitions of EF(s)

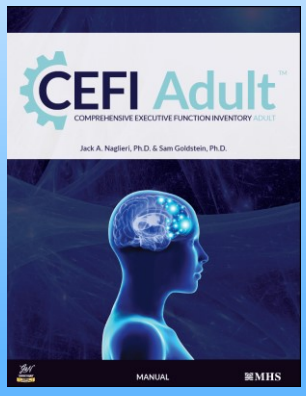


Executive Function(s)

- Definitions of EF(s) vary but mainly differ on this question:
  - Is the term Executive Function***s*** or Executive Function the best term?
- One way to answer the question is to research the factor structure of behavioral observations for children and adults - we used the CEFI and CEFI-Adult

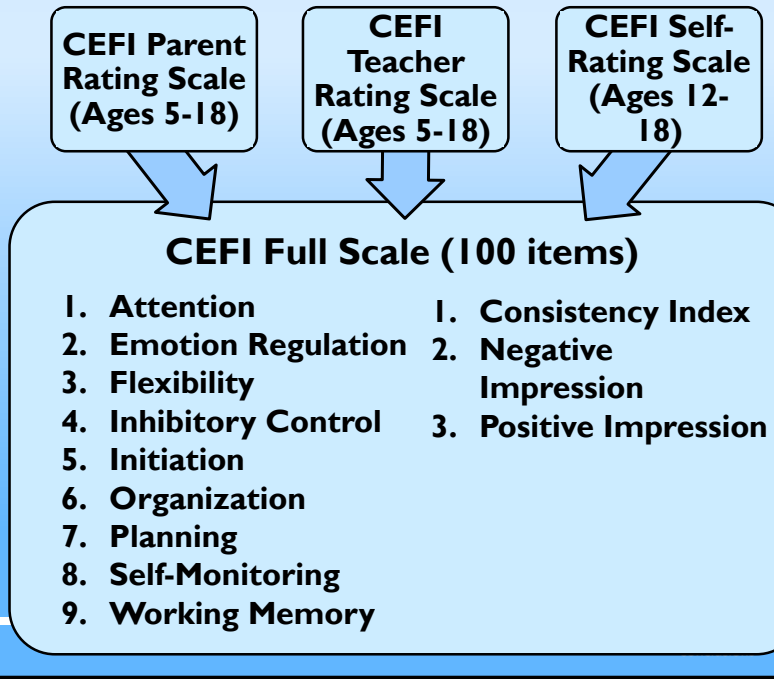
CEFI (Naglieri & Goldstein, 2012) & CEFI-Adult (Naglieri & Goldstein, 2012)





CEFI Standardization Samples

- CEFI (ages 5-18 years)
  - Parent (N=1,400), Teacher (N=1,400) and Self (N=700), ratings stratified by Age, Gender, Race/Ethnicity, Region, Parental Education Level, Special Ed Services (see manual pages 52-65)
- CEFI Adult (ages 18-80+)
  - Self (N = 1,660) and Observer (N = 1,660) ratings stratified by Age, Gender, Race/Ethnicity, Region, Education Level, Clinical Status (pg. 52-65)
- In total these nationally representative samples span aged 5 to 80 years (N = 6,820)



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

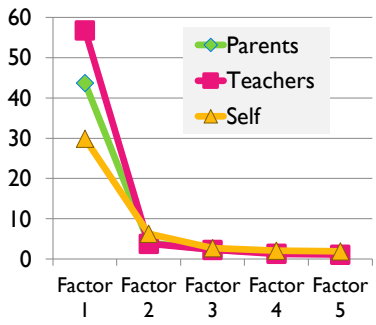
CEFI Scales
Attention
Emotion Regulation
Flexibility
Inhibitory Control
Initiation
Organization
Planning
Self-Monitoring
Working Memory

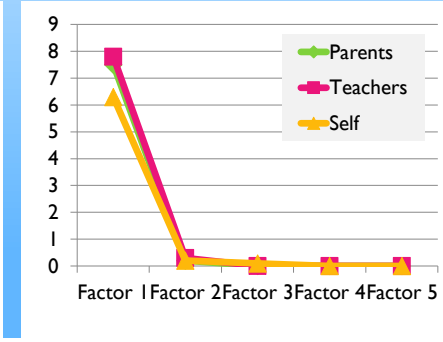
- The sample …

Exploratory Factor Analyses

90 Items: factor analysis clearly indicted that *one factor* was the best solution

Nine item groups: Attention, Emotion Regulation, Flexibility, Inhibitory Control, Initiation, Organization, Planning, Self-Monitoring, and Working Memory scales form *one factor*





EXPLORATORY FACTOR ANALYSES

Table 8.6. Consistency of Factor Loadings Across Groups

Grouping Factor	CEFI Form	Coefficient of Congruence
Gender	Parent	.999
	Teacher	.999
	Self-Report	.992
Race/ Ethnic Group	Parent	.996
	Teacher	.999
	Self-Report	.995
Age	Parent	.999
	Teacher	.999
	Self-Report	.995
Clinical/ Educational	Parent	.993
	Teacher	.994
	Self-Report	.976

Nearly identical factor solutions (ALL ONE FACTOR) by Gender, Race/Ethnic, Age and Clinical/typical status

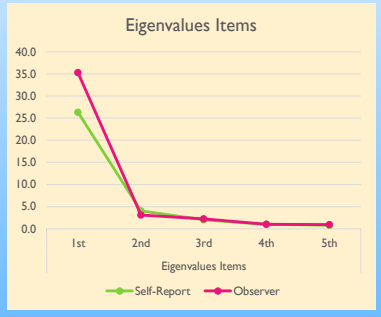
Factor Analysis of the CEFI Adult

(Naglieri & Goldstein, 2017)

- Same scale structure as CEFI
  - Full Scale
    - Attention
    - Emotion Regulation
    - Flexibility
    - Inhibitory Control
    - Initiation
    - Organization
    - Planning
    - Self-Monitoring
    - Working Memory

Adult CEFI Samples

- Self (N = 1,600), Observer (N = 1,600) results: 1 factor



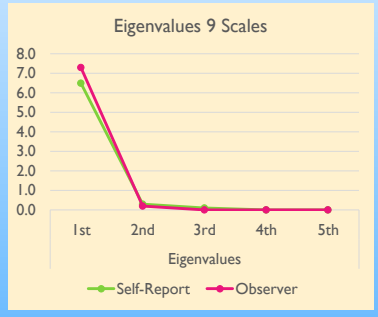


Table 8.2. Eigenvalues from the Inter-Item Correlations

Form	1st:2nd	Factor								
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Self-Report	6.7	26.3	4.0	2.0	1.0	0.8	0.7	0.6	0.5	0.5
Observer	11.3	35.3	3.1	2.2	1.0	0.9	0.8	0.7	0.5	0.5

Note. Extraction method: Principal Axis Factoring. Only the first 9 eigenvalues are presented.

Table 8.4. Eigenvalues from the CEFI Adult Scales Correlations

Form	1st:2nd	Factor								
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Self-Report	21.7	6.5	0.3	0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1
Observer	32.7	7.3	0.2	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1

Note. Extraction method: Principal Axis Factoring.

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CEFI Adult Consistency of Loadings

Consistency of Factor Loadings Across Groups

Exploratory factor analysis (EFA) was used to examine the replicability of the unidimensional factor structure of the CEFI Adult across several demographic groups (gender, age, race/ethnicity, and clinical status). The EFA procedure was conducted for each demographic group to determine if the factor structure was consistent across genders (males vs. females), ages (below vs. at or above the normative mean of 50), race/ethnicity (broken down into White vs. non-White to allow large enough sample sizes to detect differences), and clinical status (non-clinical vs. clinical). The factor loadings of the items were correlated across groups to compute the coefficient of congruence (Abdi, 2010); results revealed a very high degree of consistency across all groups (see Table 8.6), indicating that the unidimensionality of the CEFI Adult generalized across the demographic groups.

Table 8.6. Consistency of Factor Loadings Across Groups

Grouping Factor	Form	Coefficient of Congruence	Group 1		Group 2	
			Level	*N*	Level	*N*
Gender	Self-Report Form	.998	Male	795	Female	865
	Observer Form	.999	Male	795	Female	865
Race/Ethnicity	Self-Report Form	.997	White	1,153	Non-white	507
	Observer Form	.999	White	1,154	Non-white	506
Age	Self-Report Form	.997	Under 50 years	840	50+ years	820
	Observer Form	.999	Under 50 years	840	50+ years	820
Clinical Status	Self-Report Form	.993	Non-clinical	1,501	Clinical	159
	Observer Form	.996	Non-clinical	1,497	Clinical	163

conclusions

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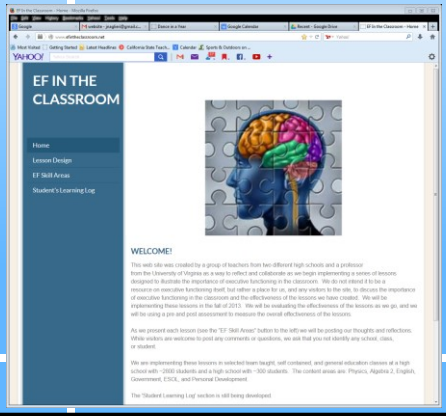
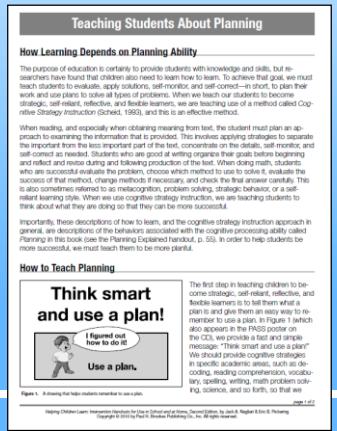
Findings and Implications

- From these nationally representative samples aged 5 to 80 years (N = 6,820) results indicate Executive Function best describes the concept when measured by a rating scale
- The TOTAL score from the CEFI & CEFI Adult tells you if there is an EF problem or not
- The part scores are used for
  - intervention planning and determining if more assessment is needed
    - For example, if working memory appears to be a problem give CAS2 to clarify: "Is it working memory or Successive processing"

Other Lessons from www.efintheclassroom.net

www.Efintheclassroom.net




Teaching Students About Planning

How Learning Depends on Planning Ability

The purpose of education is certainly to provide students with knowledge and skills, but researchers have found that children also need to learn how to learn. To achieve that goal, we must teach students to evaluate, apply solutions, self-monitor, and self-correct—in short, to plan their work and use plans to solve all types of problems. When we teach our students to become strategic, self-reliant, reflective, and flexible learners, we are teaching use of a method called Cognitive Strategy Instruction (Scheid, 1993), and this is an effective method.

When reading, and especially when obtaining meaning from text, the student must plan an approach to examining the information that is provided. This involves applying strategies to separate the important from the less important part of the text, concentrate on the details, self-monitor, and self-correct as needed. Students who are good at writing organize their goals before beginning and reflect and revise during and following production of the text. When doing math, students who are successful evaluate the problem, choose which method to use to solve it, evaluate the success of that method, change methods if necessary, and check the final answer carefully. This is also sometimes referred to as metacognition, problem solving, strategic behavior, or a self-reliant learning style. When we use cognitive strategy instruction, we are teaching students to think about what they are doing so that they can be more successful.

Importantly, these descriptions of how to learn, and the cognitive strategy instruction approach in general, are descriptions of the behaviors associated with the cognitive processing ability called *Planning* in this book (see the Planning Explained handout, p. 55). In order to help students be more successful, we must teach them to be more planful.

How to Teach Planning

Think smart and use a plan!

I figured out how to do it!

Use a plan.

The first step in teaching children to become strategic, self-reliant, reflective, and flexible learners is to tell them what a plan is and give them an easy way to remember to use a plan. In Figure 1 (which also appears in the PASS poster on the CD), we provide a fast and simple message: "Think smart and use a plan" We should provide cognitive strategies in specific academic areas, such as decoding, reading comprehension, vocabulary, spelling, writing, math problem solving, science, and so forth, so that we

Figure 1. A drawing that helps students remember to use a plan.

Implications

- The TOTAL score from the CEFI & CEFI Adult tells you if there is an EF problem or not
- The part scores are used for
  - intervention
  - If more assessment is needed, that is, if working memory appears to be a problem give CAS2 to clarify: "Is it working memory or Successive processing"
- But even generic intervention works…

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SAGE

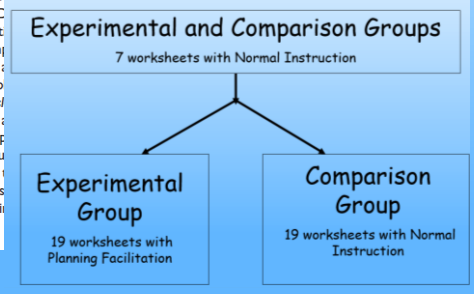
A Cognitive Strategy Instruction to Improve Math Calculation for Children With ADHD and LD: A Randomized Controlled Study

Jackie S. Iseman[1] and Jack A. Naglieri[1]

Abstract

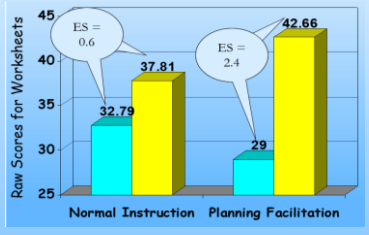
The authors examined the effectiveness of cognitive strategy instruction
Successive) given by special education teachers to students with ADHD
experimental group were exposed to a brief cognitive strategy instruct
development and application of effective planning for mathematical comp
standard math instruction. Standardized tests of cognitive processes
students completed math worksheets throughout the experimental p
Johnson Tests of Achievement, Third Edition, Math Fluency and *Wechsl*
Numerical Operations) were administered pre- and postintervention,
follow-up. Large pre–post effect sizes were found for students in the exp
math worksheets (0.85 and 0.26), Math Fluency (1.17 and 0.09), and Nu
At 1 year follow-up, the experimental group continued to outperform
students with ADHD evidenced greater improvement in math works
(which measured the skill of generalizing learned strategies to other si
when provided the PASS-based cognitive strategy instruction.

Design of the 10-day Study

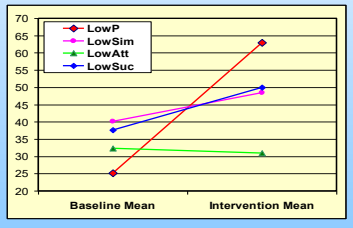


Students with ADHD *and* SLD

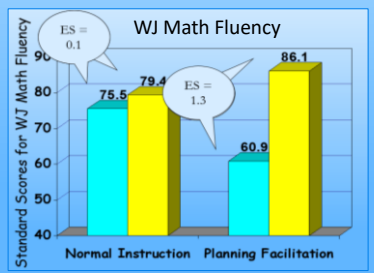
Math Work Sheets



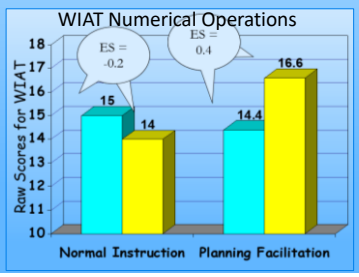
Pre-Post by PASS Weakness



WJ Math Fluency



WIAT Numerical Operations



One Year Follow-up

At 1-year follow-up, 27 of the students were retested on the WJ-III ACH Math Fluency subtest as part of the school's typical yearly evaluation of students. This group included 14 students from the comparison group and 13 students from the experimental group. The results indicated that the improvement of students in the experimental group ($M = 16.08$, $SD = 19$, $d = 0.85$) was significantly greater than the improvement of students in the comparison group ($M = 3.21$, $SD = 18.21$, $d = 0.09$).