Comprehensive Assessment of Executive Function from Assessment to Intervention

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1

Welcome !

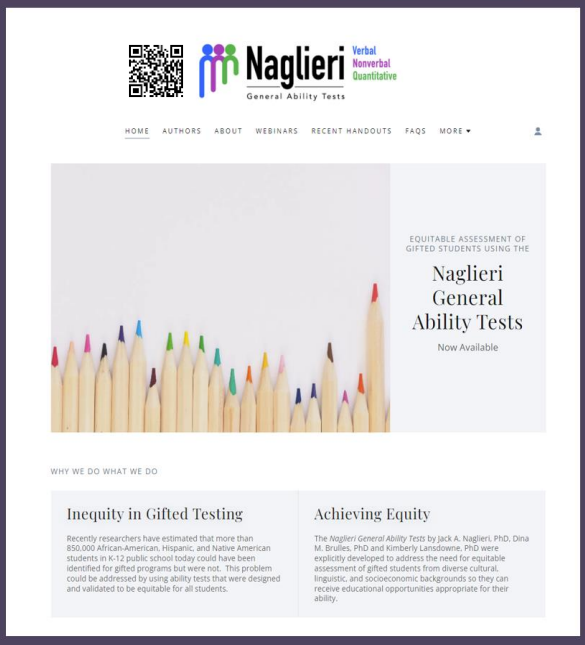
2

How Are You Feeling Today ?

Let's Get Ready to Learn

Mindful Breathing

FOR MORE INFORMATION PLEASE GO TO MY WEB PAGES



5

Disclosures

Executive Function | **Social Emotional** | **Autism** | **Gifted Identification** | **PASS Neurocognitive Theory: Assessment & Intervention Handouts**

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6

6

Goals and Objectives for Today: Keep Executive Function Functioning!

- Describe current research on executive function.
- Embrace a COMPREHENSIVE approach to assessment of EF
- Teach students to be metacognitive thinkers who can "Think Smart."
- Provide practical research–based strategies that are applicable in classrooms and at home
- Encourage learning using CORE GROUPS

Core Group Discussion → Deeper Learning

- **Coach**- Guide the discussion
- **Organizer** – Keeps the time
- **Recorder** – Keep notes and speak for the group

8

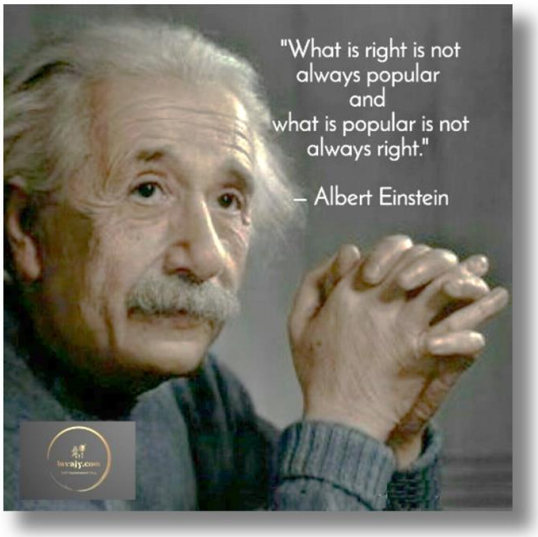
Why this session on EF?

- Executive Function (EF) is the most important ability we have, because it provides us a way to decide ***how to do what we choose to do to achieve a goal***
- The best news is that EF **can be taught**
- Instruction that improves EF will affect a person's ability to learn, their behavior, and their social skills.
- Improving EF will change an individual's life

9

The BIG picture

- We often use scores from a rating scale to evaluate Executive Function
- Is that Comprehensive enough?
- The scores can have a significant impact on that student's future
- We must fully understand the concept, interpretation of test scores, and instructional implications



10

Presentation Outline

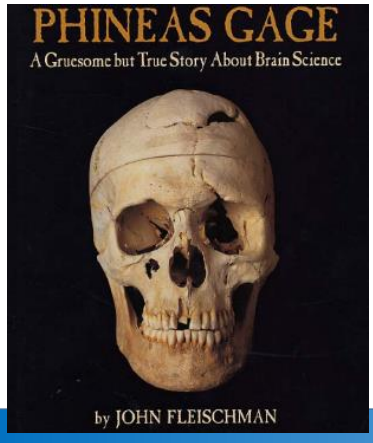
- Introduction to Executive Function (EF)
- EF Behaviors
- EF and Cognition (intelligence)
- EF and Social Emotional Skills
- EF and Academic/Job Performance
- Research about EF as ability, behavior, and SE
- Conclusions

11

Do you know any kids (or adults!) who act like this?

12

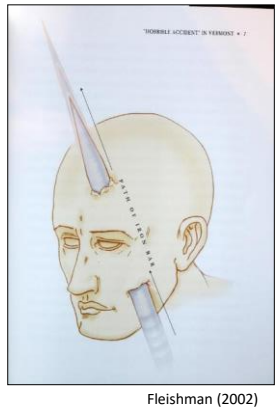
The Curious Story of Phineas Gage



- September 13, 1848 26 year old Phineas Gage was in charge of a railroad track construction crew blasting granite bedrock near Cavendish, Vermont
- The job Phineas has is to use a "tamping iron" to set explosives
- The tamping iron is a rod about 3 ½ feet long weighing 13 ½ lbs pointed at one end

Fleishman (2002, p 70)

- From Damasio (1994) article in *Science*
- The rod passed through the left frontal lobe
- The damage was to the front of the frontal cortex more than the back, and the underside more than the top
- This diminished his planning and decision making, self monitoring, self correction, especially in novel settings



Fleishman (2002)

Before . . . & . . . After

Before the accident 'he possessed a well-balanced mind, was seen as a shrewd, smart business man, very energetic and persistent in executing all his plans of operation' (p 59)

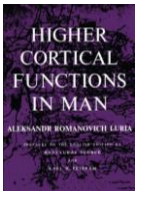
After the accident his ability to direct others was gone, he had considerable trouble with:

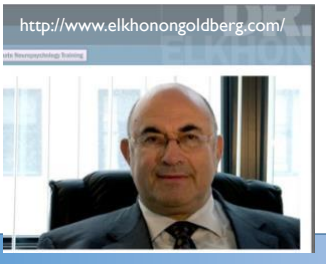
- Thinking
- Behaviors
- Work
- Social-emotional

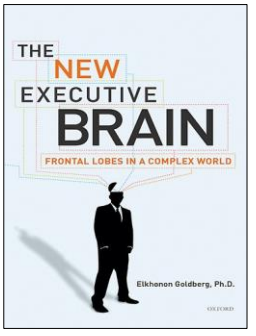
15

Executive Functions

- In 1966 Luria first wrote and defined the concept of Executive Function (EF) and described the frontal lobes as "the organ of civilization"
- Luria's student, Nick Goldberg states that the frontal lobes are about …"leadership, motivation, drive, vision, self-awareness, and awareness of others, success, creativity, sex differences, social maturity, cognitive development and learning…"







16

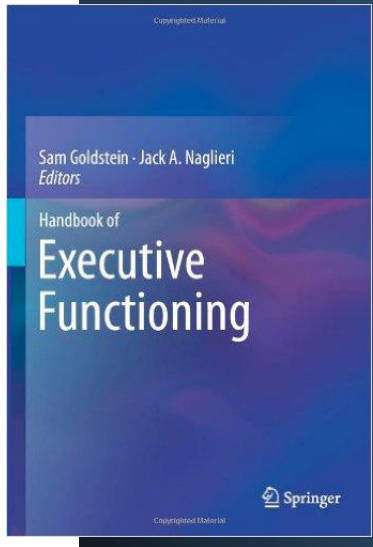
Frontal Lobes and Executive Function or is it Functions

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

17

What is Executive Function(s)

- There is no formal excepted definition of EF
- Goldstein, Naglieri, Princiotta, & Otero (2013) found more than 30 definitions of EF !
  - EF is a **unitary** construct
  - EF is a **unitary** construct with **many parts**
  - EF has **three components**: inhibitory control, set shifting (flexibility), and working memory
  - EF is a multidimensional model with many independent abilities
- **Critical Question: Is EF a unitary or multidimensional concept when measured by observable behaviors?**



18

Executive Function: The front part of the brain provides a specific way of THINKING

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19

EF is all about *how you do what you decide to do.*

This means EF is thinking about how to achieve a goal regardless of what the goal or task may be.

20

- EF in Academics
  - How to write a story, solve a math problem, evaluate the demands of any task.
- EF in SEL
  - How to decide when to say something given what you think others want.
- EF in Life
  - How to conceive and manage your short- and longer-term goals.

21

Goal of this presentation

Describe a comprehensive approach to understanding and assessing EF

Behaviors related to Cognition	Behaviors related to Social-Emotional Skills	Academic and job skills
Neurocognitive Ability is the foundation		

22

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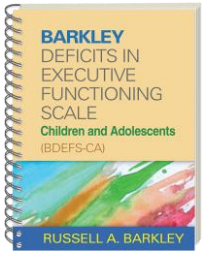
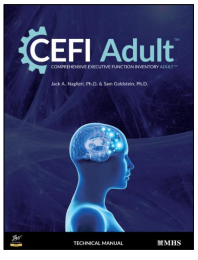
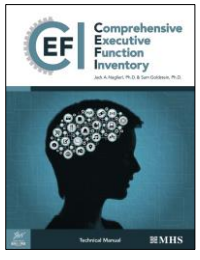
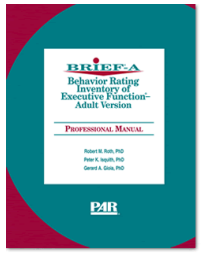
Psychometrics of EF Rating Scales

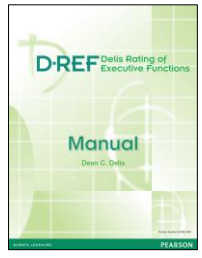
Some published rating scales







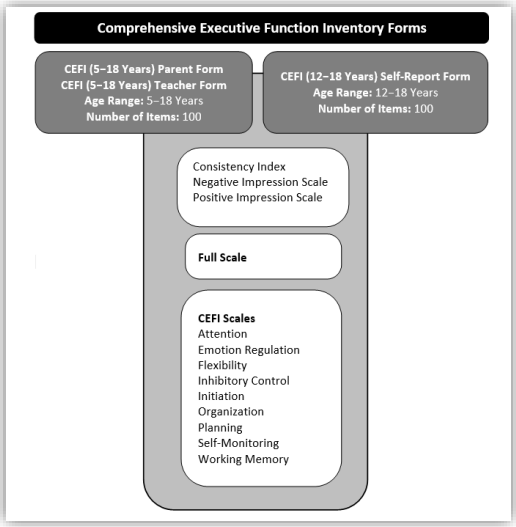


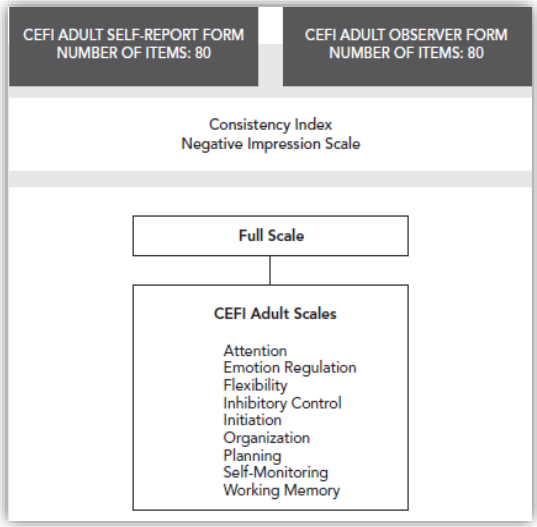


CEFI and the CEFI Adult

- **Strength based** EF measures
- Items are **positively** worded
- Higher scores = **good** behaviors related to EF
- Scores set at mean of **100**, SD of **15**
- CEFI: Ages 5-18 years rated by a parent, teacher, or the child/youth
- CEFI Adult: Ages 18+ years rated by the adult or an observer

CEFI Child & CEFI-Adult Scales



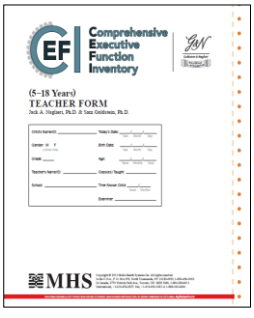


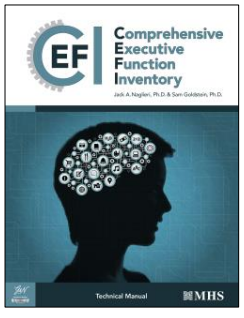
Behaviors Related to Executive Function(s)

- Given all the definitions of EF(s) we wanted to address the question…
  Executive Function***s …*** or
  Executive Function?
- One way to answer the question is to research the factor structure of EF behaviors
- Factor structure of the Comprehensive Executive Function Inventory (CEFI), and the Comprehensive Executive Function Inventory Adult (CEFI Adult)

CEFI

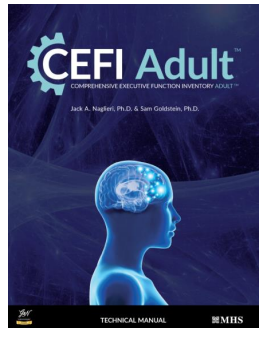
(Naglieri & Goldstein, 2012)

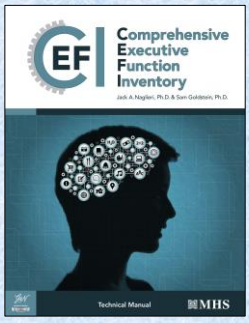




CEFI Adult

(Naglieri & Goldstein, 2017)





CEFI Factor Analysis

Item Level Analysis

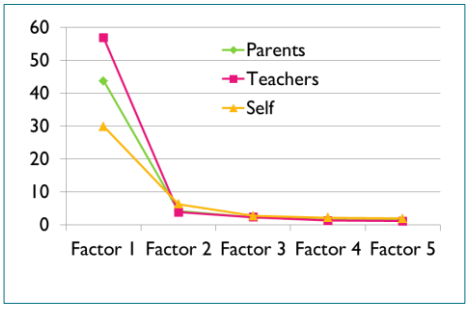
- For the ***first half*** of the normative sample (Parent, Teacher and Self ratings') **item scores** (90 items) used in factor analysis

Scale Level Analysis

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

CEFI Factor Analysis

Item Factor Analyses

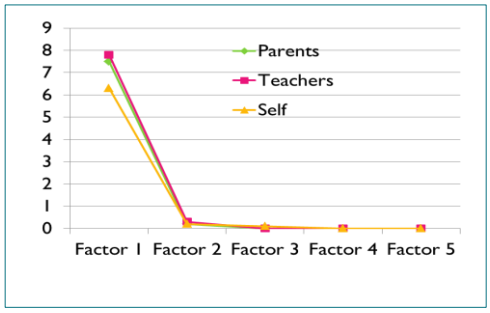


Eigenvalues from the Inter-Item Correlations

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 Axis Factoring. Only the first 10 eigenvalues are presented.

Scale Factor Analyses



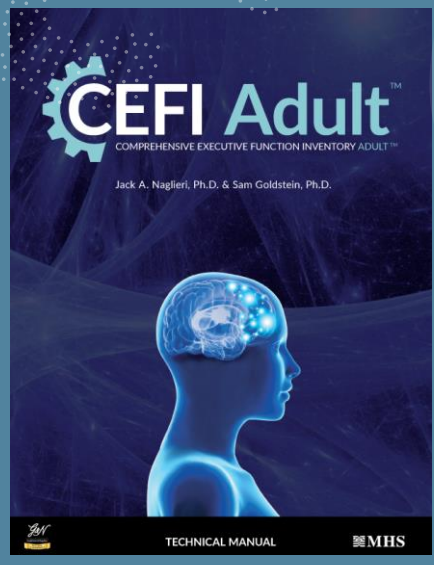
Eigenvalues of the CEFI Scales Correlations

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: Principal Axis Factoring.

Factor Analysis of the CEFI Adult

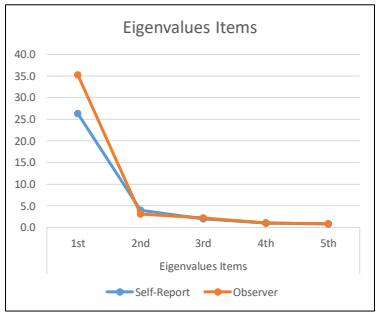
- Same scale structure as CEFI
- Full Scale
  - Attention
  - Emotion Regulation
  - Flexibility
  - Inhibitory Control
  - Initiation
  - Organization
  - Planning
  - Self-Monitoring
  - Working Memory



31

CEFI Adult Self (N = 1,600) & Observer (N = 1,600)

Item Factor Analyses

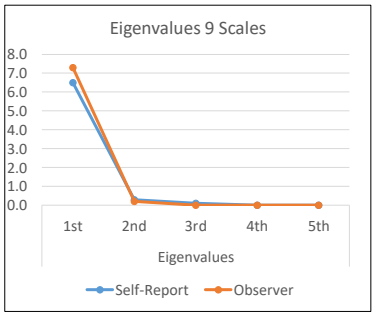


Eigenvalues from the Inter-Item Correlations

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.

Scale Factor Analyses



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.

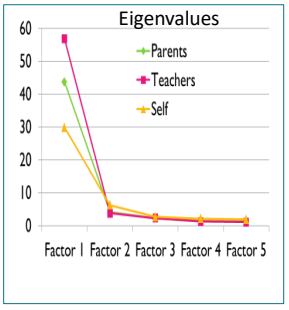
32

CEFI Parent (N=1,400), Teacher (N=1,400) and Self (N=700)

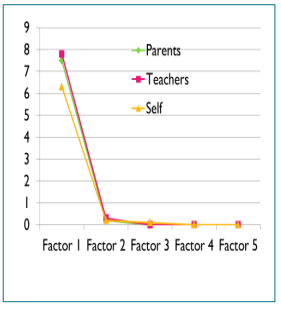
CEFI Adult Self (N = 1,600) & Observer (N = 1,600)

- Factor analytic studies using the CEFI and CEFI-Adult nationally representative standardization samples (N = 6,700)

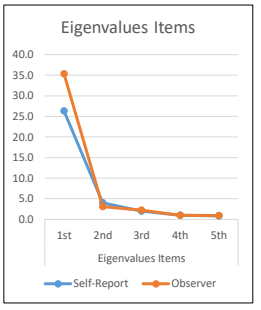
Item Factor Analyses



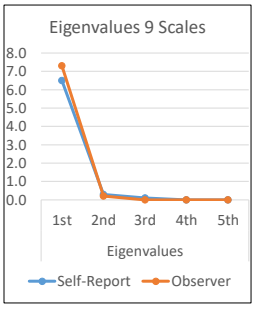
Scale Factor Analyses



Item Factor Analyses



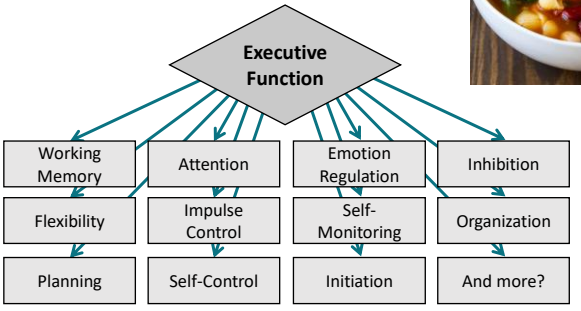
Scale Factor Analyses



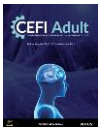
33

Executive Function or Functions

- Factor analyses also conducted by gender, race, ethnicity, clinical vs nonclinical status – same findings
- This means EF behaviors are best seen as **one construct**
- ***"How* you do what *you* decide to do"**



CEFI (Naglieri & Goldstein, 2012)



CEFI Adult (Naglieri & Goldstein, 2017)

34

Executive Function Involves

"How you do what *you* decide to do" demands…

- **Initiation** to achieve a goal, **planning** and **organizing** parts of a task, **attending** to details to notice success of the solution, keeping information in **memory**, having **flexibility** to modify the solution as information from **self-monitoring** is received and demonstrating **emotion regulation** (which also demands **inhibitory control**) to ensure clear thinking so that the task is completed successfully.

35

One Factor and 9 Scales?

- EF is a unidimensional concept
- Use the Full Scale to answer the question "Is the individual poor in EF or not?"
- Use the 9 scales to identify the specific groups of items that represent 9 different types of behaviors that can be addressed by Intervention

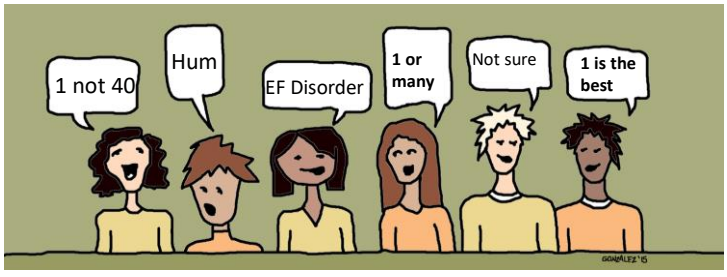
CEFI Scales	CEFI Adult Scales
Attention	Attention
Emotion Regulation	Emotion Regulation
Flexibility	Flexibility
Inhibitory Control	Inhibitory Control
Initiation	Initiation
Organization	Organization
Planning	Planning
Self-Monitoring	Self-Monitoring
Working Memory	Working Memory

36

Conclusion: EF is a unitary concept

Core Group Discussion → Deeper Learning

- **DISCUSS – What implications does the data which suggest EF is ONE DIMENSION have?**



If Executive Function Requires Thinking, is it a Skill ?

EF= Thinking About How to do What You Decide to do?

39

Executive Function and Skills

- What does the term SKILLS refer to?
  - A well practiced activity that can be executed automatically and with ease
    - This means there is fluency and little thinking involved
- What does the term Executive Function refer to?
  - Thinking About How You Do What You Decide To Do
    - Therefore EF can NOT be described as a skill

40

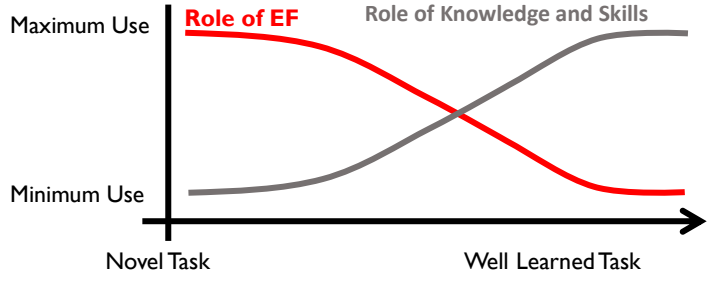
EF's Learning Curves
(Goldberg, 2009; Naglieri & Otero, 2017)

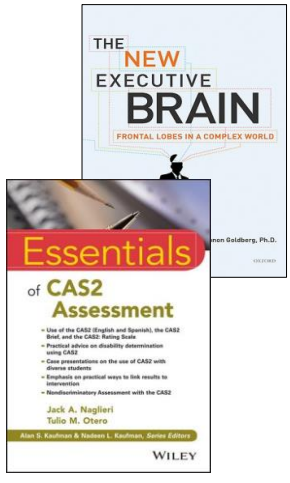
- Because MAKING DECISIONS about how to do what you decide to do is particularly demanded in novel situations, we need to fully engage our frontal lobes (EF) to be successful in our world today.

41

EF's Learning Curves (Naglieri & Otero, 2017)

- Learning depends upon instruction and EF
- At first, EF plays a major role in learning (see Goldberg, 2009, p. 90)
- When a new task is learned and practiced it becomes a skill and execution requires less EF (see Naglieri & Otero, 2017, p. 117)



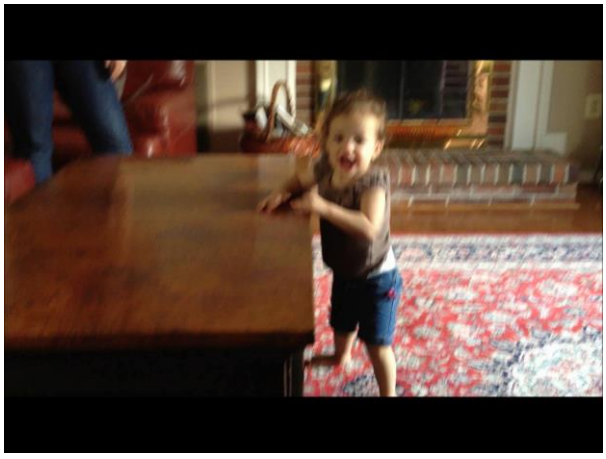


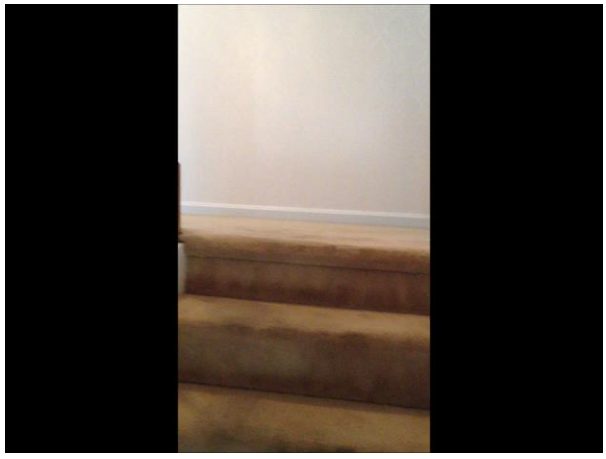
Over time and with experience

42

A 13 month old's Plan

At 19 months Planning & Knowledge

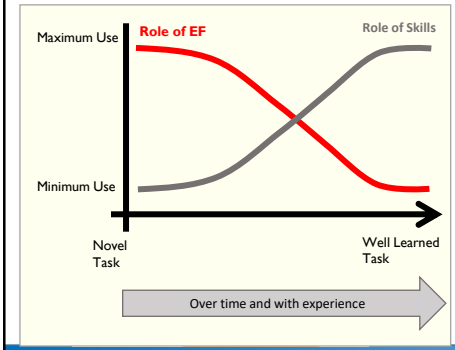


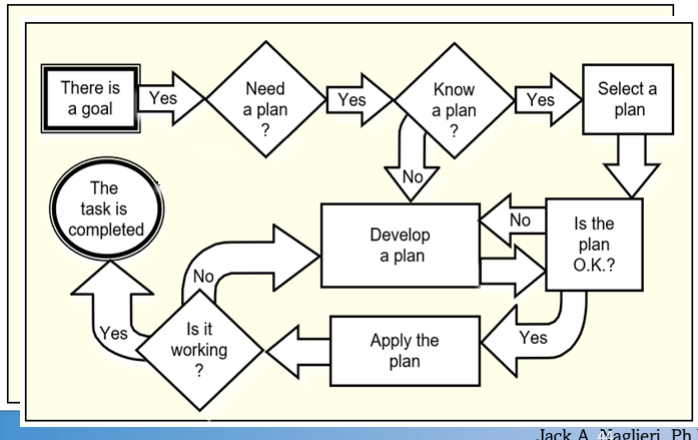


A Deeper View of Executive Function

EF STRATEGY: Graphic Organizers help us make sense of big ideas.

***How* you do what *you* decide to do** which demands…Especially in NOVEL situations





Encourage Students to use EF to Self Regulate

- Self Regulation enables children to engage in mindful, intentional and thoughtful behaviors.
- ***Self-Regulation is a KEY to success.***

When children are constantly regulated by adults, they may appear to be self-regulated, but they are actually "teacher regulated."

Don't Be the Child's Pre-Frontal Cortex!

Don't Commit Assumicide

- **Assuming that someone has taught students to use EF in the classroom**
- **Teaching students *how* to think is as important as teaching them *what* to learn.**

Coping with COVID Pandemic and Trauma

- Our world changed dramatically when COVID hit
- We had to figure out HOW to do just about everything
- The cognitive demands of COVID make life much harder
- This means EF is more important now than ever

49

Planning (EF) and Skills

- Given that Planning (EF) demands intentionality, that means that planning processing is something that occurs over time and with effort.
- Skills are things we do with very little thinking. Automatic actions do not afford the time for thinking (planning) but rather immediate responding.
- Therefore, Planning and EF should not be described as 'skills'
- Your thoughts?

What do YOU think ?

50

TIME TO STRETCH

51

Presentation Outline

- Introduction to Executive Function (EF)
- EF Behaviors
- EF and Cognition (intelligence)
- EF and Social Emotional Skills
- EF and Academic/Job Performance
- Research about EF as ability, behavior, and SE
- Conclusions

52

Given the importance of EF, should we measure EF when we give an intelligence test?

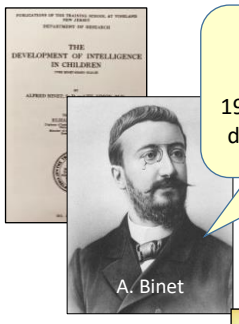
What do our intelligence tests measure?

Traditional IQ and Achievement Tests

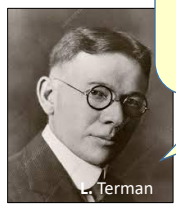
- When I started working as a school psychologist in 1975…I had concerns
  - Why did the WISC have Verbal and Performance (?) subtests?
  - What exactly did the scores mean?
  - Was the Stanford-Binet really different from the WISC?
  - Was there a theory behind the WISC and Binet that could guide my interpretation of the scores?

1975 Charles Champagne Elementary, Bethpage, NY

Stanford-Binet → Army Mental Tests → Today

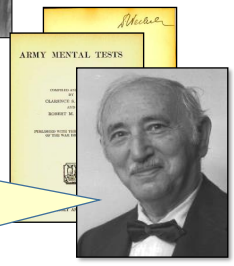


When working on the 1911 scale, Binet removed items from 1908 scale because 'they depended too much on school learning'



Terman added items dependent upon school learning into the 1916 Stanford-Binet because he believed 'intelligence at the verbal and abstract levels is the highest form of mental ability'.

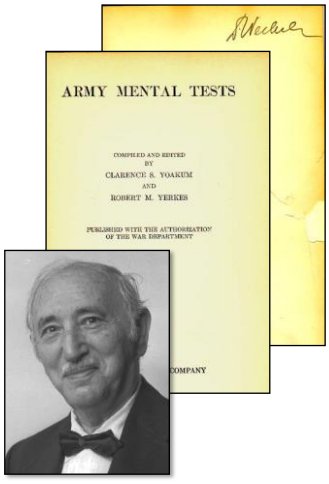
Arthur Otis (Terman's student) was instrumental in the development of the U.S. Army Alpha (Verbal & Quantitative) and Beta (Nonverbal), the Otis-Lennon Ability Test and known for the multiple-choice format



Wechsler based his intelligence test on the U.S. Army Mental Tests (Verbal, Quantitative & Nonverbal)

55

Alpha & Beta → Wechsler



- **Army Alpha**
  - Synonym- Antonym
  - Disarranged Sentences
  - Number Series
  - Arithmetic Problems
  - Analogies
  - Information

- **Army Beta**
  - Maze
  - Cube Imitation
  - Cube Construction
  - Digit Symbol
  - Pictorial Completion
  - Geometrical Construction

Verbal & Quantitative IQ (Knowledge)

Nonverbal IQ (Thinking)

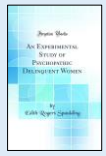
WISC, WJ CogAT & Otis-Lennon

56

IQ Tests Defined Intelligence

Edwin Boring: The Stanford-Binet became the **operational definition of intelligence**

Edith Spaulding & William Healy



The claim that we have measured hereditary intelligence has **no scientific foundation**

INHERITANCE AS A FACTOR IN CRIMINALITY.

A STUDY OF A THOUSAND CASES OF YOUNG REPEATED OFFENDERS.[1]

EDITH R. SPAULDING[2] AND WILLIAM HEALY.[3]

Inheritance as a factor in criminality may be considered under two heads: (a) the direct inheritance of criminalistic traits in otherwise normal individuals; (b) the indirect inheritance of criminalistic tendencies through such heritable factors as epilepsy, insanity, feeble-mindedness, etc. The first should include only those cases in which the traits themselves are primarily criminalistic, while the second comprises those in which certain inherited qualities of body or mind, not anti-social in themselves, produce criminals when ill proportioned to other characteristics in the same individual, or ill adjusted to environment. Thus a feeble-minded individual may show no delinquent tendencies if sufficiently protected, but placed on his own resources in society, he soon finds his way to the police court.

In the thousand cases which have been reviewed, we have carefully sought for evidence of direct inheritance of criminalistic traits, as such. However, in no one case of the thousand have we been able to discover evidence of anti-social tendencies in succeeding generations without also finding underlying trouble of a physical or mental nature, or such striking environmental faults or mal-adjustments as often develop delinquency in the absence of defective inheritance. In order to prove the existence of the first class, we feel it absolutely essential to rule out other well-known causative factors in each case.

Family charts alone, without detailed environmental and developmental history, are not sufficient proof of inherited criminalism, no matter how many criminal histories they may contain. Studying the history of criminalistic tendencies, which themselves may arise through any of a large number of possible biologic, mental or social factors, is

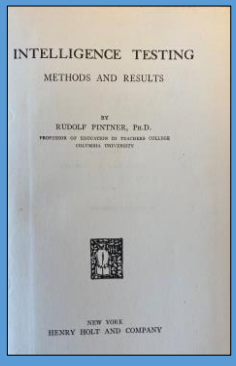
[1]Read before the American Academy of Medicine at its thirty-eighth annual meeting, Minneapolis, June 18, 1913. Published here and in the Bulletin of the American Academy of Medicine simultaneously, by courtesy of the Bulletin.

We cannot measure intelligence *when we have never defined it.*

Brookwood, M. (2021). The Orphans of Davenport. New York: Norton & Company. See Chapter 4.

57

General Ability Defined by Pintner (1923)



INTELLIGENCE TESTING

METHODS AND RESULTS

BY

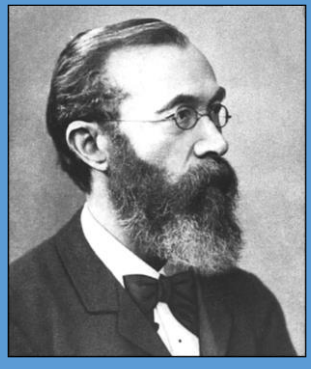
RUDOLF PINTNER, Ph.D.

PROFESSOR OF EDUCATION IN TEACHERS COLLEGE

COLUMBIA UNIVERSITY

NEW YORK

HENRY HOLT AND COMPANY



- "we did not start with a clear definition of general intelligence… [but] borrowed from every-day life a vague term implying all-round ability and… we [are] still attempting to define it more sharply and endow it with a stricter scientific connotation" (p. 53, Pintner, 1923)".

58

Journal Information
Journal TOC

PsycARTICLES: Journal Article

Structural validity of the Wechsler Intelligence Scale for Children–Fifth Edition: Confirmatory factor analyses with the 16 primary and secondary subtests.

© Request Permissions

Canivez, Gary L.,Watkins, Marley W.,Dombrowski, Stefan C.
Canivez, G. L., Watkins, M. W., & Dombrowski, S. C. (2017). Structural validity of the Wechsler Intelligence Scale for Children–Fifth Edition: Confirmatory factor analyses with the 16 primary and secondary subtests. *Psychological Assessment, 29*(4), 458–472.
https://doi.org/10.1037/pas0000358

Support for 'g'

- …The small portions of variance uniquely captured by [WISC-V subtests]… render the group factors [scales]of questionable interpretive value independent of g (FSIQ general intelligence)
- Present CFA results confirm the EFA results (Canivez, Watkins, & Dombrowski, 2015); Dombrowski, Canivez, Watkins, & Beaujean (2015); and Canivez, Dombrowski, & Watkins (2015).

Revisiting Carroll's Survey of Factor-Analytic Studies: Implications for the Clinical Assessment of Intelligence

Nicholas F. Benson and A. Alexander Beaujean
Baylor University

Ryan J. McGill
College of William & Mary

Stefan C. Dombrowski
Rider University

- **The results of this study indicate that most cognitive abilities specified in** John Carroll's **three-stratum theory have little-to-no interpretive relevance above and beyond that of general intelligence.**

59

Factor Analytic Models of Intelligence

- CHC is a statistical model that is not consistent with brain functioning *(i.e.* ***modularity vs. gradiental)***
- It fails to account for the frontal lobes *(i.e. executive functions)*,
- Assumes 69 specific narrow abilities!
- Can lead to "over-testing" of students.
- Does not always intuitively correlate with academic performance and therefore can be problematic in generating interventions

(i.e. The cluster score for reading on WJIV includes number-pattern matching?)

Cattell-Horn-Carroll's three stratum

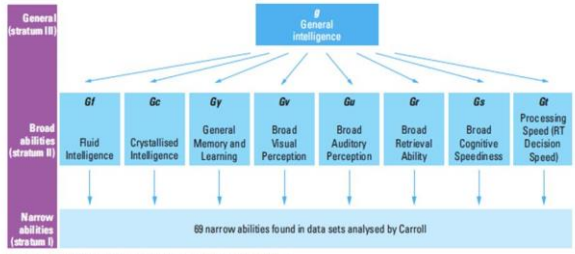


Figure 11.14 Carroll's three-stratum theory of cognitive abilities

60

A case for only ”g”

Watkins, M. W., & Canivez, G. L. (2021). Assessing the psychometric utility of IQ scores: A tutorial using the Wechsler intelligence scale for children–fifth edition. *School Psychology Review*, 1-15.

Dombrowski, S. C., Watkins, M. W., McGill, R. J., Canivez, G. L., Holingue, C., Pritchard, A. E., & Jacobson, L. A. (2021). Measurement Invariance of the Wechsler Intelligence Scale for Children, 10-Subtest Primary Battery: Can Index Scores be Compared across Age, Sex, and Diagnostic Groups?. *Journal of Psychoeducational Assessment*, *39*(1), 89-99.

Watkins, M. W., Canivez, G. L., Dombrowski, S. C., McGill, R. J., Pritchard, A. E., Holingue, C. B., & Jacobson, L. A. (2021). Long-term stability of Wechsler Intelligence Scale for Children–fifth edition scores in a clinical sample. *Applied Neuropsychology: Child*, 1-7.

61

Research Supports ‘g’ but little More

Watkins, M. W., & Canivez, G. L. (2021). Assessing the psychometric utility of IQ scores: A tutorial using the Wechsler intelligence scale for children–fifth edition. School Psychology Review, 1-15.

Benson, N. F., Beaujean, A. A., McGill, R. J, & Dombrowski, S. C. (2018). Revisiting **Carroll’s Survey of Factor-Analytic Studies**: Implications for the Clinical Assessment of Intelligence. *Psychological Assessment,* 30, 8, 1028–1038.

Canivez, G. L., Watkins, M. W., & Dombrowski, S. C. (2017). Structural validity of the **Wechsler Intelligence Scale for Children–Fifth Edition:** Confirmatory factor analyses with the 16 primary and secondary subtests. *Psychological Assessment, 29,* 458-472.

Canivez, G. L., & McGill, R. J. (2016). Factor structure of the **Differential Ability Scales–Second Edition**: Exploratory and hierarchical factor analyses with the core subtests. *Psychological Assessment, 28,* 1475-1488. http://dx.doi.org/10.1037/pas0000279

Canivez, G. L., & McGill, R. J. (2016). Factor structure of the **Differential Ability Scales-Second Edition**: Exploratory and hierarchical factor analyses with the core subtests. Psychological Assessment, 28, 1475–1488. https://doi.org/10.1037/pas0000279

Canivez, G. L. (2008). Orthogonal higher order factor structure of the **Stanford-Binet Intelligence Scales-Fifth Edition** for children and adolescents. School Psychology Quarterly, 23, 533–541.

Dombrowski, S. C., **Canivez, G. L.,** & Watkins, M. W. (2017, May). Factor structure of the 10 **WISC–V** primary subtests across four standardization age groups. *Contemporary School Psychology.* Advance online publication.

Dombrowski, S. C., McGill, R. J., & Canivez, G. L. (2017). Exploratory and hierarchical factor analysis of the **WJ IV Cognitive** at school age. *Psychological Assessment, 29,* 394-407.

McGill, R. J., & **Canivez, G. L.** (2017, October). Confirmatory factor analyses of the **WISC–IV Spanish** core and supplemental Subtests: Validation evidence of the Wechsler and CHC models. *International Journal of School and Educational Psychology*. Advance online publication.

Watkins, M. W., Dombrowski, S. C., & **Canivez, G. L.** (2017, October). Reliability and factorial validity of the **Canadian Wechsler Intelligence Scale for Children–Fifth Edition**. *International Journal of School and Educational Psychology*.

62

School Psychology Quarterly
2011, Vol. 26, No. 4, 305–317

1045-3830/11/$12.00 DOI: 10.1037/a0025973

Hierarchical Factor Structure of the Cognitive Assessment System: Variance Partitions From the Schmid–Leiman (1957) Procedure

Gary L. Canivez
Eastern Illinois University

Orthogonal higher-order factor structure of the Cognitive Assessment System (CAS; Naglieri & Das, 1997a) for the 5–7 and 8–17 age groups in the CAS standardization sample is reported. Following the same procedure as recent studies of other prominent intelligence tests (Dombrowski, Watkins, & Brogan, 2009; Canivez, 2008; Canivez & Watkins, 2010a, 2010b; Nelson & Canivez, 2011; Nelson, Canivez, Lindstrom, & Hatt, 2007; Watkins, 2006; Watkins, Wilson, Kotz, Carbone, & Babula, 2006), three- and four-factor CAS exploratory factor extractions were analyzed with the Schmid and Leiman (1957) procedure using MacOrtho (Watkins, 2004) to assess the hierarchical factor structure by sequentially partitioning variance to the second- and first- order dimensions as recommended by Carroll (1993, 1995). Results showed that greater portions of total and common variance were accounted for by the second-order, global factor, but compared to other tests of intelligence CAS subtests measured less second-order variance and greater first-order Planning, Attention, Simultaneous, and Successive (PASS) factor variance.

Keywords: CAS, construct validity, hierarchical exploratory factor analysis, Schmid–Leiman higher-order analysis, structural validity

Support for INTERPRETATION OF THE FOUR PASS Scales

- "…compared to the WISC–IV, WAIS–IV, SB–5, RIAS, WASI, and WRIT, the CAS subtests had less variance apportioned to the higher-order general factor (g) and *greater proportions of variance apportioned to first-order (PASS…) factors*.
- This is consistent with the subtest selection and construction in an attempt to measure PASS dimensions linked to PASS theory … and neuropsychological theory (Luria)." (p. 311)

63

63

Papadopoulos, et al., 2023

Unravelling the Multifaceted Nature of Intelligence: A Correlated Factor Model Approach with Insights from the PASS Theory

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Cyprus
papadopoulos.timothy@ucy.ac.cy

George Spanoudis
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Jack A. Naglieri
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University of Alberta, Edmonton, AB, Canada
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- Our results unambiguously support the notion that intelligence is not a unidimensional entity but a composite of distinct cognitive processes…which posits separate cognitive domains for Planning, Attention, Simultaneous and Successive processing… [these] emerged as the most fitting representation of intelligence [and] the best fit to the data.
- This outcome reinforces the notion that intelligence is a multifaceted construct, with various cognitive abilities working in concert, corroborating previous findings (e.g., Das & Kirby, 2022; Naglieri, 2015; Papadopoulos et al., 2018).

64

Intelligence as Neurocognitive Functions

- In my first working meeting with JP Das (February 11, 1984) we proposed that intelligence was better REinvented as neurocognitive processes andwe began development of the **C**ognitive **A**ssessment **S**ystem (N

➢ We conceptualized intelligence as Planning, Attention, Simultaneous, and Successive (PASS) neurocognitive processes based on Luria's concepts of brain function.

65

65

Neuropsychological *Conceptualization* of EF

- If a person's frontal lobes are impaired that person would likely get low scores on:
  1. Behaviors related to Executive Function
  2. Performance measures Executive Function
  3. Rating scales of social emotional behaviors
  4. Academic tasks that require HOW to do things
- If a person has problems in all of the above except cognitive processes related to EF, the cause is likely an environmental issue

66

PASS Theory

- The PASS Theory is operationalized using the CAS and CAS2
- This is the only test of its kind that was explicitly developed according to a THEORY of ability (intelligence)
- The theory is based on neuropsychology and cognitive psychology so we use the term "neurocognitive"
- The section that follows provides an explanation of each of these basic psychological processes, an example of how the neurocognitive process is measured and case studies

67

We Operationalized the CAS2 To Measure Thinking (PASS) not Knowing

What does the examinee have to **know** to complete a task?

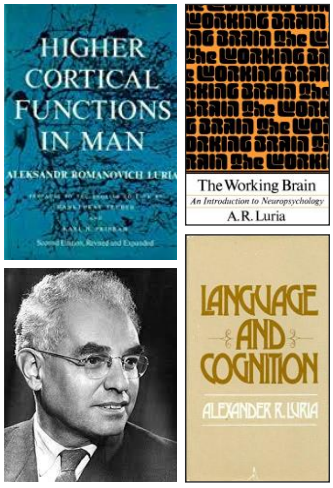
- This is dependent on *instruction*

How does the examinee have to **think** to complete a task?

- This is dependent on the *brain – 'basic psychological processes'*
- Some thinking involves executive function and some does not

68

PASS Neurocognitive Theory



- **P**lanning = THINKING ABOUT HOW YOU DO WHAT YOU DECIDE TO DO
- **A**ttention = BEING ALERT AND RESISTING DISTRACTIONS
- **S**imultaneous = THINKING USED TO SEE HOW THINGS ARE RELATED (THE BIG PICTURE)
- **S**uccessive = THINKING THAT IS USED TO MANAGE A SEQUENCE

PASS = 'basic psychological processes'

NOTE: Easy to understand concepts!

69

EF is a Brain-Based Ability

- If we define intelligence from a neurocognitive perspective
- EF is an ability (type of intelligence) by virtue of its relationship to the brain
- But EF is not measured by traditional IQ tests
- EF can be measured on the CAS2

70

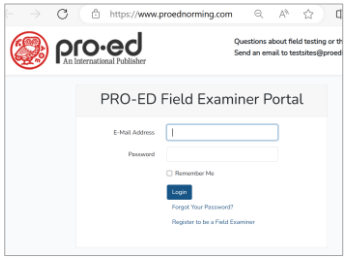
PASS Comprehensive System

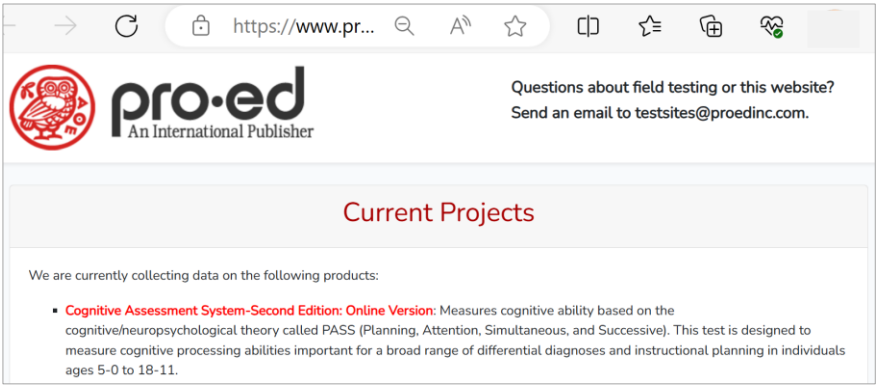
(Naglieri, Das, & Goldstein, 2014)

CAS2 Online Norming Study

www.proednorming.com

Field Examiner Portal (proednorming.com)

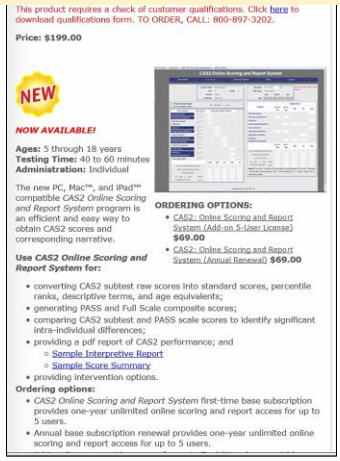




CAS2 Online Score & Report

http://www.proedinc.com/customer/ProductView.aspx?ID=7277

- Enter data at the subtest level or enter subtest raw scores
- Online program converts raw scores to standard scores, percentiles, etc. for all scales.
- A narrative report with graphs and scores is provided



This product requires a check of customer qualifications. Click here to download qualifications form. TO ORDER, CALL: 800-897-3202.

Price: $199.00

NEW

NOW AVAILABLE!

Ages: 5 through 18 years
Testing Time: 40 to 60 minutes
Administration: Individual

The new PC, Mac™, and iPad™ compatible *CAS2 Online Scoring and Report System* program is an efficient and easy way to obtain CAS2 scores and corresponding narrative.

ORDERING OPTIONS:

- CAS2: Online Scoring and Report System (Add-on 5-User License) **$69.00**
- CAS2: Online Scoring and Report System (Annual Renewal) **$69.00**

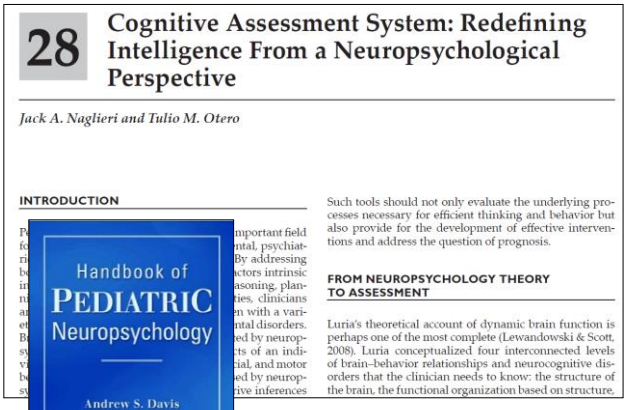
Use CAS2 Online Scoring and Report System for:

- converting CAS2 subtest raw scores into standard scores, percentile ranks, descriptive terms, and age equivalents;
- generating PASS and Full Scale composite scores;
- comparing CAS2 subtest and PASS scale scores to identify significant intra-individual differences;
- providing a pdf report of CAS2 performance; and
  - Sample Interpretive Report
  - Sample Score Summary
- providing intervention options.

Ordering options:

- *CAS2 Online Scoring and Report System* first-time base subscription provides one-year unlimited online scoring and report access for up to 5 users.
- Annual base subscription renewal provides one-year unlimited online scoring and report access for up to 5 users.

PASS Neurocognitive Theory of Intelligence



28

Cognitive Assessment System: Redefining Intelligence From a Neuropsychological Perspective

Jack A. Naglieri and Tulio M. Otero

INTRODUCTION

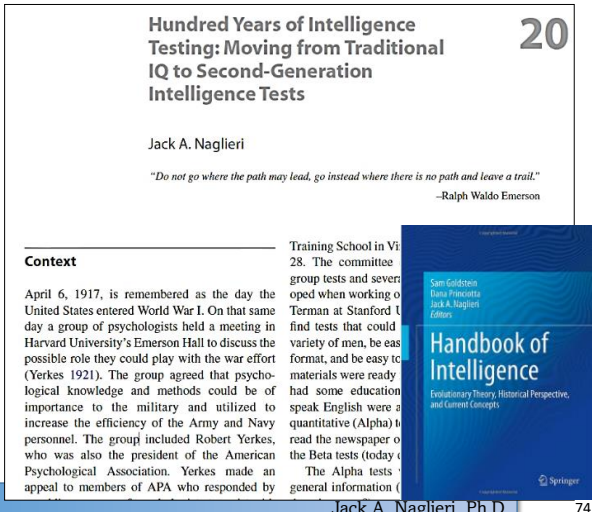
Such tools should not only evaluate the underlying processes necessary for efficient thinking and behavior but also provide for the development of effective interventions and address the question of prognosis.

FROM NEUROPSYCHOLOGY THEORY TO ASSESSMENT

Luria's theoretical account of dynamic brain function is perhaps one of the most complete (Lewandowski & Scott, 2008). Luria conceptualized four interconnected levels of brain–behavior relationships and neurocognitive disorders that the clinician needs to know: the structure of the brain, the functional organization based on structure,

Handbook of PEDIATRIC Neuropsychology

Andrew S. Davis
Editor



20

Hundred Years of Intelligence Testing: Moving from Traditional IQ to Second-Generation Intelligence Tests

Jack A. Naglieri

"Do not go where the path may lead, go instead where there is no path and leave a trail."
–Ralph Waldo Emerson

Context

April 6, 1917, is remembered as the day the United States entered World War I. On that same day a group of psychologists held a meeting in Harvard University's Emerson Hall to discuss the possible role they could play with the war effort (Yerkes 1921). The group agreed that psychological knowledge and methods could be of importance to the military and utilized to increase the efficiency of the Army and Navy personnel. The group included Robert Yerkes, who was also the president of the American Psychological Association. Yerkes made an appeal to members of APA who responded by

Training School in Vi
28. The committee
group tests and sever
oped when working o
Terman at Stanford U
find tests that could
variety of men, be eas
format, and be easy to
materials were ready
had some education
speak English were a
quantitative (Alpha) t
read the newspaper o
the Beta tests (today
The Alpha tests
general information

Sam Goldstein
Dana Princiotta
Jack A. Naglieri
Editors

Handbook of Intelligence

Evolutionary Theory, Historical Perspective, and Current Concepts

Springer

PASS Theory Based on Luria's Concept of Functional Units

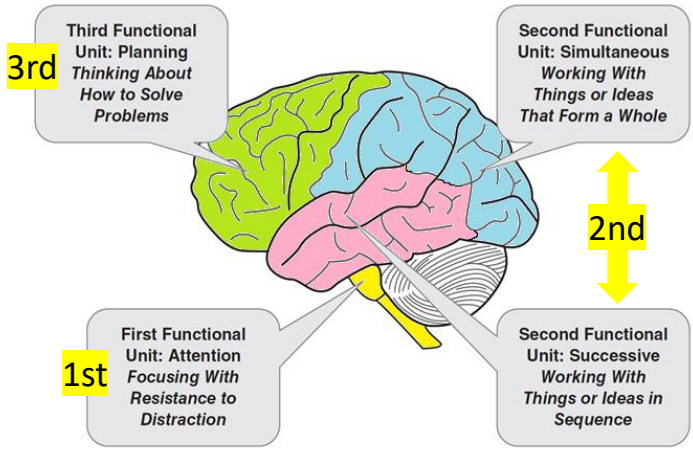


Figure 1.2 Three Functional Units and Associated Brain Structures

From: *Essentials of CAS2 Assessment*. Naglieri & Otero, 2017

Time for Questions and Answers

PASS Theory of Intelligence: Planning

Planning is a neurocognitive ability that a person uses to determine, select, and use efficient solutions to problems

- problem solving
- developing plans and using strategies
- retrieval of knowledge
- impulse control and self-control
- control of processing

77

Planning Subtests

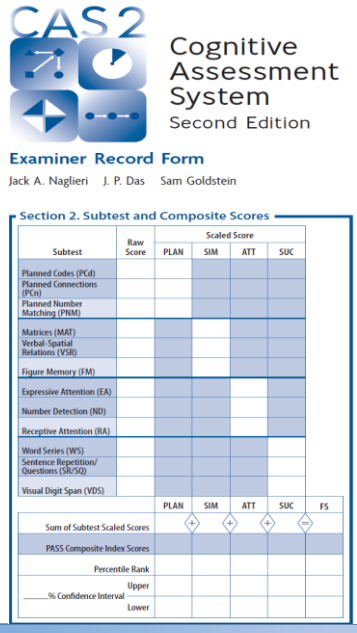
Planned Codes

Planned Connections

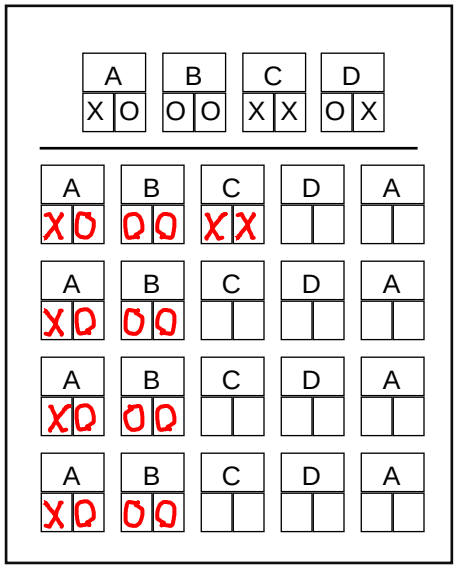
1 4 2 3

Planned Number Matching

5176	5761	5167	1576	5176	1567



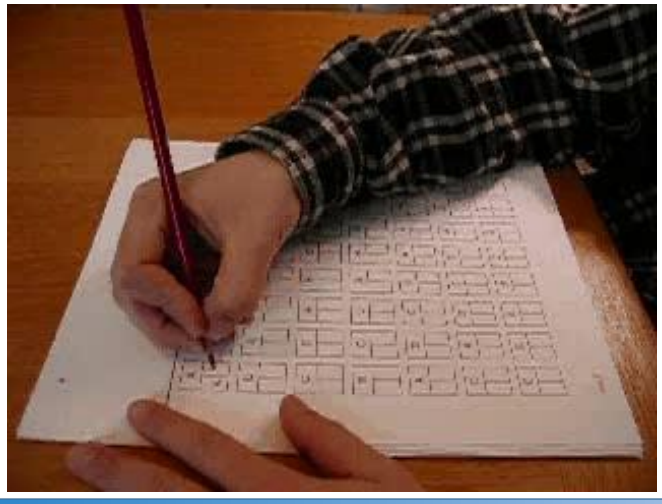
78



Planned Codes Page 1

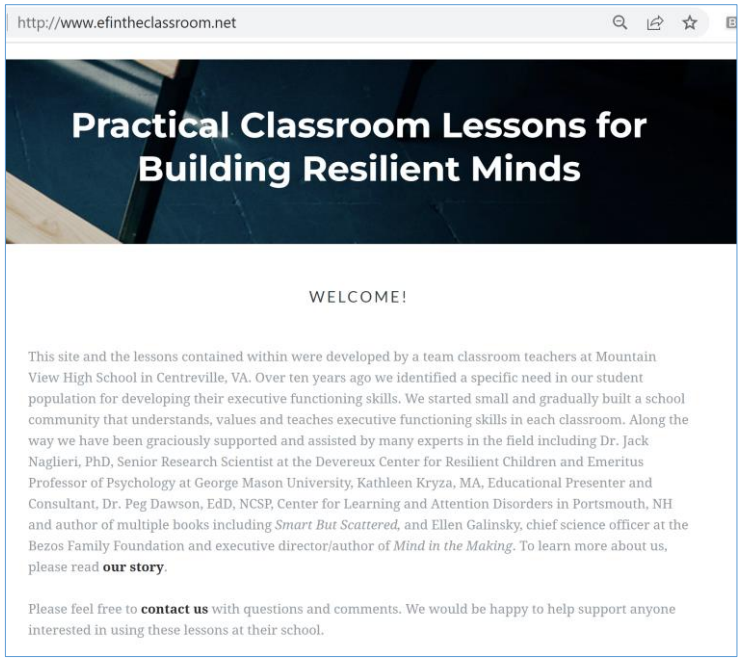
- Jack Jr. at age 5
- Child fills in the codes in the empty boxes
- After being told the test requirement, examinees are told: “You can do it any way you want”

Planned Codes Page 2 Jack Jr age 10



All Lessons Available for Free at

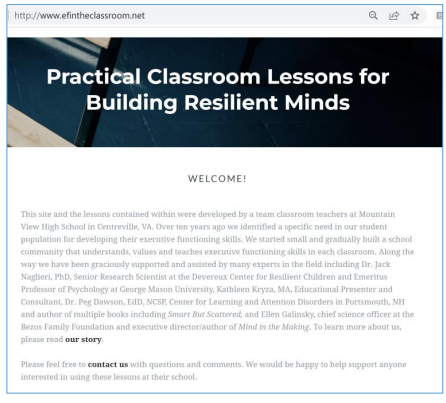
www.efintheclassroom.net



81

www.efintheclassroom.net Interventions for EF Behaviors

CEFI Scales	Efintheclassroom.net
Attention	Sustained Attention
Emotion Regulation	Emotional Control
Flexibility	Cognitive Flexibility
Inhibitory Control	Response Inhibition
Initiation	Task Initiation
Organization	Organization
Planning	Planning
Self-Monitoring	Response Inhibition
Working Memory	Working Memory



82

Antwerp train Station (2009)

Planning Lesson Student Responses

Q 1: What would you have to plan out?

- They had to learn the dance steps (knowledge)
- Someone had to start dancing (initiation)

Q2: What are the parts of a good plan?

- Think of possible problems (strategy generation)
- Organize the dance (organization)

Planning Lesson Student Responses

Q3: How do you know if a plan is any good?

- Put the plan in action and see if it works (self-monitoring)
- Give it a try (perhaps learn by failing)

Q4: What should you do if a plan isn't working?

1. Fix it. (self-correction)
2. Go home! (a bad plan)

Planning Lesson Student Responses

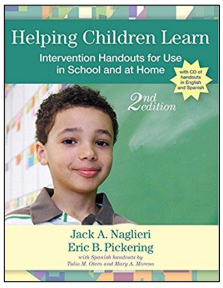
Q5: How do you use planning in this class?

1. We don't plan in this class
2. Mrs. X does all the planning in this class so you don't have to think about planning

To encourage EF we have to stress thinking about *how to do what **you** chose to do*

Encourage Planning

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



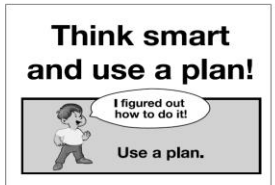
Step 1 – Talk with Students

How Can You Be Smarter?

You can be smarter if you PLAN before doing things. Sometimes people say, "Look before you leap," "Plan your work and work your plan," or "Stop and think." These sayings are about using the ability to plan. When you stop and think about *how* to study, you are using your ability to plan.

You will be able to do more if you remember to use a plan. An easy way to remember to use a plan is to look at the picture "Think smart and use a plan!" (Figure 1). You should always use a plan for reading, vocabulary, spelling, writing, math problem solving, and science.

Do you have a favorite plan for learning spelling words? Do you use flashcards or go on the Internet to learn? Do you ask the teacher or another student for help? You can learn more by using a plan for studying that works best for you.



It is smart to have a plan for doing all schoolwork. When you read, you should have a plan. One plan is to look at the questions you have to answer about the story first. Then read the story to find the answers. Another plan is to make a picture of what you read so that you can see all the parts of the story. When you write you should also have a plan. Students who are good at writing plan and organize their thoughts first. Then they think about what they are doing as they write. Using a plan is a good way to be smarter about your work!

Planning Facilitation for Math Calculation

Math calculation is a complex activity that involves recalling basic math facts, fol
dures, working carefully, and checking one's work. Math calculation requires a c
approach to follow all of the necessary steps. Children who are good at math ca
move on to more difficult math concepts and problem solving with greater ease
are having problems in this area. For children who have trouble with math calcul
that helps them approach the task planfully is likely to be useful. Planning facilita
technique.

Planning facilitation helps students develop useful strategies to carefully comple
through discussion and shared discovery. It encourages students to think about
problems, rather than just think about whether their answers are correct. This he
careful ways of doing math.

How to Teach Planning Facilitation

Planning facilitation is provided in three 10-minute time periods: 1) 10 minutes o
utes of discussion, and 3) 10 more minutes of math. These steps can be descrit

Step 1: The teacher should provide math worksheets for the students to comple
10-minute session. This gives the children exposure to the problems and ways t
teacher gives each child a worksheet and says, "Here is a math worksheet for y
try to get as many of the problems correct as you can. You will have 10 minutes
on this instruction are okay, but do not give any additional information.

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SAGE

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

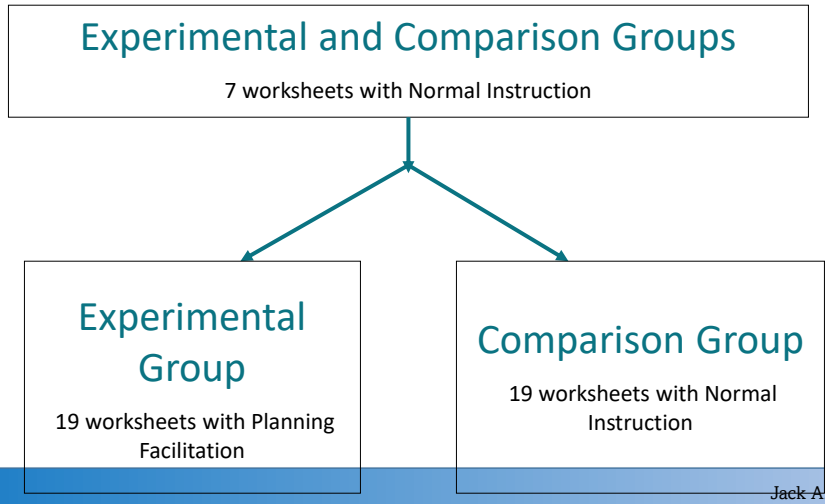
Jackie S. Iseman[1] and Jack A. Naglieri[1]

Abstract

The authors examined the effectiveness of cognitive strategy instruction based on PASS (Planning, Attention, Simultaneous, Successive) given by special education teachers to students with ADHD randomly assigned by classroom. Students in the experimental group were exposed to a brief cognitive strategy instruction for 10
development and application of effective planning for mathematical computation,
standard math instruction. Standardized tests of cognitive processes and math
students completed math worksheets throughout the experimental phase. Star
Johnson Tests of Achievement, Third Edition, Math Fluency and *Wechsler Individu*
Numerical Operations) were administered pre- and postintervention, and Math
follow-up. Large pre–post effect sizes were found for students in the experimental
math worksheets (0.85 and 0.26), Math Fluency (1.17 and 0.09), and Numerical C
At 1 year follow-up, the experimental group continued to outperform the compa
students with ADHD evidenced greater improvement in math worksheets, far
(which measured the skill of generalizing learned strategies to other similar task
when provided the PASS-based cognitive strategy instruction.

Design of the Study

Iseman & Naglieri (2005)



89

Strategy Instruction

Iseman & Naglieri (2005)

- Teachers facilitated discussions to help students become more self-reflective about use of strategies
- Teachers asked questions like:
  - What was your goal?
  - Where did you start the worksheet?
  - What strategies did you use?
  - How did the strategy help you reach your goal?
  - What will you do again next time?
  - What other strategies will you use next time?

90

Iseman & Naglieri (2005)

Iseman and Naglieri

Table 3. Students' Comments During Planning Facilitation Sessions

Goals
- "My goal was to do all of the easy problems on every page first, then do the others."
- "To get as many correct as I can."
- "To get as many right as quickly as possible."
- "To take time and make sure I get them correct."

Starting place
- "I started on the first one."
- "I skipped around."
- "I do the easy ones first."
- "I look at the type of problem and the number of steps and decide which problems to do first."

Overall plan
- "I did all the easy problems on a page and went onto the next one."
- "I do all the addition first, then the easy minus, and then I move onto the harder ones."
- "I do the problems I know, then I check my work."

Specific strategies
- "I simplify fractions first."
- "Skip the longer multiplication questions."
- "The problems that have lots of steps take more time, so I skip them."
- "I do them [the algebra] by figuring out what I can put in for X to make the problem work."
- "I draw lines so I don't get my columns confused [on the multiplication]."
- "I stopped drawing lines because it slowed me down."
- "If a problem is taking a long time I skip it and come back to it if I have time."
- "I did the ones that take the least time."
- "Remember that anything times 0 is 0."

Noticing patterns in the worksheets
- "I did all the problems in the brain-dead zone first."
- "I started in the middle of the page, the problems on top take longer."
- "Next time I'll skip the hard multiplication at the top of the first page."

- "My goal was to do all of the easy problems on every page first, then do the others."
- "I do the problems I know, then I check my work."
- "I did all the problems in the brain-dead zone first."

91

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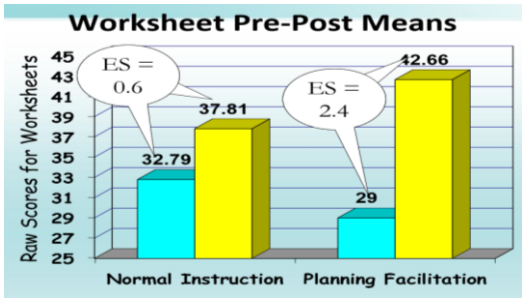
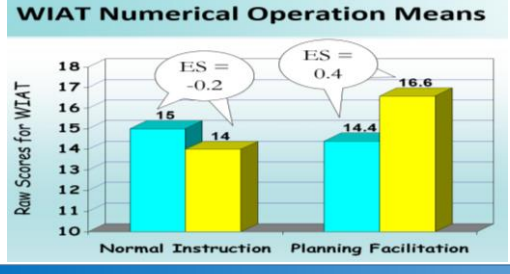
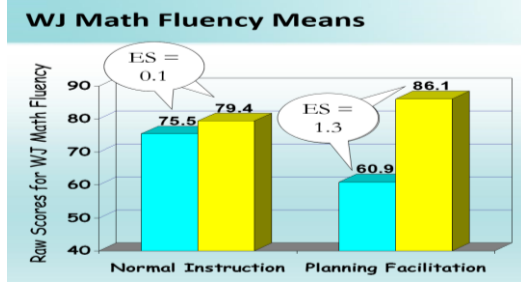
Iseman & Naglieri (2005)







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 ($M = 3.21$, $SD = 18.21$, $d = 0.09$).

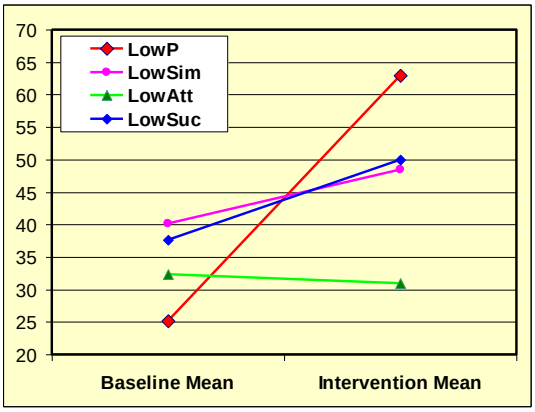
Jack A. Naglieri, Ph.D.

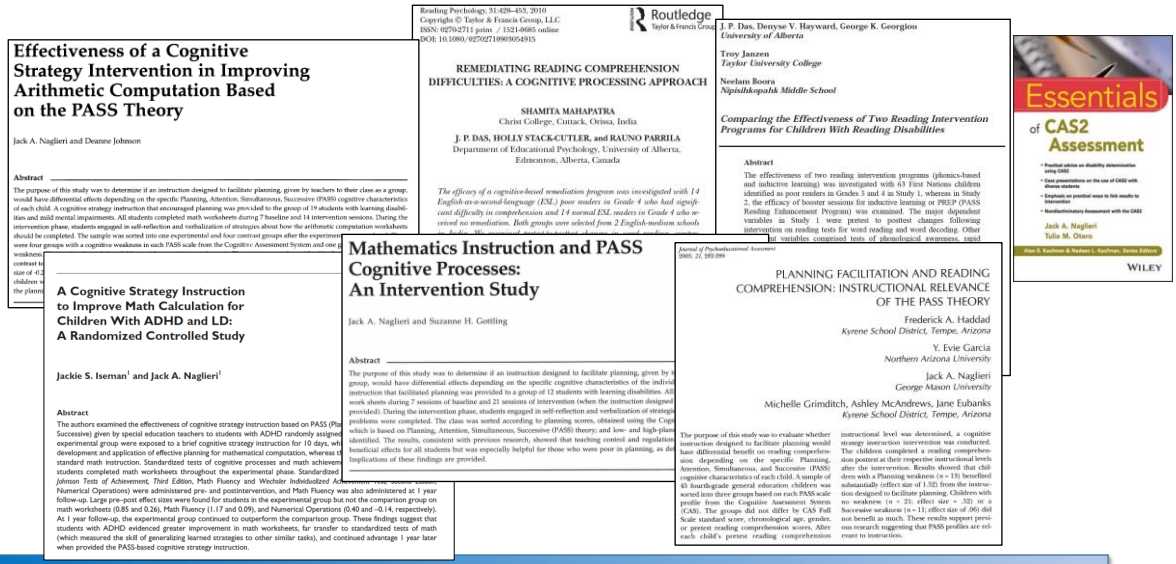
92

92

Iseman & Naglieri (2005)

- Baseline Intervention means by PASS profile
- Different response to the same intervention





QUESTIONS about the Interventions?

95

Brain Break – STAND AND STRETCH

96

PASS Neurocognitive Abilities that are NOT EF

Simultaneous and Successive processes

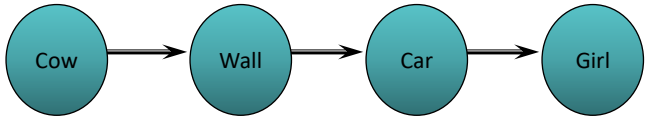
97

PASS Theory

Successive Processing

Successive processing is a basic cognitive ability which we use to manage stimuli in a specific serial order

- Stimuli form a chain-like progression
- Stimuli are not inter-related



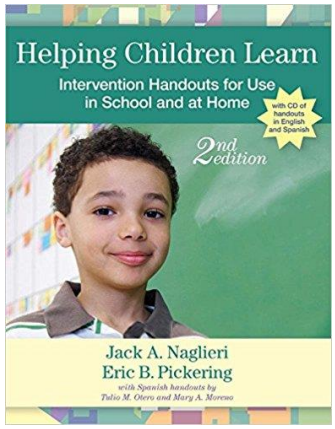
98

Using good EF to overcome a neurocognitive processing disorder

Ben's Problem with Successive Processing

Ben was an energetic but frustrated third-grade student who liked his teachers, was popular with his peers, and fit in well socially at school. However, Ben said he did not like school at all, particularly schoolwork. Ben was good at turning in all of his work on time, and he worked hard, but he earned poor grades. He appeared to be getting more and more frustrated at school.

In general, Ben struggled to perform well because he had a lot of trouble following directions that were not written down, his writing often did not make sense, and he did not appear to comprehend what he read. Ben's teachers noticed that when directions for assignments and projects were given orally in class, he often only finished part of the task. Ben's teacher described an assignment in which students had to collect insects, label them, organize them into a collection, and then give a brief presentation about each insect. Unlike any other student, Ben chose to make the labels for the insects first and then go look for the insects. He found only a few of the insects he had made labels for, and when he put them in the collection, they were not in the order that had been specified. He also had trouble with the spelling of the scientific names of the insects and made many errors in the sequence of letters in the words.



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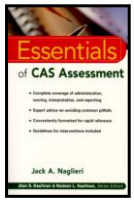
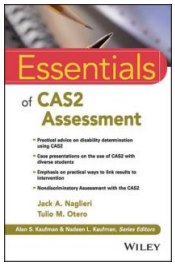
Discrepancy Consistency Method (DCM)

- …first introduced in 1999 (most recently in 2017)





Pattern of Strengths and Weaknesses Using the Discrepancy/Consistency Method for SLD Determination

Three methods for detecting a pattern of strengths and weaknesses (PSW) that can be used as part of the process of identifying a student with a specific learning disability (SLD) have been suggested by Naglieri in 1999, Hale and Fiorello in 2004, and by Flanagan, Ortiz, and Alfonso in 2007. These authors share the same goal: to present a procedure to detect a PSW in scores that can be used to identify an SLD (sometimes referred to as a third option; Zirkel & Thomas, 2010). Despite differences in the composition of the scores used and the definitions of what constitutes a basic psychological process, these methods all rely on finding a combination of differences as well as similarities in scores across academic and cognitive tests. Our approach to operationalizing a PSW is called the Discrepancy/Consistency Method (DCM) for the identification of SLD. Determining SLD is essentially based on the combination of PASS and achievement test scores. The method involves a systematic examination of variability of PASS and academic achievement test scores, which has two main ingredients. First, there must be evidence of a PASS cognitive weakness as described in Step 1 of this chapter, and, second, achievement test scores should show substantial variability that aligns with the high and low PASS scores. What

DON'T FORGET 3.5

The essence of the Discrepancy/Consistency Method is two discrepancies and one consistency.

Discrepancy 1:
Significant variability among the PASS scores indicating a weakness in one or more of the basic psychological processes

Discrepancy 2:
Significant difference between high PASS scores and low achievement test scores

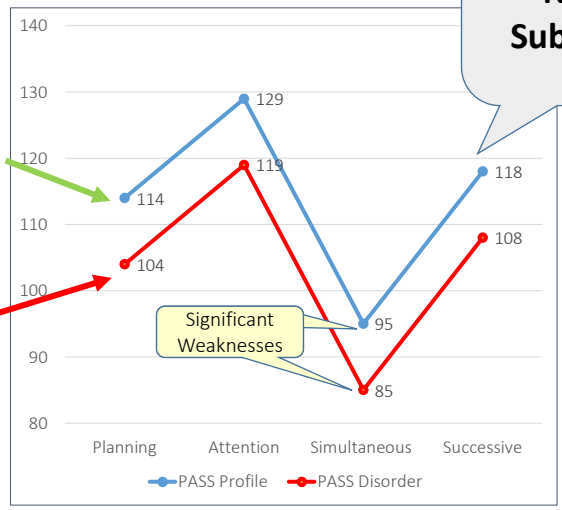
Consistency:
No significant difference between low PASS scores and low achievement

100

How to Determine a Disorder

PASS Scales NOT Subtests

- Two sets of PASS scores were studied
  - Significant variation in relation to student's average has *instructional relevance*
  - Significant variation in relation to student's average AND a standard score less than 90 (< 25th %tile) *supports designation as SLD*



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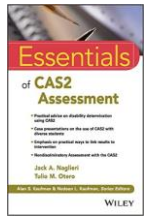
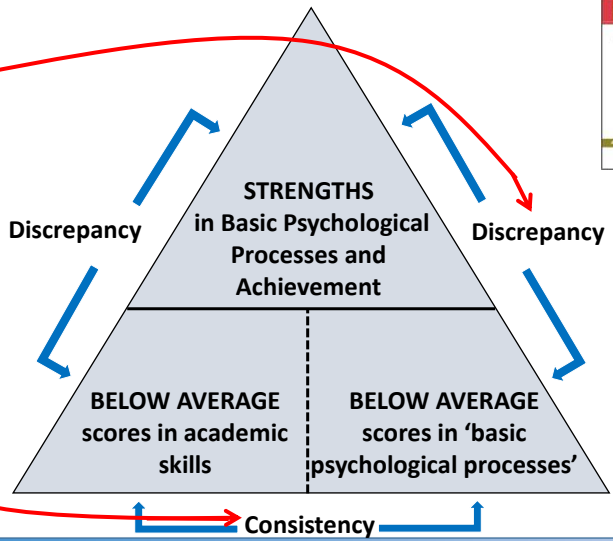
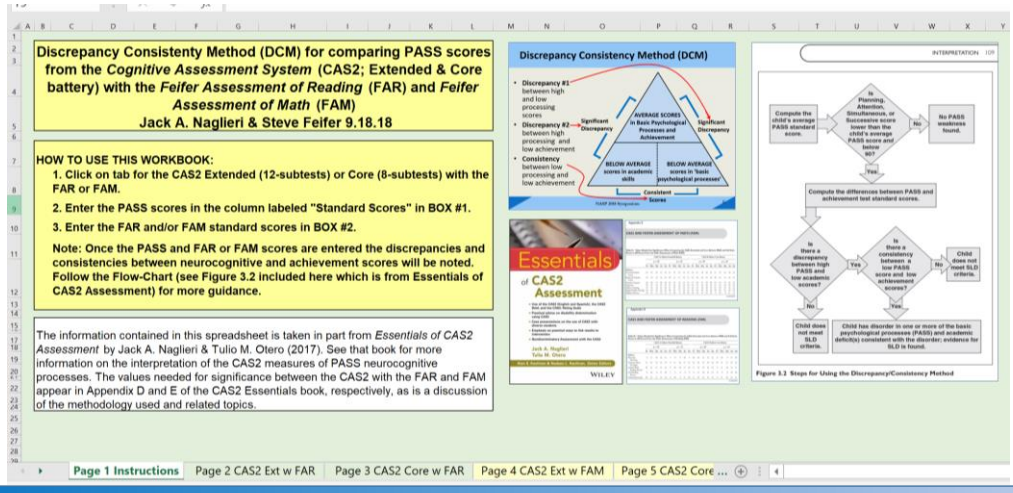


- **Discrepancy** between high and low processing scores
- **Discrepancy** between high processing and low achievement
- **Consistency** between low processing and low achievement = WHY the student fails



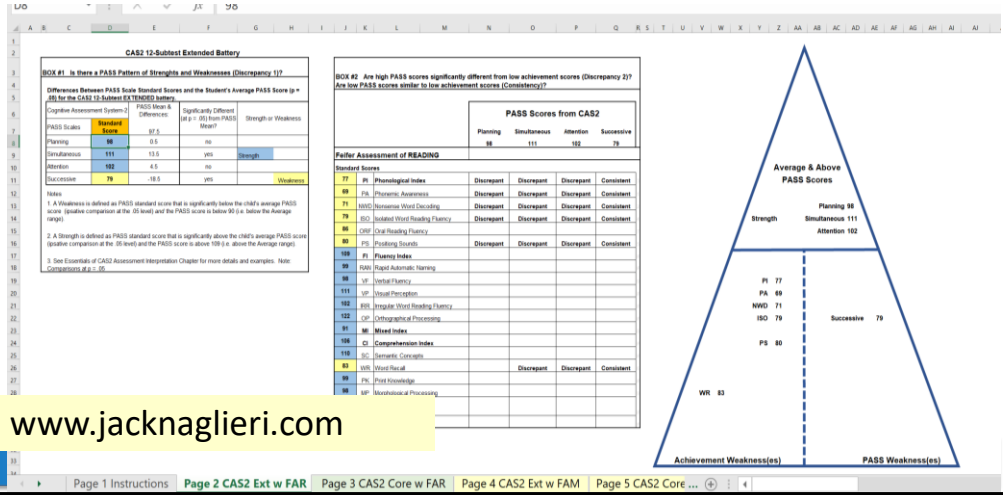
102

FREE CAS2 PSW Analyzer for FAR, FAM, & FAW, WJ4, KTEA3, WIAT4



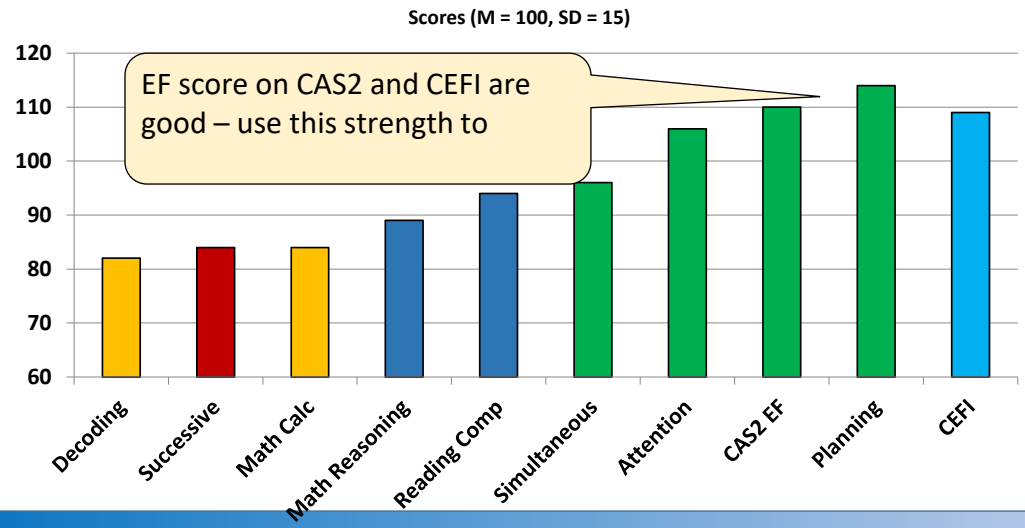
CAS2 & FAR PSW Analyzer

- CAS2 and Achievement Analyzer



FREE – on www.jacknaglieri.com

Ben's Problem with Successive processing Ability



105

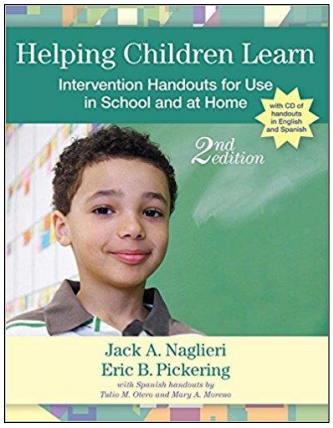
Ben's Problem with Successive Processing

- Ben has difficulty whenever ANY task requires sequencing
  - Academic or ability tests
  - Visual or auditory tests
  - Math or spelling or reading
  - Tasks that require memory of seque
- How do we help him learn better?

106

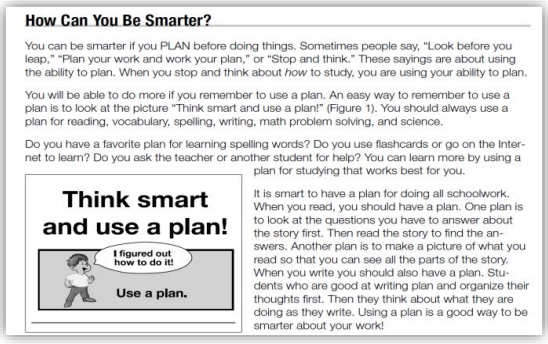
Teach Children about their Abilities

- Helping Children Learn Intervention Handouts for Use in School and at Home, *Second Edition (*Naglieri, & Pickering, 2011)
- Spanish handouts by Tulio Otero & Mary Moreno



Ben's Problem with Successive Ability

Teach him to use his strength in EF (Planning)



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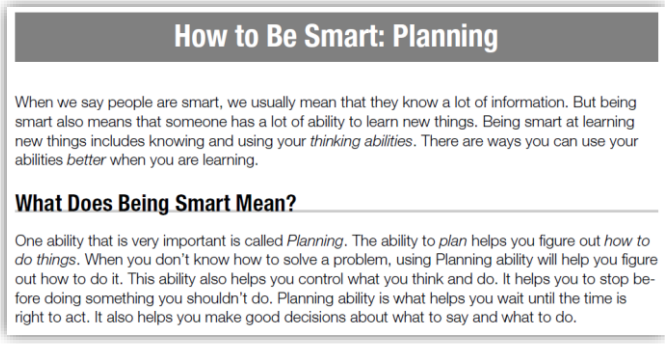
Do you have a favorite plan for learning spelling words? Do you use flashcards or go on the Internet to learn? Do you ask the teacher or another student for help? You can learn more by using a plan for studying that works best for you.

Think smart and use a plan!

It is smart to have a plan for doing all schoolwork. When you read, you should have a plan. One plan is to look at the questions you have to answer about the story first. Then read the story to find the answers. Another plan is to make a picture of what you read so that you can see all the parts of the story. When you write you should also have a plan. Students who are good at writing plan and organize their thoughts first. Then they think about what they are doing as they write. Using a plan is a good way to be smarter about your work!



How to Be Smart: Planning

When we say people are smart, we usually mean that they know a lot of information. But being smart also means that someone has a lot of ability to learn new things. Being smart at learning new things includes knowing and using your *thinking abilities*. There are ways you can use your abilities *better* when you are learning.

What Does Being Smart Mean?

One ability that is very important is called *Planning*. The ability to *plan* helps you figure out *how to do things*. When you don't know how to solve a problem, using Planning ability will help you figure out how to do it. This ability also helps you control what you think and do. It helps you to stop before doing something you shouldn't do. Planning ability is what helps you wait until the time is right to act. It also helps you make good decisions about what to say and what to do.

Ben's Problem with Successive Ability

Teach him to recognize sequences

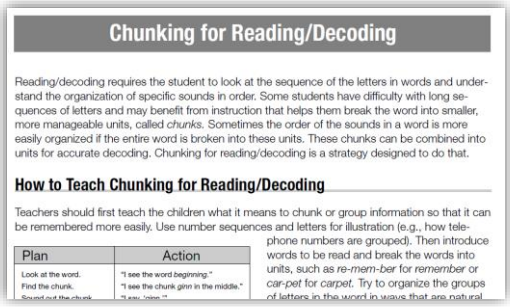
How to Teach Successive Processing Ability

The first step in teaching children about their own abilities is to explain what Successive processing ability is. In Figure 1 (which is included in the PASS poster on the CD), we provide a fast and

1. Teach children that most information is presented in a specific sequence so that it makes sense.
2. Encourage children by asking, "Can you see the sequence of events here?" or "Did you see how all of this is organized into a sequence that must be followed?"
3. Remind the students to think of how information is sequenced in different content areas, such as reading, spelling, and arithmetic, as well as in sports, playing an instrument, driving a car, and so forth.
4. Teach children that the sequence of information is critical for success.
5. Remind students that seeing the sequence requires careful examination of the serial relationships among the parts.

Solutions for Ben- Use EF

Teach him to use strategies



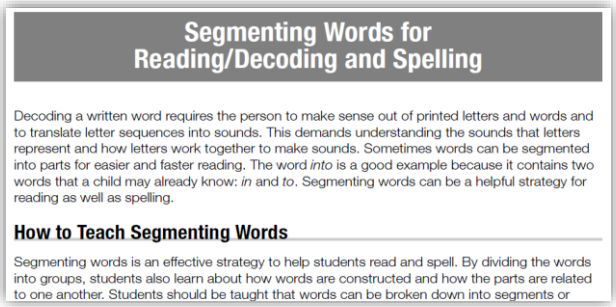
Chunking for Reading/Decoding

Reading/decoding requires the student to look at the sequence of the letters in words and understand the organization of specific sounds in order. Some students have difficulty with long sequences of letters and may benefit from instruction that helps them break the word into smaller, more manageable units, called *chunks*. Sometimes the order of the sounds in a word is more easily organized if the entire word is broken into these units. These chunks can be combined into units for accurate decoding. Chunking for reading/decoding is a strategy designed to do that.

How to Teach Chunking for Reading/Decoding

Teachers should first teach the children what it means to chunk or group information so that it can be remembered more easily. Use number sequences and letters for illustration (e.g., how telephone numbers are grouped). Then introduce words to be read and break the words into units, such as *re-mem-ber* for *remember* or *car-pet* for *carpet*. Try to organize the groups of letters in the word in ways that are natural

Plan	Action
Look at the word.	"I see the word *beginning*."
Find the chunk.	"I see the chunk *ginn* in the middle."
Sound out the chunk	"I say '*ginn*'."



Segmenting Words for Reading/Decoding and Spelling

Decoding a written word requires the person to make sense out of printed letters and words and to translate letter sequences into sounds. This demands understanding the sounds that letters represent and how letters work together to make sounds. Sometimes words can be segmented into parts for easier and faster reading. The word *into* is a good example because it contains two words that a child may already know: *in* and *to*. Segmenting words can be a helpful strategy for reading as well as spelling.

How to Teach Segmenting Words

Segmenting words is an effective strategy to help students read and spell. By dividing the words into groups, students also learn about how words are constructed and how the parts are related to one another. Students should be taught that words can be broken down into segments or

Core Group Discussion → Deeper Learning

- Discuss: what do you think about conceptualizing EF as a part of intelligence

111

Presentation Outline

- Introduction to Executive Function (EF)
- EF Behaviors
- EF and Cognition (intelligence)
- EF and Social Emotional Skills
- EF and Academic/Job Performance
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- Conclusions

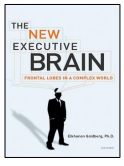
112

Phineas had Social Emotional Deficit

- Phineas had profound social emotional problems after his injury to the frontal lobes
- Phineas was
  - Insulting
  - impulsively says things
  - uses vulgar language
  - can't manage his emotions
  - inconsistent in social situations
  - doesn't recognize he is offensive
  - looses control in interactions with others

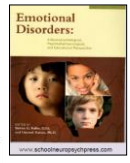
Frontal Lobes and Emotion

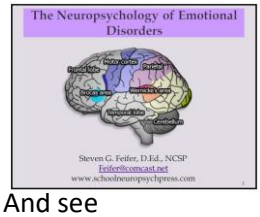
Goldberg (2011, p 116-117)



- the "emphasis in the classic studies of frontal lobe syndromes was on cognition [intelligence] rather than on affect [social emotional]"
- 'very few researchers have attempted to merge cognitive and emotional aspects of frontal lobe dysfunction'

- Feifer's Emotional Disorders book contains a collection of papers on the relationship between EF and Emotional Disorders





- And see Feifer@comcast.net

EF and Self Regulation (Feifer)

- Self-Regulation problems in Behavior, Emotion and Attention are neurocognitive expression of difficulty with Executive Function

ED and Self Regulation

*Children with emotional disturbances tend to be unsuccessful in school due in part to a lack self regulation skills in one or more of the following domains:

a) **Behavioral Self-Regulation** – poor inhibition of impulses and motor control.
b) **Emotional Self-Regulation** - and inability to self-regulate moods and reactions to social situations.
c) **Attention Self-Regulation** – an inability to modulate and sustain attention.

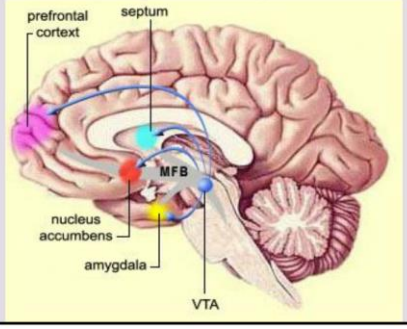
* A **neuropsychological approach** does not try to put semantic labels on observable behavior, but instead tries to identify core brain regions responsible for the dysfunction.

16

115

115

The Cerebral Orchestra of Emotions: Subcortical Regions



22

The Cerebral Orchestra of Emotions: Cortical Regions

(1) Orbitofrontal cortex - region of the brain responsible for ascribing an emotional valence or value judgment to another's feelings. Often triggers an automatic social skills response (Rolls, 2004).

* Has rich interconnections with the limbic system.
* Responsible for ***emotional executive functioning***.
* Self-regulation of behavior as highest levels of emotional decision making dictated by this brain region.

23

Emotions and the Frontal Lobe

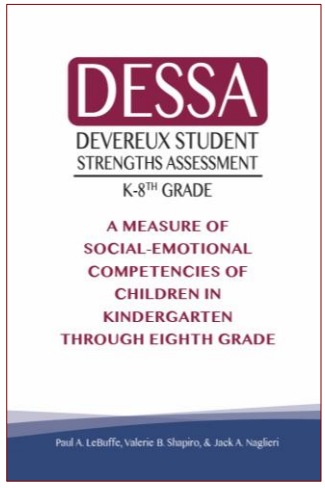
Emotional Executive Functioning

116

116

The Devereux Student Strengths Assessment (DESSA)

- Based on the concept of resilience & SEL principles described by CASEL
  - Identify social-emotional strengths and needs of elementary and middle school children (for K-8th grade)
  - 72 items and 8 scales
  - Completed by parents, teachers, and/or after-school / community program staff
  - Takes 15 minutes to complete
  - On-line administration, scoring and reporting available



DESSA Rating Form (72 items)

DESSA
DEVEREUX STUDENT STRENGTHS ASSESSMENT
K-8TH GRADE

Child's Name: Jessica
School/Organization: Wilson Elementary
Person Completing this Form: Mary Smith

Item #	During the past 4 weeks, how often did the child…	Never	Rarely	Occasionally	Frequently	Very Frequently
37	follow the example of a positive role model?	☐	☐	☐	☑	☐
38	compliment or congratulate somebody?	☐	☐	☑	☐	☐
39	accept responsibility for what she/he did?	☐	☐	☐	☐	☑
40	do something nice for somebody?	☐	☐	☐	☑	☐
41	make accurate statements about events in her/his life?	☐	☐	☐	☑	☐
42	show good judgment?	☐	☐	☐	☐	☑

CASEL and DESSA Scales

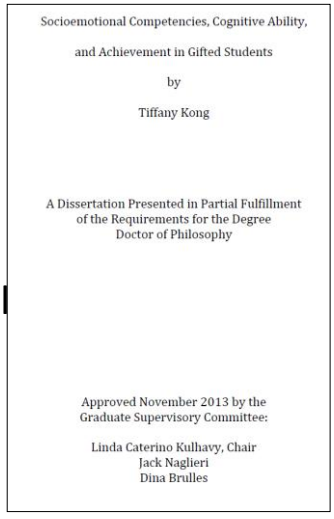
1. **Self-awareness**—being able to ac and strengths; maintaining a well-
2. **Self-management**—being able to control impulses, and persevere progress toward personal and ac
3. **Social awareness**—being able to others; recognizing and appreciat differences; recognizing and usin
4. **Relationship skills**—being able t relationships based on cooperati preventing, managing, and resolv needed
5. **Responsible decision-making**—h consideration of reason, ethical for self and others, and likely con making skills to academic and so one's school and community.[1]

Social Emotional Composite

- Self Awareness
- Self Management
- Social Awareness
- Relationship Skills
- Decision Making
- Goal Directed Behavior
- Personal Responsibility
- Optimistic Thinking

Kong (2013): IQ, SEL & Achievement

- Tiffany Kong studied CogAT, DESSA, and achievement scores for 276 elementary students grades K-8
- All gifted based on scores on verbal, quantitative, or nonverbal test scores at least 97th percentile



Socioemotional Competencies, Cognitive Ability, and Achievement in Gifted Students

by

Tiffany Kong

A Dissertation Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy

Approved November 2013 by the Graduate Supervisory Committee:

Linda Caterino Kulhavy, Chair
Jack Naglieri
Dina Brulles

Kong (2013): IQ, SEL & Achievement

- Mean IQ score = 129.6 nearly 2 SDs above the normative mean (achievement also high)
- Mean SEL score on DESSA was only ½ SD above the normative mean (T = 55.5)

Table 1

Means and Standard Deviations of Study Variables

Construct	Mean	*SD*
Age	10.96	1.81
DESSA Total	55.51	9.41
Verbal	125.69	13.74
Quantitative	124.41	10.34
Nonverbal	125.10	12.56
CogAT Composite	129.61	8.22
Reading	75.56	15.72
Language	69.46	19.60
Math	76.30	17.13
SAT10 Achievement Composite	73.77	12.66

Kong (2013): IQ, SEL & Achievement

- DESSA Total score correlated .44 with Total Achievement (reading, math, language) and the CogAT Total correlated .36
  - A clearer picture of the relationships between IQ (CogAT) and SEL (DESSA) with achievement was obtained from hierarchical regression analysis…

Kong (2013) SEL Predicts Beyond IQ (p. 44)

DESSA predicted reading, language and math scores over IQ (CogAt) scores

Relations between Cognitive Ability, Socioemotional Competency, and Achievement Variables

Hierarchical regression analyses were conducted to determine which scales and subtests predicted the most variance in the dependent achievement variables. Composite CogAT scores were not found to significantly predict composite achievement, $R^2\Delta = .03$, $F(1, 121) = 3.27$, $p > .05$, reading, language, or math scores over-and-above the DESSA Total scores (Table 11). On the other hand, the DESSA Total scores significantly predicted composite achievement, $R^2\Delta = .05$, $F(1, 121) = 6.99$, $p < .05$; language scores, $R^2\Delta = .03$, $F(1, 121) = 4.26$, $p < .05$; and math scores, $R^2\Delta = .05$, $F(1, 121) = 6.09$, $p < .05$, over-and-above the composite CogAT scores.

123

Take Away Messages

- Social Emotional Skills are the result of EF and what the person has learned in all aspects of the environment
- Individuals CAN BE TAUGHT good, or bad, social emotional skills
- Your Comments? Questions?

124

Presentation Outline

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125

EF in the Classroom

- Consider any task that requires the student to figure out HOW to complete a task such as:
  - Writing a story
  - Coming up with several ways of solving a math problem
  - Organizing a complex set of items, thoughts, tasks
  - Reading comprehension and inferential test questions
  - When strategies are needed for any academic task
  - How to study
  - How to prepare for a test
  - Etc.

126

- See www.jacknaglieri.com for papers on CAS2, Feifer Assessments of Reading, Math, and Writing

Correspondence of FAR and PASS	Planning	Attention
Phonemic Awareness - measures rhyming, blending, segmenting, and manipulating sounds.		
Positioning Sounds - a phonemic localization task determining sound positions.		
Nonsense Word Decoding - the student decodes a series of nonsense words.		
Isolated Word Reading Fluency - the student reads a list of words in 60 seconds.		
Oral Reading Fluency - the student reads a passage composed of the same words as the Isolated Word Reading Fluency task.		
Rapid Automatic Naming - the student names either objects, letters, or stencils.		
Visual Perception - the student identifies letters or words printed backwards from an array.		X
Verbal Fluency - the student retrieves words from a category, or items that start with a letter.	X	X
Orthographic Processing - the student recalls a letter, or group of letters, from a target word.		X
Irregular Word Reading Fluency - the student reads a list of phonologically irregular words.		
Semantic Concepts - the student identifies the correct antonym or synonym of a target word.	X	
Word Recall - the student repeats back a list of words over two trials.	X	X
Morphological Processing - the student selects the correct prefix, suffix, or stem that completes a target word.		
Silent Reading Fluency - the student answers questions after reading a passage silently.	X	X

Correspondence of FAM and PASS	Planning	Attention
Phonemic Awareness - measures rhyming, blending, segmenting, and manipulating sounds.		
Positioning Sounds - a phonemic localization task determining sound positions.		
Nonsense Word Decoding - the student decodes a series of nonsense words.		
Isolated Word Reading Fluency - the student reads a list of words in 60 seconds.		
Oral Reading Fluency - the student reads a passage composed of the same words as the Isolated Word Reading Fluency task.		
Rapid Automatic Naming - the student names either objects, letters, or stencils.		
Visual Perception - the student identifies letters or words printed backwards from an array.		X
Verbal Fluency - the student retrieves words from a category, or items that start with a letter.	X	X
Orthographic Processing - the student recalls a letter, or group of letters, from a target word.		X
Irregular Word Reading Fluency - the student reads a list of phonologically irregular words.		
Semantic Concepts - the student identifies the correct antonym or synonym of a target word.	X	
Word Recall - the student repeats back a list of words over two trials.	X	X
Morphological Processing - the student selects the correct prefix, suffix, or stem that completes a target word.		
Silent Reading Fluency - the student answers questions after reading a passage silently.	X	X

Note: The correspondence of PASS with FAR and FAM needs to be carefully examined for each stu

127

Presentation Outline

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Jack A. Naglieri, Ph.D. 128

128

Executive Function Behaviors, Intelligence, and Achievement test scores

EF, WISC-IV, CAS, Achievement

- Data from Sam Goldstein's evaluation center in Salt Lake City, UT
- Children given the WISC-IV (N = 43), CAS (N = 62), and the WJIII achievement (N = 58) as part of the typical test battery

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

Demographic		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
Parental Education Level	High school diploma or less	1	1.6	0	0.0	1	1.7
	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
Diagnostic or Educational Group	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	4.8	8	4.6	9	5.1
	Total	62	100.0	43	100.0	58	100.0
	Age *M* (*SD*)	10.4 (2.9)		10.2 (2.6)		10.5 (2.7)	

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

	CAS				
	FS	Plan	Sim	Att	Suc
CEFI					
Full Scale	.45	.49	.43	.37	.32

	WISC-IV				
	FS	VC	PR	WM	PS
CEFI					
Full Scale	.39	.44	.27	.30	.34

	WJ-III Achievement Tests				
CEFI Scales	Total	Broad Reading	Broad Math	Broad Written Language	Median
Full Scale	.51	.48	.49	.47	.49

EF and Achievement (Naglieri & Rojahn, 2004)

- Correlation between Executive Function (Planning + Attention) with achievement = **.51** (N = 1,559) is stable across 5–17-year range
- EF scores added significantly to the prediction of achievement after Simultaneous and Successive scores

Contents lists available at ScienceDirect

Learning and Individual Differences

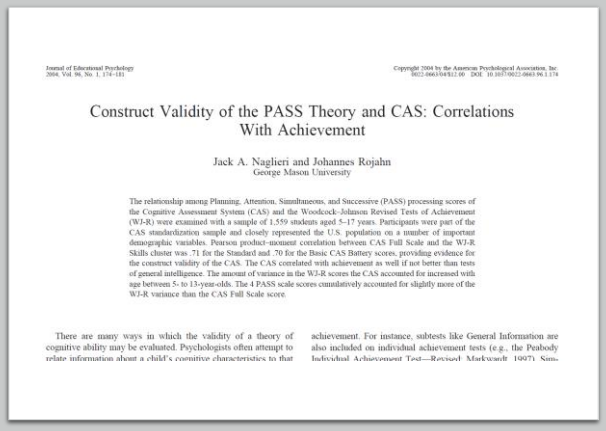
journal homepage: www.elsevier.com/locate/lindif

Relations between executive function and academic achievement from ages 5 to 17 in a large, representative national sample

John R. Best [a,*], Patricia H. Miller [b], Jack A. Naglieri [c]

ARTICLE INFO

ABSTRACT



Journal of Educational Psychology
2004, Vol. 96, No. 1, 174–181

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Construct Validity of the PASS Theory and CAS: Correlations With Achievement

Jack A. Naglieri and Johannes Rojahn
George Mason University

The relationship among Planning, Attention, Simultaneous, and Successive (PASS) processing scores of the Cognitive Assessment System (CAS) and the Woodcock–Johnson Revised Tests of Achievement (WJ-R) were examined with a sample of 1,559 students aged 5–17 years. Participants were part of the CAS standardization sample and closely represented the U.S. population on a number of important demographic variables. Pearson product–moment correlation between CAS Full Scale and the WJ-R Skills cluster was .71 for the Standard and .70 for the Basic CAS Battery scores, providing evidence for the construct validity of the CAS. The CAS correlated with achievement as well if not better than tests of general intelligence. The amount of variance in the WJ-R scores the CAS accounted for increased with age between 5- to 13-year-olds. The 4 PASS scale scores cumulatively accounted for slightly more of the WJ-R variance than the CAS Full Scale score.

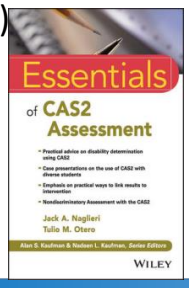
There are many ways in which the validity of a theory of cognitive ability may be evaluated. Psychologists often attempt to relate information about a child's cognitive characteristics to that

achievement. For instance, subtests like General Information are also included on individual achievement tests (e.g., the Peabody Individual Achievement Test—Revised; Markwardt, 1997). Sim-

131

Correlations: We can do better!

Average correlations between IQ Scales with total achievement scores from *Essentials of CAS2 Assessment* Naglieri & Otero (2017)



Correlations Between Ability and Achievement Test Scores			Average Correlation: All Scales	Average Correlation: Scales without achievement
WISC-V	Verbal Comprehension	.74		
WIAT-III	Visual Spatial	.46		
N = 201	Fluid Reasoning	.40		
	Working Memory	.63		
	Processing Speed	.34	.53	.47
WJ-IV COG	Comprehension Knowledge	.50		
WJ-IV ACH	Fluid Reasoning	.71		
N = 825	Auditory Processing	.52		
	Short Term Working Memory	.55		
	Cognitive Processing Speed	.55		
	Long-Term Retrieval	.43		
	Visual Processing	.45	.54	.50
KABC	Sequential/Gsm	.43		
WJ-III ACH	Simultaneous/Gv	.41		
N = 167	Learning/Glr	.50		
	Planning/Gf	.59		.48
	Knowledge/GC	.70	.53	
CAS	Planning	.57		
WJ-III ACH	Simultaneous	.67		
N=1,600	Attention	.50		
	Successive	.60		.59

Note: WJ-IV Scales Comp-Know= Vocabulary and General Information; Fluid Reasoning = Number Series and Concept Formation; Auditory Processing = Phonological processing.

Note: All correlations are reported in the ability tests' manuals. Values were averaged within each ability test using Fisher z transformations.

132

Intelligence 79 (2020) 101431

Contents lists available at ScienceDirect

Intelligence

journal homepage: www.elsevier.com/locate/intell

PASS theory of intelligence and academic achievement: A meta-analytic review

George K. Georgiou[b,*], Kan Guo[b,**], Nithya Naveenkumar[a], Ana Paula Alves Vieira[c], J.P. Das[a]

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ARTICLE INFO

Keywords:
Intelligence
Mathematics
Meta-analysis
PASS processes
Reading

ABSTRACT

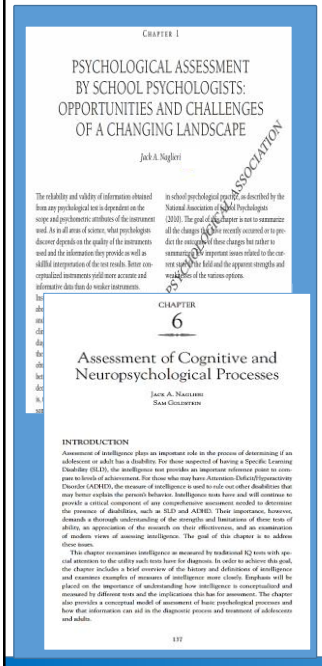
Although Planning, Attention, Simultaneous and Successive (PASS) processing theory of intelligence has been argued to offer an alternative look at intelligence and PASS processes – operationalized with the Cognitive Assessment System – have been used in several studies, it remains unclear how well the PASS processes relate to academic achievement. Thus, this study aimed to determine their association by conducting a meta-analysis. A random-effects model analysis of data from 62 studies with 93 independent samples revealed a moderate-to-strong relation between PASS processes and reading, $r = 0.409$, 95% CI = [0.363, 0.454]), and mathematics, $r = 0.461$, CI = [0.405, 0.517]. Moderator analyses further showed that (1) PASS processes were more strongly related with reading and math in English than in other languages, (2) Simultaneous processing was more strongly related to math accuracy and problem solving than math fluency, (3) Simultaneous processing was more strongly related to problem solving than Attention, and (4) Planning was more strongly related to math fluency than Simultaneous processing. Age, grade level, and sample characteristics did not influence the size of the correlations. Taken together, these findings suggest that PASS cognitive processes are significant correlates of academic achievement, but their relation may be affected by the language in which the study is conducted and the type of mathematics outcome. They further support the use of intervention programs that stem from PASS theory for the enhancement of reading and mathematics skills.

Georgiou, G., Guo, K., Naveenkumar, N., Vieira, A. P. A., & Das, J. P. (2019) PASS theory of intelligence and academic achievement: A meta-analytic review. *In press Intelligence.*

PASS Research

- "The results clearly show that when CAS Full Scale is used it correlates **.60 with reading** and **.61 with mathematics**."
- "**These correlations are significantly stronger … than the correlations reported in previous meta-analysis for other measures of intelligence** (e.g., Peng et al., 2019; Roth et al., 2015)…(e.g., WISC) that include tasks (e.g., Arithmetic, Vocabulary)..."
- "if we **conceptualize intelligence as … cognitive processes that are linked to the functional organization of the brain**" it leads to significantly higher relations with academic achievement."
  - "and these processes have direct implications for instruction and intervention…"

133



CHAPTER 1

PSYCHOLOGICAL ASSESSMENT BY SCHOOL PSYCHOLOGISTS: OPPORTUNITIES AND CHALLENGES OF A CHANGING LANDSCAPE

Jack A. Naglieri

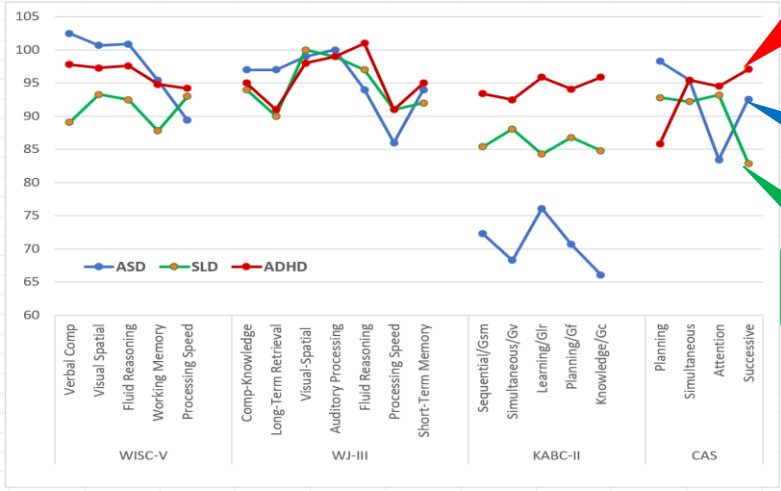
CHAPTER 6

Assessment of Cognitive and Neuropsychological Processes

Jack A. Naglieri
Sam Goldstein

INTRODUCTION

Profiles for Dyslexia, ADHD & ASD



ADHD (Low Planning)

ASD – Low Attention

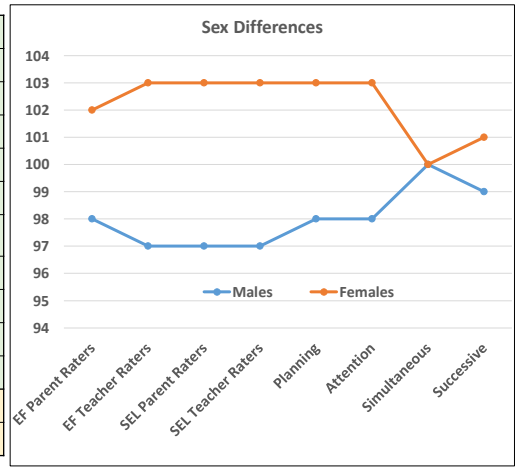
Dyslexia – Low Successive

134

Sex Differences in Executive Function

135

	CEFI	Males	Females	Difference
EF	EF Parent Raters	98	102	4
EF	EF Teacher Raters	97	103	6
	DESSA	Males	Females	Difference
SEL	SEL Parent Raters	97	103	6
SEL	SEL Teacher Raters	97	103	5
	PASS from CAS	Males	Females	Difference
EF	Planning	98	103	5
EF	Attention	98	103	5
	Simultaneous	100	100	0
	Successive	99	101	1



Note: CEFI Adult scores did not differ for adults.

Females have higher EF scores than Males

136

Core Group Discussion → Deeper Learning

- Discuss: what stands out as the most important message from what we have discussed today?

137

Presentation Outline

- Introduction to Executive Function (EF)
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- Conclusions

138

Conclusions

Assessment of EF should be comprehensive and include cognition, behavior and academic skills

We can encourage the use of EF

This is the gift of smarter thinking

This is a gift of optimism

This is a gift for life success

139

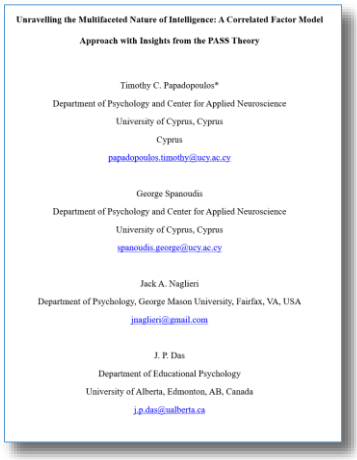
Time for final Questions and Answers

140

Additional Advantages of measuring PASS theory with CAS2

1. PASS scores have sufficient unique variance to be interpreted
2. PASS profiles are different for students with ADHD, SLD and ASD
3. CAS2 is the most equitable measure of intelligence
4. PASS scores predict achievement better than all other intelligence tests
5. PASS constructs are easily understood and linked to instruction

Papadopoulos, et al., 2023



Unravelling the Multifaceted Nature of Intelligence: A Correlated Factor Model Approach with Insights from the PASS Theory

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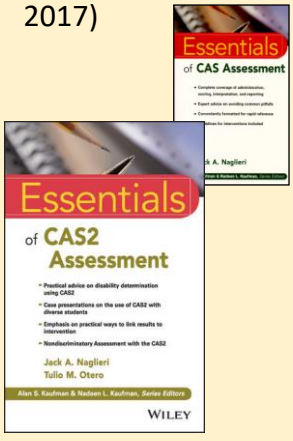
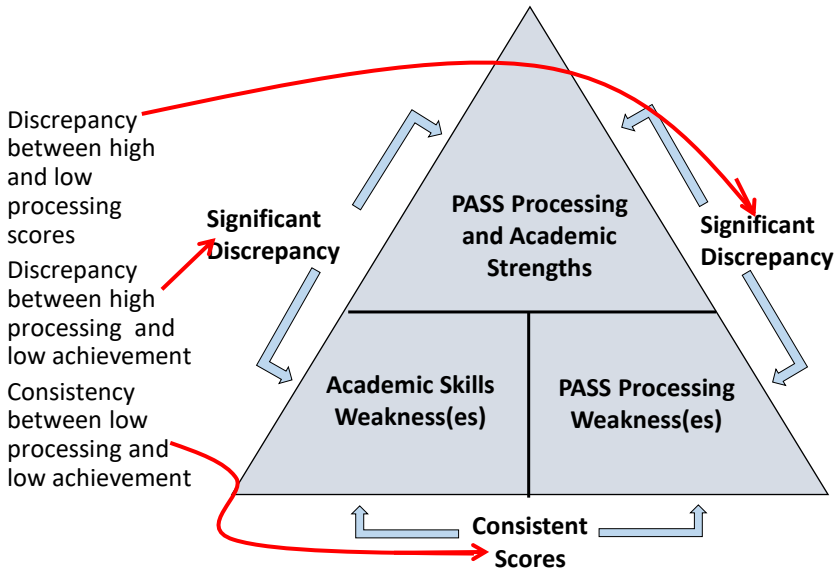
- Our results unambiguously support the notion that intelligence is not a unidimensional entity but a composite of distinct cognitive processes…which posits separate cognitive domains for Planning, Attention, Simultaneous and Successive processing… [these] emerged as the most fitting representation of intelligence [and] the best fit to the data.
- This outcome reinforces the notion that intelligence is a multifaceted construct, with various cognitive abilities working in concert, corroborating previous findings (e.g., Das & Kirby, 2022; Naglieri, 2015; Papadopoulos et al., 2018).

- The Discrepancy Consistency Method (DCM) was first introduced in 1999 (most recently in 2017)

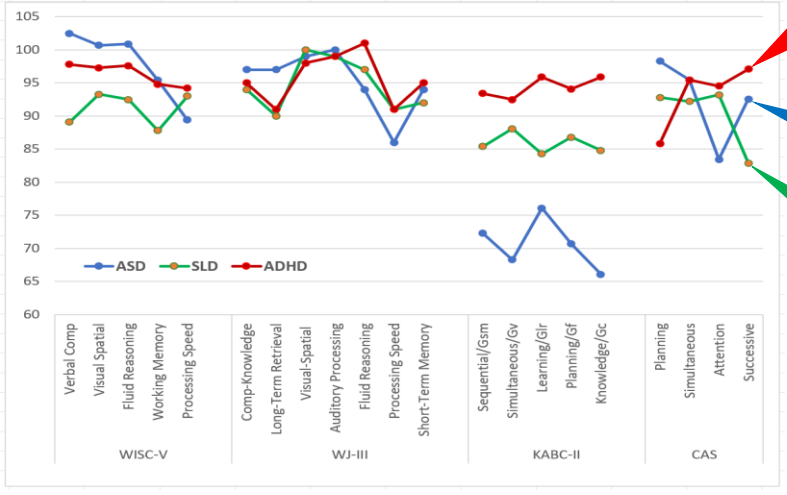




143

These profiles across tests is very revealing - PASS works

Patterns of Strengths & Weaknesses



ADHD (Low Planning)

ASD – Low Attention

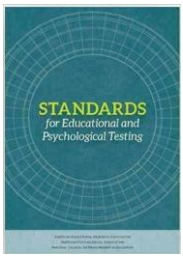
Dyslexia – Low Successive

144

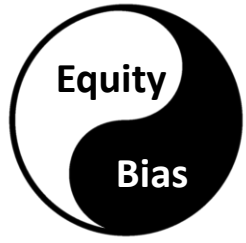
144

Test Bias, Test Equity and Test Content

According to the *Standards for Educational and Psychological Testing* (AERA, APA, & NCME, 2014) Psychometric TEST BIAS and TEST EQUITY are two different ways of measuring TEST FAIRNESS.

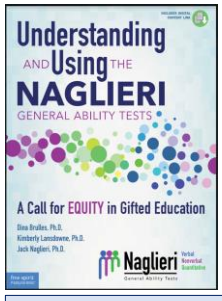


- … **if a person has had limited opportunities to learn the content in a test of intelligence, *that test may be considered unfair* … even if there is no evidence of psychometric test bias.**
- **Evidence of EQUITY is examined by test content and mean score differences.**



145

Race and Ethnic Average Score Differences by Ability Test



Traditional tests that include knowledge and *2nd-Generation* Ability Tests that minimize knowing

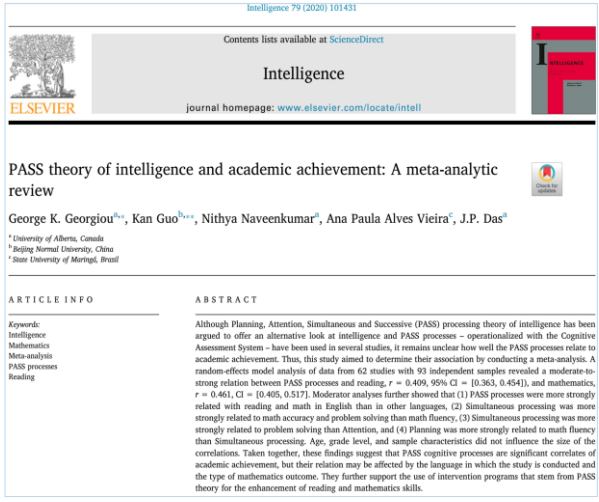
See Brulles, D., Lansdowne, K. & Naglieri, J. A. (2022). Understanding and Using the Naglieri General Ability Tests: A Call to Equity in Gifted Education. Minneapolis, MN: Free Spirit Publishing for more details.

Note: Even though a test may not show psychometric bias (Worrell, 2019) those tests with academic content that show large mean score differences are not equitable and are unfair.

	By Race	By Ethnicity
Tests that require knowledge	**Mn = 9.5**	**Mn = 5.2**
Otis-Lennon School Ability Test (distric wide)	13.6	
Stanford-Binet IV (normative sample)	12.6	
WISC-V (normative sample)	11.6	
WJ- III (normative sample)	10.9	10.7
CogAT7 (Nonverbal scale)	11.8	7.6
CogAT7 - Verbal	6.6	5.3
CogAT7-Quantitative	5.6	3.6
CogAT- Nonverbal	6.4	2.9
CogAT-Total (V, Q & NV)	7.0	4.5
WISC-V (statistical controls normative sample)	8.7	
Tests that require minimal knowledge	**Mn = 4.3**	**Mn = 2.9**
K-ABC (normative sample)	7.0	
K-ABC (matched samples)	6.1	
KABC-II (adjusted for gender & SES)	6.7	5.4
CAS-2 (normative sample)	6.3	4.5
CAS (statistical controls normative sample)	4.8	4.8
CAS-2 (statistical controls normative sample)	4.3	1.8
CAS-2 Brief (normative samples)	2.0	2.8
NNAT (matched samples)	4.2	2.8
Naglieri General Ability Test-Verbal	2.2	1.6
Naglieri General Ability Test-Nonverbal	1.0	1.1
Naglieri General Ability Test-Quantitative	3.2	1.3

Note: The results summarized here were reported for the Otis-Lennon School Ability Test by Avant and O'Neal (1986); Stanford-Binet IV by Wasserman (2000); Woodcock-Johnson III race differences by Edwards and Oakland (2006) and ethnic differences by Sotelo-Dynega, Ortiz, Flanagan, and Chaplin (2013); CogAT7 by Carman, Walther and Bartsch (2018) and Lohman (2016), WISC-V by Kaufman, Raiford, and Coalson (2016); Kaufman Assessment Battery for Children-II by Lichtenberger, Volker, Kaufman & Kaufman, (2006); CAS by Naglieri, Rojahn, Matto, and Aquilino (2005); CAS-2 and CAS2:Brief by Naglieri, Das, and Goldstein, 2014a and 2014b; Naglieri Nonverbal Ability Test by Naglieri and Ronning (2000), and Naglieri General Ability Tests by Naglieri, Brulles, and Lansdowne (2022).

146



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PASS theory of intelligence and academic achievement: A meta-analytic review

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ABSTRACT

Although Planning, Attention, Simultaneous and Successive (PASS) processing theory of intelligence has been argued to offer an alternative look at intelligence and PASS processes – operationalized with the Cognitive Assessment System – have been used in several studies, it remains unclear how well the PASS processes relate to academic achievement. Thus, this study aimed to determine their association by conducting a meta-analysis. A random-effects model analysis of data from 62 studies with 93 independent samples revealed a moderate-to-strong relation between PASS processes and reading, $r = 0.409$, 95% CI = [0.363, 0.454]), and mathematics, $r = 0.461$, CI = [0.405, 0.517]. Moderator analyses further showed that (1) PASS processes were more strongly related with reading and math in English than in other languages, (2) Simultaneous processing was more strongly related to math accuracy and problem solving than math fluency, (3) Simultaneous processing was more strongly related to problem solving than Attention, and (4) Planning was more strongly related to math fluency than Simultaneous processing. Age, grade level, and sample characteristics did not influence the size of the correlations. Taken together, these findings suggest that PASS cognitive processes are significant correlates of academic achievement, but their relation may be affected by the language in which the study is conducted and the type of mathematics outcome. They further support the use of intervention programs that stem from PASS theory for the enhancement of reading and mathematics skills.

Georgiou, G., Guo, K., Naveenkumar, N., Vieira, A. P. A., & Das, J. P. (2019) PASS theory of intelligence and academic achievement: A meta-analytic review. *In press Intelligence.*

PASS Research

- "The **CAS is highly correlated** with reading and math.
- "**The correlations are significantly stronger … than the correlations reported in previous meta-analysis for other measures of intelligence** (e.g., Peng et al., 2019; Roth et al., 2015)…(e.g., WISC) that include tasks (e.g., Arithmetic, Vocabulary)…"
- "if we **conceptualize intelligence as …[PASS] cognitive processes that are linked to the functional organization of the brain**" it leads to significantly higher relations with academic achievement."
- "and **these processes have direct implications for instruction and intervention**…"

147

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148