

LEARNING & THE BRAIN

We Needed Executive Function During COVID-19 and Still Do: Assessment and Intervention

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Summary: How More than 50% of important EF skills are Executive Functions that can be taught and practiced to improve the learning and after the pandemic. This means that the vast majority of success and employment is being in our new world.

Learning Objectives:
This session will provide participants will learn:
1. how the research support for Executive Functions in the classroom and in the home
2. how to use EF in the classroom and in the home
3. how to use EF for a comprehensive assessment of EF

WELCOME

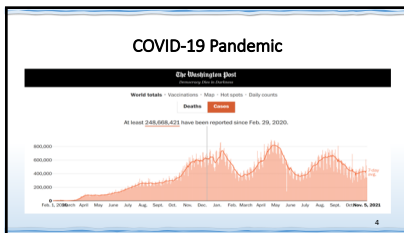
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DISCLOSURES

FOR MORE INFORMATION, PLEASE GO TO MY WEB PAGE

Why This Work?

- Interest in intelligence and instruction
- Working as a school psychologist in 1975...I realized that the tests I used had a profound impact on what I said about the results and ultimately the life of a student
- NY -> Georgia -> Arizona -> Ohio -> Virginia
- Tests and measurement became my passion even into my "retirement"
- We must follow the science



Why We Really Need EF During COVID-19?

- 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*
- *EF is especially important in NOVEL Situations such as COVID-19*
- Before COVID-19 we had plans and routines for doing so many things ...
- During COVID-19 we had to **rethink how to do most everything!**
- EF is what we use learn new ways of doing what we need to do.
- EF played a critical role in our survival

Learning loss due to school closures during the COVID-19 pandemic

Learning Loss amplifies the need for EF

Inequality in learning is a major concern after school closures

- Overall learning delay is clear
- Children of very low-educated parents suffer more from school closure than children from more-educated backgrounds.
- The learning delay is much stronger in schools with a higher share of disadvantaged children.

van de Werhorst, H. G. (2021). Inequality in learning is a major concern after school closures. *Proceedings of the National Academy of Sciences*, 118(20).

Presentation Outline

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

Conceptualization and Assessment of EF

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

Comprehensive Assessment of EF

- I suggest that if a person's frontal lobes are impaired that person would likely get low scores on:
 - Behaviors related to Executive Function
 - Performance measures Executive Function
 - Rating scales of Social
 - 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

The Curious Story of Phineas Gage

The story of Phineas Gage had a profound impact on our understanding of the Frontal Lobes

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.98)

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

- Thinking (Intelligence)
- Behaviors
- Work
- Social-emotional

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Executive Function

- 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 stated that the frontal lobes are about 'making decisions, leadership, motivation, drive, vision, self-awareness, and awareness of others, success, creativity, sex differences, social maturity...'

Executive Function(s)

- There is no formal accepted 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
- I initiated a study to answer the question: Is EF a unitary or multidimension concept when measured by observable behavior using my two EF rating scales?

Test Development → Research

CEFI

(Naglieri & Goldstein, 2012)

CEFI Adult

(Naglieri & Goldstein, 2017)

Executive Function(s)

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

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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

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

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

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

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"**
- But **WHY** does this matter?

CEFI (Naglieri & Goldstein, 2012) CEFI Adult (Naglieri & Goldstein, 2017)

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.

Jessica in 4th grade (Dr. Tulio Otero)

- Previous diagnoses of ADHD, ODD, Anxiety and Depression.
- Received OT since 1st grade.
- Problems following verbal directions, inefficient work, struggles to work in a noisy setting, is distractable, fiddles with objects, inflexible, and frustrates easily.
- She receives speech and language services for language processing issues.
- Currently takes medications to manage her diagnoses, she takes Clonidine 0.2 mg to help with sleep and anger issues. She also takes Ritalin 40 mg ER in the am and 10 mg booster at lunch time.

Jessica 4th grade (Dr. Tulio Otero)

PASS and Full Scale Scores

Planning	74
Simultaneous	84
Attention	85
Stop and go	85

Supplemental Composite Scores

Nonverbal CEF Index	78
Verbal CEF Index	86
Work in 9th m	88
Be calm if not in math	82
Be calm if not in	79

Impressions (Dr. Tulio Otero)

- This case is an example of the behaviors (CEFI) that are consistent with a low planning score on CAS2.
- Based on the data and teacher reports/observations, I see her low performance is driven by Low planning and Attention (EF).
- She often can't get to the point where she can fully recruit Attention, Simultaneous and Successive neurocognitive processes to be successful.

A 13 month old's EF At 19 months EF & Knowledge

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

- Learning depends upon instruction and EF
- At first, EF plays a major role in learning **NEW THINGS (COVID)** (see Goldstein, 2009, p. 40)
- When a new task is learned and practiced it becomes a skill and execution requires less EF (see Naglieri & Otero, 2017, p. 117)

THE NEW EXECUTIVE BRAIN

EF Skill?

- If EF is what we use in novel situations, then it can NOT be a skill.
- As SKILL is something we use with minimal thinking
- The definition of EF – **HOW WE DO WHAT WE DECIDE TO DO** – demands reflection, anticipation, selection of a plan, evaluation of the effectiveness of the plan, etc.
- Therefore to improve the USE of EF, we have to **help students decide for themselves**.
- Teaching students **WHAT TO DO** means they have to remember what someone told them – **THAT DOES NOT INVOLVE EF**
- Behaviors that we observe give some idea of the strategies being used

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Two Kinds of Executive Function Rating Scales

Strength Based Scales

Deficit Based 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**
- CEF: 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

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

Interpretation

- Compare each scale to the student's average scale and the normative average category
- Attention is a relative weakness AND it is below the Average range → **WEAKNESS**
- Emotion Regulation is significantly lower than the student's average but clearly in the Average range → **NOT a WEAKNESS**

CEFI and CEFI Adult Interpretive Reports & Interventions

www.efintheclassroom.net

FREE Interventions for EF Behaviors

<ul style="list-style-type: none"> • Attention • Emotion Regulation • Inhibitory Control • Initiation • Organization • Planning • Self-Monitoring • Working Memory 	<ul style="list-style-type: none"> • Sustained Attention • Emotional Flexibility • Cognitive Flexibility • Response Inhibition • Task Initiation • Organization • Planning • Response Inhibition • Working Memory
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Planning Lesson Student Responses

Students view FLASH MOB DANCE

Q1: 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: Teacher Probes & Student Responses

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 decide to do...That is **THINK out of the box**

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 Yulio Otero & Mary Moreno

Step 1 – Talk with Students

How Can You Be Smarter?

How can you be smart? Do you have a plan? Plan, Plan, Plan. Remember people say, "Think before you act." The plan will save you a lot of trouble. If you don't have a plan, you are going to waste a lot of time. The plan will save you a lot of trouble. If you don't have a plan, you are going to waste a lot of time. The plan will save you a lot of trouble. If you don't have a plan, you are going to waste a lot of time.

Think smart and use a plan!

Introduction to Executive Function (EF)

EF Behaviors

- EF & Cognition (Intelligence)
- EF & Social Emotional Skills
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Research about EF as ability, behavior, & SEL

Conclusions

EF is a Brain-Based Ability

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

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

PASS Theory of Learning Includes EF

28 Cognitive Assessment System: Redefining Intelligence From a Neuropsychological Perspective

Jack A. Naglieri and Yulio M. Otero

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

Jack A. Naglieri

PASS Theory Based on Luria's Concept of Functional Units

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

IQ defined by BRAIN function

- PASS theory is a modern way to define 'ability' (AKA – intelligence)
- Planning = THINKING ABOUT THINKING
- Attention = BEING ALERT
- Simultaneous = GETTING THE BIG PICTURE
- Successive = FOLLOWING A SEQUENCE

A Neurocognitive Test Measures Thinking not Knowing

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

- This is dependent on instruction
- "I know that!"

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
- "I need a plan!"

Six Ways to Measure PASS

20 min	40 min	60 min	
CAS2 Rating Scale (4 subtests)	CAS2 Brief (6 subtests, 20 minutes)	CAS2 Core (8 subtests, 40 minutes)	CAS2 Extended (12 subtests, 60 minutes)
Total Score Planning Simultaneous Attention Successive	Total Score Planning Simultaneous Attention Successive	Full Scale Planning Simultaneous Attention Successive	Full Scale Planning Simultaneous Attention Successive

• CAS2 Core & Extended English & Spanish for comprehensive Assessment

• CAS2 Brief for re-evaluation, instructional planning, gifted screening

• CAS2 Rating Scale for teacher ratings

• CAS2 Digital Assessment System (English & Spanish) coming in 2022

CAS2 Scales includes EF

- CAS2 yields scores for EF with or without working memory.

PASS Theory: 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
- Planning (and Attention) tests measure Executive Function

PASS Theory: Attention

- Attention is a neurocognitive ability that a person uses to selectively attend to some stimuli and ignore others.
 - selective attention
 - focused cognitive activity over time
 - resistance to distraction

PASS Theory: Simultaneous

- Simultaneous processing is used to integrate stimuli into groups.
 - Each piece must be related to the other
 - Stimuli are seen as a whole
- Academics:
 - Reading comprehension
 - geometry
 - math word problems
 - whole language
 - verbal concepts

PASS Theory: Successive

- Successive processing is a basic psychological process we use to manage stimuli in a specific serial order.
 - Stimuli form a chain-like progression
 - Recall a series of words
 - Decoding words
 - Letter-sound correspondence
 - Phonological tasks
 - Understanding the syntax of sentences
 - Comprehension of written instructions

EF Intervention for Math: ADHD & SLD Students

Planning Facilitation for Math Calculation

Math calculation is a complex activity that involves building basic math facts, using working memory, and working with units. This calculation involves attention to the relevant items. Children who are poor at math may have trouble with these complex tasks because of their limited attentional resources. For children who have trouble with math, we need to help them improve their ability to focus on the math they are doing.

How to Teach Planning Facilitation

The strategy involves teaching students to use a checklist to help them plan and solve math problems. The checklist includes: 1. Read the problem carefully. 2. Circle the numbers and the operation. 3. Write down the numbers and the operation. 4. Solve the problem. 5. Check your answer.

Strategy Instruction EF Intervention for Math

- Teachers facilitated discussions to help students become more self-reflective about use of strategies.
 - 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?

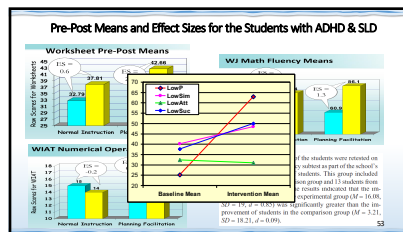
Student Plans: ADHD & SLD Students

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.

I try not to fall asleep.



Summary of PASS Intervention Research in Essentials of CAS2

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

Mathematical Instruction and PASS Question Prompts: An Intervention Study

Essentials of CAS2 Assessment

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Frontal Lobes and Emotion

Goldberg (2005, p.104-105)

- 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"

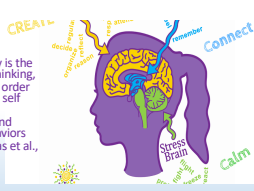
Feifer's Emotional Disorders book contains a collection of papers on the relationship between EF and Emotional Disorders

See Feifer@comcast.net

EF & Social Emotional

Social emotional activity is the process of integrating thinking, feeling, and behaving in order to become aware of the self and of others, make responsible decisions, and manage one's own behaviors and those of others (Elias et al., 1997). THAT IS EF




Phineas had Social Emotional deficit

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

Kong (2013): IQ, SEL & Achievement

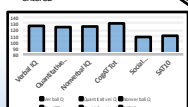
- Research Study on SEL, IQ and Achievement
- DESSA is a 72-item rating scale of social-emotional skills such as Self Awareness, Relationship Skills, etc. related to resilience
- CogAT is based on traditional IQ (Army Alpha and Beta) containing Verbal, Quantitative, Nonverbal
- SAT is norm-referenced achievement test



Kong (2013): IQ, SEL & Achievement

- DESSA Total correlated .44 with Achievement (reading, math, language)
- CogAT Total correlated .36
- Hierarchical regression analysis showed that
 - CogAT did not add to the prediction of achievement after DESSA scores were entered

DESSA predicted reading, language and math scores over IQ (CogAT) scores because: **Social behaviors REVEAL EF**




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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 from CAS



Academics

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

Assessment	Reading	Math	Writing	EF
Reading Comprehension	X			
Math Computation		X		
Writing Fluency			X	
Executive Function (EF)				X

EF and Achievement

Any task that is influenced by HOW the student approaches the problem is EF

SOL 5.2a
Converting Fractions to Decimals

Which fractions are equivalent to $\frac{5}{8}$?

1. Question: What does 5/8 mean? Answer: 50%
2. What does 50% of a pie mean? One Half.
3. How can you tell if a fraction equals one half? If the top number NUMERATOR is the bottom DENOMINATOR.

4. EASY!

Using good EF to overcome a neurocognitive processing disorder Ben's Problem with Successive processing

Scores (M= 100, SD= 15)

It is good but he isn't using this ability to solve problems.

Ben's SLD: Discrepancy Consistency Method

- Discrepancy between high and low processing scores
- Discrepancy between high processing and low achievement
- Consistency between low processing and low achievement

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 sequence
- How do we help him learn better?

Ben's Problem with Successive Ability

Teach him to use his strength in EF (Planning)

How Can You Be Smarter?
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 good ability to learn new things. Being smart is learning new things quickly because you know how to learn. This is called "learning how to learn."

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 good ability to learn new things. Being smart is learning new things quickly because you know how to learn. This is called "learning how to learn."

Think smart and use a plan!
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 good ability to learn new things. Being smart is learning new things quickly because you know how to learn. This is called "learning how to learn."

What Does Being Smart Mean?
One ability that is very important in school/learning, the ability to plan. When you plan, you think about what you need to do to reach your goal. The ability also helps you control what you do. You can stop something you are doing if it is not working or if you are not doing it right. It also helps you make good decisions about what to do next.

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. Figure 1 below is included in the IEDS manual on the CD, and provides a list and explanation of the most important information presented in a typical sequence to build a motor series.

- 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?"
- Repeat the sequence 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.
- Teach children that the sequence of information is critical for success.
- Repeat to students that using 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
Providing students with chunking strategies can help them to break down words into smaller, more manageable parts. This can be done by grouping letters into syllables or by identifying common letter patterns. For example, the word "butter" can be broken down into "but" and "ter".

Segmenting Words for Reading/Decoding and Spelling
Segmenting words into individual letters or syllables can help students to identify and remember the correct order of letters. This can be done by using finger tracing, air writing, or by using letter cards. For example, the word "cat" can be segmented into "c", "a", and "t".

How to Teach Chunking for Reading/Decoding
1. Choose a word to chunk. 2. Write the word on a piece of paper. 3. Circle the first letter of each syllable. 4. Read the word aloud, saying each syllable separately. 5. Repeat the process with other words.

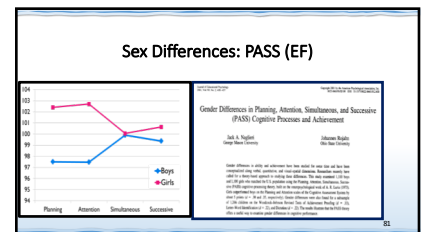
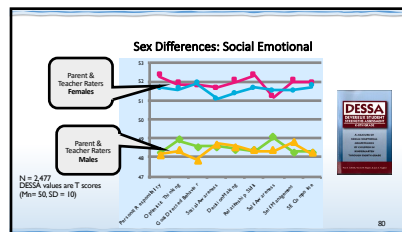
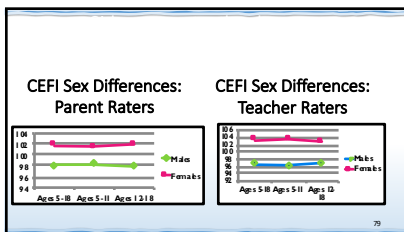
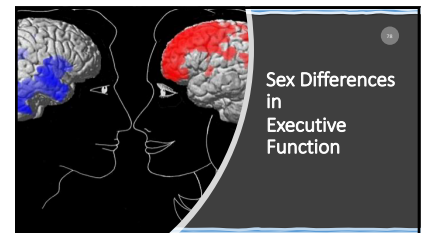
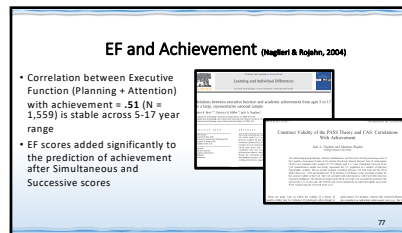
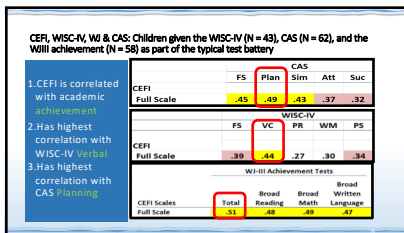
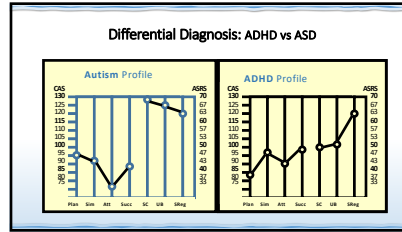
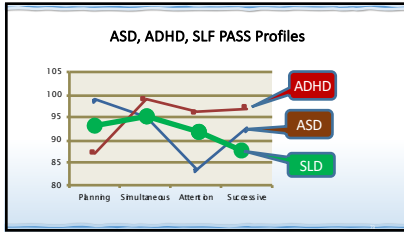
How to Teach Segmenting Words
1. Choose a word to segment. 2. Write the word on a piece of paper. 3. Write each letter of the word on a separate piece of paper. 4. Read the word aloud, saying each letter separately. 5. Repeat the process with other words.

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ADHD & ASD Attention Difficulty

- Individuals with ASD have been described as having "difficulties in disengaging and shifting attention" (p. 214) (see Klinger, O'Kelly, & Mussey's chapter 8 in *Assessment of Autism Spectrum Disorders* (Goldstein, Naglieri, & Ozonoff, 2009))
- the ASRS (6-18 Years) and Cognitive Assessment System (CAS; Naglieri & Das, 1997) was administered to children diagnosed with an ASD



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Conclusions

- Because so many things are still evolving due to COVID, EF continues to be the key to success
- Assessment of ADHD should evaluate cognition (PASS), behaviors, social emotional competence and academic skills
 - Students with ADHD are particularly at risk because they are low in EF.
 - If a student is low in EF → Cognitive Intervention
 - If a student, for example meets the criteria for ADHD has Average or above EF → Behavioral Intervention
- ALL students can BEFEFIT from Thinking Smarter by using EF

Time for Final Questions and Thoughts



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