Executive Functions: Integrating Oral Language, Self-Regulation, and Academic Achievement

The State University of New York at Fredonia
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The Pragmatics of Executive Function: What SLPs and Educators Should Know and Be Able to Do

- Understand the components of executive function
- Understand the oral language underpinnings of executive function
- Understand standardized and informal assessment measures and techniques
- Use parent, teacher, and child anecdotal data to round out the diagnostic picture
- Observe classroom and test-taking behaviors to obtain qualitative as well as quantitative data
- Integrate diagnostic data from neuropsychology, psychology, special education, occupational therapy, speech-language therapy
- Design and/or facilitate appropriate interventions and learning contexts

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Introduction

There are many children whose diagnostic data do not predict the difficulties they face every day in school.

Many times the cause for the unexpected difficulty is weak executive functioning.

Introduction

Children who have executive functions dysfunction have a difficult time adapting to the teaching styles and rules of different teachers, conceptualizing, planning and implementing a research report (and even a simple book report), and performing tasks that have multiple layers (such as spontaneous writing and the need to integrate knowledge in spelling, capitalization/punctuation, sentence structure and handwriting).
Introduction

Some children withdraw and become very cautious learners, others become defiant, and still other children become noncompliant and appear “lazy” or “unmotivated.”

Children who have executive dysfunction often become depressed and/or anxious because they just can’t negotiate their world efficiently.

Children who have executive function difficulties are convinced they are “stupid.”

These frequently very bright children never take advantage of educational opportunities that can affect the quality of their lives.

Often, children with executive function difficulties become very frustrated because “they can’t do school” despite their ability to understand the concepts taught in the moment they are taught.
Executive Functions

Things you do metacognitively to get through your day:

- self-regulation
- self-direction of our day-to-day and longer term functioning
- purposeful management of thinking
- purposeful management of behavior to achieve some desired outcome

(Kaufman, 2010, p. 2)

The use of Executive Functions enables human beings to:

- Develop and carry out plans
- Form analogies
- Obey social rules
- Solve problems
- Adapt to unexpected circumstances
- Do many tasks simultaneously
- Place episodes in time and place to allow for efficient retrieval of memories
Executive Functions: Skills for Life and Learning

http://developingchild.harvard.edu/resources/inbrief-executive-function-skills-for-life-and-learning/

Center on the Developing Child
Harvard University

A Functional Definition of Executive Dysfunction

Phillip:
14 years old
9th grader

Poor academic performance and motivation...
Anecdotal Reports:

- School apathy
- Very smart but failing
- Good student in elementary school
- Grades fell in middle school
- Difficulty completing work and turning it in
- Last minute assignment completion
- Struggles with organization, project planning
- Bored in school

A Functional Definition of Executive Dysfunction

PARENTS

- Tourette’s age 7, ADHD, combined, age 8
- Attention seems to be improved, no longer takes medication
- Resists parental help

PHILLIP

- Is popular, but has a small select group of friends
- Makes careless errors when working quickly
- Has poor handwriting;
Hallmarks of Executive Dysfunction: Phillip’s Parent/Teacher’s reports

- Mild to extreme disorganization
- Described as lazy, unmotivated, unable to get work done, confused
- Disorganized expressive oral and written language
- Late emerging academic difficulties
- Anxious despite grade level skills

Hallmarks of Executive Dysfunction: Psychologist’s perspective

- Easily distracted by external or internal stimuli
- Perseveration of response sets
- Difficulty with initiating activity
- Difficulty with maintaining effort
- Difficulty with recognizing and/or utilizing feedback
- Difficulty modulating activity without cues
- Poor self-awareness of deficits

D. Williams, 1989
Development of Executive Functions

Executive Functions develop sequentially to “build a mental structure that facilitates self-control.” (Barkley, 2010, p. 70)

- From external events to internal forms of information (past and future)
- From controlled by others to self-control
- From the present to the future
- From instant gratification to deferred gratification

(Barkley, Taking Charge of Adult ADHD, 2010, pp. 70-71)

Barkley (1997)

Five essential elements:

- Behavioral inhibition
- Working memory (nonverbal)
- Internalization of speech (verbal working memory)
- Self-regulation
- Reconstitution
Development of Executive Functions

Behavioral Inhibition
- Emerges 5-12 months
- Gives the infant power to respond or not and eventually gives rise to:
  - Ability to delay or prevent a response to deter a negative in hopes of a positive impact
  - Stop ongoing, unsuccessful behaviors
  - Manage distractions

Development of Executive Functions

Working memory (nonverbal)
- Emerges 5-12 months
- Needed to remove infant from here and now, facilitates hindsight and forethought
- Behavior brought under the control of mental representations

Makes me think of object permanence
Internalization of speech (verbal working memory)
- Begins as adult management of child behavior, but shifts to a tool used by child to manage adult behavior and gradually for self-management
- Emerges in the 3-5 year old, achieved by 9-12 years
- Eventually facilitates the development of
  - rules
  - Problem solving strategies
  - self-monitoring
  - self-instruction
  - metacognition

Development of Executive Functions

Self-regulation of affect/motivation/ arousal
- Earliest demonstration at about 5 months
- Increases as locomotion develops
- Involves subskills:
  - Regulation of emotional and motivational states
  - Regulation of arousal
  - Capacity for social perspective taking
- Enhanced by the development of language
- Tied to working memory and internalization of speech
Development of Executive Functions

Reconstitution
- Analysis and synthesis of behavior
- Break complex behavioral sequences into small units and recombine in novel ways to solve new problems of reach new goals
- Represents cognitive flexibility, fluency, creativity (Dawson & Guare, 2010)
- Emerges at about age 6 years

Development of Executive Function: Think about this

https://www.youtube.com/watch?v=QX_oy9614HQ

Predictor of self-control:
- 2 of 3 children ate the marshmallow
- Those who did not eat the marshmallow:
  - Less likely to be overweight by 11 years old
  - Less likely to use drugs
  - Had higher SAT scores
What about EF and Preschoolers?

Executive Function Disorder in Higher Cognitive Activities –
Evident throughout the Life Span:

- Can talk the plan but not necessarily walk it
- Difficulty with generalization and/or carryover of single skills
- Weak Memory for retrieval or procedure
- Disorganized way of responding
- Inability to break down projects into manageable components
- Reduced attention to details
Do These Behaviors Persist through High School? College? Life?

- Neurological maturity = improved executive skills
- Many do not improve until 25 to 30 years of age
- Some always struggle and need coaching or a spouse with a great frontal lobe system and a lot of love...

Executive Functions and Intelligence

- Crystallized intelligence
  - Knowing facts or knowledge
- Fluid intelligence
  - Reasoning ability
- Self-regulation
  - Ways that people adjust behavior
- Social emotional skills (SELS)
  - Emotional self-awareness, self-regulatory
- Noncognitive
  - Anything not academic or IQ but important for academic success such as persistence, determination and SEL

EF skills have less to do with possessing knowledge or facts then it has to do with the use of knowledge in the service of goals

Zelazo, Blair, Willoughby, 2017
Make a Connection

Smart but no common sense....

Someone with high functioning autism?

Someone with ADHD with impulsivity?

Makes me think of...

Ways to Conceptualize Executive Functions

- Basic interactive functional brain units (Luria)
- Inhibitory Control (Barkley)
- Anatomical and Mechanistic Framework Models of Catecholamine Regulation of Executive Functions (CF Brocki, Fan, Fossella, 2008)
- Basal ganglia thalamocortical circuit model
- Supervisory Attentional System (SAS) (Norman & Shalice)
- Three component model (Miyake)
- Somatic marker hypothesis (cold vs. hot) (Demasio)
- Domains (Goia & Isquith)
Basic Interactive Functional Brain Units (Luria, 1966)

Human brain has 3 functional units interactively linked

- Brain stem – regulates and maintains arousal of cortex
- Cortex (temporal, parietal, occipital lobes) – encodes, processes, stores information
- Frontal lobes – programs, regulates, verifies human behavior
  - contains prefrontal cortex (PFC) that controls mental activity and behavior

Inhibitory Control (Barkley)

Inhibitory control ultimately impairs the other executive functions:

- Working memory
- Internalization of speech/verbal working memory
- Reconstitution
Inhibitory Control (Barkley)

Barkley uses his hierarchical model of EF to explain that difficulty with inhibitory control ultimately impairs EF in ADHD children and adults.

Anatomical and Mechanistic Framework Models of Catecholamine Regulation of Executive Functions

Basal ganglia thalamocortical circuit models provide:

- Neuroimaging studies of dopamine movement in pathways in the prefrontal cortex
- By studying levels of dopamine, scientists are able to separate working memory processes from inhibitory control processes
- Provides a framework to conduct studies involving neurobiochemistry, imaging, and genetics which can inform medical treatments, especially for symptoms associated with ADHD, which impair executive functioning

(Brocki, Fan, Fossella, 2008)
Neurotransmitters & Executive Functions

Animal studies:

The PreFrontal Cortex is sensitive to variation in levels of neurotransmitters present in the synapse, (Wilson, et al. 2010)

- catecholamines,
- dopamine, and
- norepinephrine

In humans, levels of dopamine and norepinephrine vary for a variety of reasons, one of which is stress (Cools & D’Esposito, 2011)

- These neurotransmitters increase moderately from baseline, PFC function is efficient.
- When neurotransmitters rise beyond an intermediate level (greater stress), they shut down neural activity in PFC.

Supervisory Attentional System (SAS) (Norman & Shalice)

- Employs Luria’s frontal lobe functioning
- Two systems responsible for programming, regulating, and verifying human actions and thoughts:
  - Contention scheduling – routine, overlearned tasks, allows for prioritizing order of the tasks (making coffee while talking on the phone)
  - Supervisory attentional - regulates non-routine and novel tasks
    - Decision-making
    - Error correction or trouble shooting
    - Responses not yet over-learned or that require novel action sequences
    - Anticipation of danger
    - Overcoming strong habit response, resisting temptation
Three Component Model \textsuperscript{(Miyake)}

\textbf{Updating}
\begin{itemize}
\item Update and monitor working memory representations
\end{itemize}

\textbf{Shifting}
\begin{itemize}
\item Ability to change between mental sets or tasks
\item Engaging with or disengaging with a task (card sorting)
\end{itemize}

\textbf{Inhibition}
\begin{itemize}
\item The ability to deliberately inhibit dominant, autonomic responses when necessary
\end{itemize}

Somatic marker hypothesis (cold vs. hot) \textsuperscript{(Damasio)}

Emphasizes the role of the frontal lobe in emotion and social behavior, especially decision-making

Top-down, regulatory processing that depends on the PFC

\textbf{Hot component}
\begin{itemize}
\item Processes that operate in motivationally and emotionally charged situations
\item Aspects of EF needed in motivationally significant situation (winning or losing a game)
\item Tasks reflect flexible appraisal of whether to approach or avoid a salient stimulus (marshmallow test)
\item Deliberate emotion regulation (e.g., When trying to reduce anxiety, sadness, anger or up-regulating to accomplish a goal)
\end{itemize}

\textbf{Cool component}
\begin{itemize}
\item Processes that operate in neutral contexts
\item Tasks in a laboratory, decontextualized that lack an affective or motivational component
\end{itemize}
Make a Connection

Development of the Pre Frontal Cortex and Executive Functions

- Neuroimaging studies show that children’s EF-related brain activity is generally more diffuse, meaning more spread out and less isolated to the specific pathways seen in adults (Durston et al. 2006; Eslinger et al. 2009).

- With increasing age, there is a shift from more diffuse to more focal activity (Fair et al. 2009) -> increased ability to process information (Rypma and Prabhakaran 2009).

- Brain development is hierarchical:
  - sensory and motor first → cortical areas associated with more complex processes, such as EF, develop later
Executive Functions Domains (Gioia & Isquith)

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Experience aids Executive Functions

- Experience shapes neural connections that underlie its functions (Posner and Rothbart, 2007)

- Repeated exposure to tasks that require EF problem solving skills should
  - Strengthen the skills
  - Increase efficiency in the neural circuitry
  - Increase the likelihood the skills will be activated in the future (Shields and Lee, 2010)

Executive Functions, Plasticity, Development, Academic implications

- Training studies have shown malleability of the neural circuitry that underlies working memory and other aspects of EF in children and adults (Klingberg et al. 2005; Olesen, Westerberg, and Klingberg 2003; see Karbach and Unger 2014, for review).

- Evidence that supports the generalizability of gains in EF skills to academic achievement and other positive life outcomes is mixed at best (Melby-Lervag, Redick, and Hulme 2016).

- There are implications in subject areas that make high demands on EF:
  - math,
  - reading comprehension,
  - other subjects that require deliberate reasoning (Gropen, Hoisington, and Ehrlich 2011).
Poverty, Achievement Gap, Executive Functions, and Resilience

- Lower SES is associated with lower EF skills, even when controlling for general cognitive ability (Farah et al. 2006; Farah et al. 2008; Masten et al. 2012; Mezzacappa 2004; Noble, Norman, and Farah 2005; Obradović 2010)

- Lower EF skills in children from lower SES families are disadvantaged in a classroom context

- Evidence exists that supports the notion that strong EF skills serve as a protective factor against the academic risks associated with poverty (Masten et al. 2012; Obradović 2010).

Executive Functions and learning disorders

- Difficulties with executive functions are associated with learning difficulties, particularly when working memory is affected. (Geary 2011; McLean and Hitch 1999; Swanson, Howard, and Saez 2006; Toll et al. 2011)

- Other disorders affected:
  - Autism Spectrum
  - Conduct Disorder
  - Obsessive-Compulsive Disorder
  - ADHD
Language & Executive Functions

As proposed by Vygotsky (1962) and Luria (1961), language is integrally related to and possibly a mandatory precursor to EF.

Internalized language allows a child to delay responses, which develops working memory, and serves to allow for verbal mediation in multi step problem solving. (Welsh & Pennington, 1988)

When the language system is impaired, there is a greater likelihood that the child will also manifest some degree of executive deficit. (Gioia, Isquith, & Guy, 2000, p 10)

Working Memory & Executive Functions:

Thought to be the cornerstone of higher-order cognitive operations and complex goal-directed behaviors such as:

- Reasoning (Just & Carpenter, 1992)
- Vocabulary acquisition (Gathercole & Baddeley, 1989)
- Reading (Jorm, 1983)
- Speech comprehension (Vallar & Baddeley, 1984)
- Math (Logie and Baddeley, 1987)
Working Memory & Language Comprehension (Just & Carpenter, 1992)

- Activation underlies storage and processing of information.
- Working memory capacity (total available activation) should predict performance on language comprehension tasks (measures of storage and processing efficacy).
- An element (word, phrase, grammatical structure) can be stored and manipulated within working memory as long as the element’s activation level is above a minimal threshold.
- If the total amount of activation is not sufficient to perform a task, activation can be allocated by scaling back the activation of other elements to be stored and processed.
- As a result, some elements will not be available for further processing like “an across the board budget cut.”
- The result is both slowing and deterioration in the processing of information.

Working Memory & Language Comprehension

- People with high working memory comprehend sentences with explanatory information but people with low working memory did not benefit from that disambiguating information - too much to hold on to (Daneman and Carpenter, 1980).
- Clinically, this can be seen in children who remember unrelated word strings better than meaningful sentences.
- Has implications for how teachers need to regulate their language of instruction for children with EF difficulties.
- There is a difference between language processing (qualitative) and auditory processing (quantitative).
**Limited Capacity of Working Memory (Baddeley and Hitch, 1974)**

- A primary function of the Central Executive is to allocate processing resources within and across tasks for success and efficiency.
- When people have to maintain 6 items in memory, performance on reasoning and comprehension tasks are impaired.
- However, if memory load is reduced to 3 items, reasoning and comprehension performances are not disrupted.
- Therefore, performance is not disrupted unless working memory capacity is exceeded.

*That may be why children with executive function difficulties learn isolated skills and perform well on individually administered tests, but function poorly in an “on-line” classroom context.*

And maybe that’s why their diagnostic test scores are not that weak.
**Inhibitory Control Model of Working Memory** (Hasker & Zack, 1988)

- Designed to explain age-related decrements in working memory.
- Suggest that older adults have difficulty inhibiting task irrelevant information that intrudes upon task relevant information stored in working memory.
- The intruding information consumes available storage.

**Inhibitory Control Model: Implications for Children**

- ADD/ADHD children cannot inhibit distracting information and therefore cannot learn up to their cognitive potential.

- Hasker & Zack (1988) conjecture that deficits in working memory contribute to difficulties in older adults when
  - performing calculations
  - following shifts in conversations
  - comprehending complex sentences.
When Working Memory Doesn’t Work…

Language development
- Weak vocabulary development
- Immature and inconsistent syntax, grammar, and morphology development and usage
  - Difficulty following lengthy discourse to gather information for later use

Reading
- Weak decoding
  - Poor comprehension
  - Fluency weaknesses (rate, accuracy)

When Working Memory Doesn’t Work…

Written language
- Weak and/or inconsistent spelling
- Restricted and/or disorganized content
- Inconsistent use of punctuation/capitalization awareness and usage

Math
- Difficulty with mastering basic math facts
  - Confusion with multi-step calculations
  - Difficulty holding all data necessary for solving word problem
Speed of Cognitive Decisions and Executive Functions

- Salthouse, 1991, suggests that speed of cognitive decisions may be a more powerful predictor of cognitive performance than working memory.

- Consider the child in class who cannot finish his work or who takes several hours each night to complete homework.

- Or, is speed of cognitive decisions related to working memory?

Cognitive Flexibility & Executive Functions:

Refers to the ability to shift cognitive set, attitude, thought, or attention in order to perceive, process or respond to situations in different ways.

Shift has to occur as swiftly as the demands of the environment.

Stuss, et al. (1983) Say that poor cognitive flexibility is a major reason why people with frontal lobe lesions have problems maintaining productive employment and social relations.
Cognitive Flexibility, Executive Functions, and Oral Language

- Forms of cognitive flexibility
- Producing diverse ideas.
- Considering response alternatives.
- Modifying plans and behavior to manage changing circumstances and long term goals.
- Reactive vs. spontaneous flexibility.

Think about adolescents with weak expressive language.

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Cognitive Flexibility, Executive Functions, and Oral Language

**Reactive Flexibility:**
Ability to freely shift cognition or behaviors in response to a changing task or situation.

**Spontaneous Flexibility:**
Ideational fluency
- Ability to produce large number of ideas.
Semantic fluency
- Ability to produce a variety of diverse ideas.
Cognitive Flexibility

What are the error patterns?
Perseverations or “stuck in set.”
(Sandson & Albert, 1984)
Emotional distress, frustration

Executive Function, Working Memory, Speed of Processing, and Oral Language

What are the links?

Difficulty with:
- Language comprehension
- Following directions
- Expressive language
- Rapid retrieval for communicating
- Language flexibility
- Problem-solving
- Language details
- Simultaneous processing of language
Executive Dysfunction in Children:

No singular disorder of EF

EF is reflected by a number of symptoms

EF is often reflected in other primary difficulties such as learning disabilities, Tourette’s Syndrome, ADHD, TBI, or cranial radiation treatment for leukemia
This sounds like…..

ADHD!

What’s the difference?

Is there a difference?

Russel Barkley: ADHD is a disorder of Executive Functions, not attention

https://www.youtube.com/watch?v=GR1JZJXc6d8

5 Executive Functions involved in self-regulation

ADHD is not about knowing what to do, but about doing what one knows.
— Russell Barkley
Let’s Evaluate

► What did you already know?

► What did you learn?

► What questions do you have?

► What effect does this portion of the talk have on you?

► Who are you thinking about?

Neuroanatomy of Executive Function

Associated with frontal lobes and connections, which occupy ~1/3 or total cortical surface.

Human frontal lobes are dramatically larger than lower animal forms implying that uniquely human functions are dependent on the frontal lobes (Filley, 2000, p. 96).

Until recent technology, studies of focal brain lesions related EF to temporal lobes.
Neurological Localization of Executive Functions

Four Lobes: Frontal, Temporal, Parietal, Occipital

Frontal Lobes:
- Center of self-directed action and output
- Initiates movement
- Problem solving
- Initiates goal-oriented behavior

Temporal, Parietal, Occipital Lobes:
- Receive, process, store information

Dorsolateral frontal lobe (upper and lateral)
- Goal-setting, planning, organizing, initiating, shifting, purposeful attention
- Problem solving

Orbitofrontal lobe (lower portion, near eye sockets)
- Levels of effort needed to accomplish goals
- Connected to amygdala (emotional storage/processing center)
- Enables inhibition of behavioral impulses and control of emotions
- Weaknesses manifested by verbal and physical impulsivity

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Neurological Localization of Executive Function: Prefrontal Lobe Connections

PFC connected to every functional unit of the brain
- Sensory information
- Memory
- Emotions
- Movement

Influential with information storage through connections with the hippocampus (primary router of declarative memory)
- New info in working memory + link to known info = ↑ retention

Connected to Reticular Activating System
- Located in brain stem
- Responsible for arousal/activation throughout the midbrain

Basal Ganglia
- Collection of nuclei at the base of the cerebral hemispheres that work with frontal lobes to direct movement and basic elements of cognition
- Connected to cortical and subcortical regions, including cerebellum (Hale and Fiorello, 2004)
- Activated for talking and walking
- Caudate nucleus, putamen, nucleus accumbens

Instructions of the PFC

(Barkley, 2006)
Neurological Localization of Executive Function: Prefrontal Lobe Connections

**Cerebellum**
- Originally thought to rule over coordinated movement and balance
- Recently, thought to compare intention of movement and elements of cognition with actual performance (Timmann & Daum, 2007; Best, 2001), somewhat like a "quality control mechanism."

**Parietal Lobe**
- Perceive and store tactile information (somatosensory)
- Process spatial information in conjunction with occipital lobes for self-awareness (where am I) and environmental awareness
Neurological Localization of Executive Function: Prefrontal Lobe Connections

Amygdala

- Memory, motor functioning, cognition
- Emotional memory and processing
- Fight or flight reflex
- Anger responses
- Amygdala highjack \cite{Goleman, 1995}
- Linked to storage of “emotional baggage” \cite{Chaill, Babinsky, Markowitsch, & McGaugh, 1995}

Neurological Localization of Executive Function: Prefrontal Lobe Connections

Ammmm... See the close proximity of the Orbital Prefrontal Cortex and the Amygdala. No wonder the OPC serves as the emotional overseer!
Neurological Localization of Executive Function: Pre-frontal Lobe Connections

While the PFC is the major orchestrator of human cognition and purposeful actions and movements, it is connected to other areas of the brain to enable humans to focus, regulate, and control.

Joan’s EF Red Flags

- May perform well through grade 5, and then starts to struggle
- Presenting concern is reading comprehension, but tests well on oral language tests as well as some reading tests
- Has good splinter skills, but difficulty with integration
- Poor attention stamina
- Poor homework compliance
- Poor initiation of tasks
- Dislikes writing
- Disorganized written language
- Generally disorganized
- Takes a long time to do homework
- Gets stressed
- Shuts down with frustration
- Has been called “lazy”
- Very bright, knows a lot of things, but does not perform well on tests, expressing thoughts in writing
- Forgets multi step math processes
Executive Functions Domains (Goia & Isquith)

- Initiate
- Self-monitor
- Inhibit
- Shift
- Plan
- Organization of materials
- Task-monitor
- Emotional Control
- Working Memory
- Metacognitive Regulation Inventory
- Behavioral Regulation Inventory
- Emotional Regulation Inventory

Behavioral Definitions for Executive Functions Subdomains Chart
(Gioia, Isquith, and Guy, 2000)

Behavioral Definitions for Executive Function Sub-domains handout

A way to “operationalize” understanding and addressing different manifestations of executive functions.
### Behavioral Definitions for Executive Function Sub-domains chart (Gioia, Isquith, and Guy, 2000)

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### Assessment of Executive Function

- **Team members:** psychologist, neuropsychologist, SLP, OT, Special Educator
- **License specific tests by state**
- **There is no one test for EF**
- **Case history, anecdotal data, observations**
Assessment of Executive Function:

- Case history: School, family, development
- Observation and interviews: Family, student, teachers
- Formal Tests: Cognitive, academic, oral language

Informal Observation

- Can the child plan and organize to age expectations?
- Does the child need constant prompting to stay on task?
- Does the child need encouragement to persist?
- Does the child learn routines?
- Does the child generalize and is he flexible with routines?
- Can the child manage materials?
Tell me more

- Adapting different teaching styles
- Conceptualizing, planning and implementing a research report
- Performing tasks with multiple layers

Assessment of Executive Function:

- Inhibition tasks
- Cognitive flexibility tasks
- Problem solving tasks
- Organization tasks
- Planning tasks
- Self-monitoring tasks
Questionnaires

Behavioral Regulation Inventory of Executive functions (BRIEF), school-age, adult, preschool versions; self-report for adolescents (www.parinc.com)

There are others....
Neuropsychological: Planning

Require sequence and planning ahead:
- Tower of Hanoi
- Clock drawing
- WISC-V Mazes
- WJcog-IV Planning
- Ray-Osterrieth Complex Figure
- Beery-Beuktenica Test of Visual-Motor Integration
- Tower Test, Delis-Kaplan Executive Function System (D-KEFS)

Neuropsychological: Organization

Requires development of a strategy to categorize or sort:
- Wisconsin Card Sorting Test
- WISC-V Object Assembly
- WISC-V Block Design
- WISC-V Picture Arrangement
- Sorting Test, D-KEFS
Neuropsychological: Inhibition

Require ability to ignore extraneous irrelevant information that may conflict with a goal:
- Stroop Test
- Test of Variables of Attention
- Gordon Diagnostic Inventory
- WJcog-IV Pair Cancellation
- Color-Word Interference Test, D-KEFS

Neuropsychological: Cognitive Flexibility

Requires shift from one thing to another when feedback indicates the need to change:
- Trail Making Test, D-KEFS
- WJcog-IV Analysis/Synthesis
- WJcog-IV Concept Formation
- Sorting Test, D-KEFS
- Comprehensive Trailmaking Test
Neuropsychological: Problem Solving

Nonverbal problem solving to dissociate language from the ability to reason nonverbally:
- Raven’s Progressive Matrices
- WISC-V Block Design
- WISC-V Object Assembly
- WJcog-IV Analysis/Synthesis
- WJcog-IV Concept Formation

Neuropsychological: Self-monitoring

Requires person to monitor items they have produced while continuing to generate new items:
- FAS (Controlled Oral Word Association Test)
- California Verbal Learning Test
- WJcog-IV Retrieval Fluency
- Verbal Fluency Test, D-KEFS
- Design Fluency Test, D-KEFS
Neuropsychological: Working Memory

Requires person to listen to/see information and manipulate it the short term buffer
- WISC-V Digit Span
- WISC-V Arithmetic
- WJcog-IV Numbers Reversed
- WJcog-IV Auditory Working Memory
- WJcog-IV Sound Blending
- WRAML-2 Number/Letter
- WRAML-2 Story Memory

Oral Language: Planning

Require sequence and planning ahead:
- CELF-5 Sentence Formulation
- CELF-5 Word Definitions
- CELF-5 Metalinguistics/Conversation
- TOAL-4 Writing/Grammar
Oral Language: Organization

Requires development of a strategy to categorize or sort:
- CELF-5 Metalinguistics/Conversation
- CELF-5 Sentence Formulation
- CELF-5 Word Definitions
- LPT Categorization
- TOWK Word Definitions

Oral Language: Inhibition

Require ability to ignore extraneous irrelevant information that may conflict with a goal:
- G-F Test of Auditory Discrim.
- WJcog-IV Auditory Attention
- TOAL-4 Reading/Grammar
- CELF-5 Metalinguistics/Making Inferences
Oral Language: Cognitive Flexibility

Requires the ability to shift from one thing to another (when feedback indicates the need to change).

- CELF-5 Metalinguistics/Multiple Meanings
- CELF-5 Metalinguistics/Making Inferences
- CELF-5 Sentence Assembly
- CELF-5 Semantic Relationships
- TOAL-4 Speaking/Vocabulary
- TOAL-4 Reading/Grammar
- WJ Rcog-IV Oral Vocabulary

Oral Language: Problem Solving

Problem solving to using language or verbal reasoning:

- Test of Problem Solving
- TAPS
- CELF-5 Metalinguistics/Making Inferences
- WJ Rcog IV Analogies
Oral Language: Self-Monitoring

Requires person to monitor items they have produced while continuing to generate new item items.
- CELF-5 Word Associations
- WJcog-IV Retrieval Fluency

Oral Language: Working Memory

Requires person to listen to see information and manipulate it the short term buffer.:
- CELF-5 Understanding Spoken Paragraphs
- CELF-5 Concepts & Following Directions
- CELF-5 Word Classes
- Token Test for Children
- WJcog-IV Numbers Reversed
- WJcog-IV Sound Blending
- CTOPP-2 Blending Words, Nonword Repetition, Phoneme Reversal, Blending Nonwords
- WJach-IV Story Recall
- WRAML-2 Number/Letter
- WRAML-2 Story Memory
- Token Test for Children
- Lindamood Auditory Conceptualization
Academic: Planning

Require sequence and planning ahead:
- WJach-IV Applied Problems
- WJ-IV Writing Samples
- TOWL-4

Academic: Organization

Requires development of a strategy to categorize or sort:
- TOWL-4
- WJach-IV Writing Samples
Academic: Inhibition

Require ability to ignore extraneous irrelevant information that may conflict with a goal:
- WJach-IV Writing Fluency
- WJach-IV Math Fluency
- WJach-IV Applied Problems

Academic: Cognitive Flexibility

Requires shift from one thing to another when (feedback indicates the need to change):
- WJach-IV Applied Problems
- WJach-IV Reading Vocabulary
- WJach-IV Passage Comprehension
- WJach-IV Math Fluency
- Gray Oral Reading Test-5
Academic: Problem Solving

Problem solving:
- WJach-IV Applied Problems
- WJach-IV Quantitative Concepts
- Key Math-3
- Any well-constructed standardized math problem solving assessment

Academic: Self-Monitoring

Requires person to monitor items they have produced while continuing to generate new items:
- WJach-IV Spelling
- WJach-IV Punctuation
- WJach-IV Editing
- WJach-IV Proofing
- WJach-IV Math Fluency
Academic: Working Memory

Requires person to listen to/see information and manipulate it the short term buffer:

- WJach-IV Applied Problems
- KeyMath-3 subtests
- WJach-IV Passage Comprehension
- Gray Oral Reading Test-5
- TOWL-4 Paragraph writing subtest

Theoretical Concepts for Effective Intervention

- Independence
- Routinize
- Positive reinforcement
- Allow the child to be an active agent
- Early intervention
Administrative Issues and the Subdomains of Executive Function

Designing a "frontal-lobe-friendly" learning environment
(Kaufman, 2010, p. 79)

- Educational Philosophy
- Teacher Training
- Classroom Environment
- Scheduling
- Instructional methods
- Emotional Support
- Parent/Family support

Educational Programming: Five Major Areas to Consider

- Environmental
- Behavioral
- Instructional
- Assessment of learning
- Home-based strategies
Kaufman’s Core Strategies to Ensure an F-L-F Classroom

Provide “surrogate prefrontal lobe” support or adult supervision:

- small group support
- monitoring
- social coaching
- visual reminders

“on your own” is a death knell for these kids*

Martha Denkla

(Kaufman, 2010, p. 79-94)

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Kaufman’s Core Strategies to Ensure an F-L-F Classroom

- Teach new skills and content systematically and explicitly
- Minimize demands on working memory
- Provide many opportunities for guided, extended practice
- Anticipate frustration or anxiety-producing tasks, situations and model and practice strategies to reduce stress
- Keep routines, procedures, lesson formats, predictable and consistent

(Kaufman, 2010, p. 79-94)
Considerations to Adapt the Environment

Use preferential seating
  - Close to teacher
  - Away from distractions

Seat near classmate who will be helpful
  - Peer mentor
  - Control noise level

Consistency in organization of classroom furniture, learning stations, etc.

Design a cue-rich classroom

- Verbal prompts/reminders
- Visual cues
- Schedules
- Lists
- Alarms on electronics

(Dawson & Guare, 2010, p. 51-74)
Considerations to Adapt the Environment

TECHNOLOGY!!!!!

- Laptops, tablets a must
- Word processing a must
- Teach electronic filing
- Word prediction a big help
- Voice-to-text may be a life saver!
- Podcasts, books-on-CD, Kurzweil
- Consider mobile devices

Considerations to Modify Behavior:

- Proximity control;
- Hand signals to redirect behavior;
- Tightly planned format - help student predict what is coming next;
- Use of wait time/think time;
- Use words to express emotion/frustrations;
- Teach self-advocacy;
- Support vs. confront;
- Reinforce the positive;
- Cooperative groupings/Cooperative teaching.

(C) J. MELE-MCCARTHY, D.A., CCC , 2017
Strategies to Adapt Instruction:

Put lots of organizational strategies in place:

- Routine
- List of daily procedures
- Notebook or folder system with directions
- Weekly homework sheet
- Preview homework before leaving school
- Study sheets/outlines to organize all components of long-term assignments
- Checklists for routines (i.e., morning routine, dismissal routine)

Repeat directions (have child repeat)
Point out intent of lesson
  - What will we learn?
  - What will we do?
  - How will we do it?

Skill instruction must be discreet, well-sequenced.
Multiple multi-sensory practice to allow for recall and retrieval:
Use verbal and or visual cues to aid recall and retrieval.
Tie teaching to prior lessons.
Strategies to Adapt Instruction:

- Avoid too much:
  - Auditory input/talking
  - Copying from board
  - Written, repetitious practice
- Written workload, not the cognitive content, should be modified.
- Allow use of calculator.

Strategies to Adapt Instruction:

- Give periodic movement breaks;
- Give extra response time;
- Provide written copy of orally presented material;
- Use visuals or “job” aids:
  - Math processes
  - Writing process
  - Proofing written work
  - Vocabulary
  - Phonics: sound/grapheme symbols/digraphs/vowel teams
Strategies to Adapt Instruction:

- Small instructional groupings are very helpful and imperative for some children.

- If the child is in a traditional school setting, he will often need tutoring in weak academic areas or for subjects that have teachers who are not well-organized or requires “quantum leaps” in learning.

- If the student’s skills are not deficient, he needs a 504 Plan of Accommodations and Modifications.

Strategies to Adapt Instruction:

- Teacher talk must be clear, to the point, precise and supported with visuals and multi sensory learning.

- Project directions must be explicit and sequenced and provided in oral and written form.

- Modeling of steps to reach a product is necessary several times before independence can be expected.
Adaptations for Working Memory

- Visual arrays of information in the classroom
- Agenda books
- Outlines of notes or notes on graphic organizers during instruction
- System for writing and actually doing “to-do” lists
- Use post-it notes while reading to jot down important info

Adaptations for Sustained Attention

- Environment with reduced distractions for concentrating as appropriate
- Preferential seating
- Take movement breaks – use data to determine
- Incentivize sustained attention
- Use a timer
- Use high-interest, multisensory materials
- Consider a “brain gym” approach
Adaptations for Initiation of Activities

- Employ routines
- Pair with a peer
- Use silent, mutually agreed upon cues
- For older students, use their electronic device alarm
- Review the task with student and reduce it to manageable pieces; predict how much time each section will take and actually time it
- Build choices in the task(s) so student feels some control
- Start homework during the school day
- Use a flipped classroom approach to teaching/learning

Adaptations for Planning and organization

- Use a “trapper” system for organization
- Use consistent lesson formats across classes, subjects, teachers
- Use rubrics for any multi-stepped task
- Use rubrics as a core to instruction
- Use project planning tools
- Model and practice verbal rehearsal
- Build classroom routines and adhere to them
Adaptations for Time Management

- Have student use schedule; put in trapper; require he/she refer to it instead of providing scheduling information
- Review the day in advance and plan tasks/events
- Review the day in review and assess accomplishments, discuss ways to improve
- Put a time estimate on each task, note the actual and review accuracy for estimates, discuss.
- Provide incentives to motivate efficiency

Adaptations for Flexibility

- Provide warnings before changes in routines
- Provide notice before transitions
- Engage in “practice” runs for new activities or events
- Engage in conversations about flexibility
- Gradually build up tolerance for changes in routines
Adaptations for Metacognition

- Teach problem-solving skills, like design thinking with visual arrays for the problem solving
- Use work planning tools
- Use self-monitoring tools at the end of each class
- Critique performance with a plan for improvements in future attempts
- Use comprehension monitoring strategies for reading
- Encourage verbal mediation to work through problems, using post-its to provide visual array for thoughts

Assessment of Learning

- Projects
- Portfolios
- Visual presentations
- Exhibits, drawings
- Informal teacher assessments
- Cooperative learning/team documentation
- Student dictated responses
- Extended time on tests or shortened tests or tests in more than one sitting with minimal writing
Adaptations for Persistence

- Set student up for success; start with short tasks and increase
- Reduce homework quantity for least favorite subject and gradually build up
- Praise often
- Use meaningful materials or use something motivational for reading a completion goal
- Have students graph improvements to work to a goal
- Work in groups to increase motivation

Examples of How Summit teaches in a Frontal Lobe Friendly way

Copies can be provided electronically upon request
Morning Routine: Word + Picture Cues

- Get your subject binder
- Take out 2 sharp pencils
- Take out your homework
- Write down tonight’s homework
- Put away your trapper
- Do your warm up
- File homework and warm up

Motivational
Expected routine
Practice with verbal fluency/generating ideas
Self-monitoring and achievable goal setting

Organization & planning
Self-monitoring
Organization and planning

Idea generation

Sequencing

Lesson Plan

Presentation Date:
Fabulous Word Features!

**Category**
To what group does this word belong?

**Location**
Where do we use this?

**Color/Shape/Size**
How is it used?

**Composition**
What is it made of?

**Function**
What do we use with this?

**Components**
What are the parts?

---

Problem solving
Sequencing
Reflection
Study Strategy: Graphic Organizer

Explicitly teach study skills

Show Children Exactly What to Study and How to Study It

Excerpted from Executive Function in the Classroom: Practical Strategies for Improving Performance and Enhancing Skills for All Students by Christopher Kaufman, Ph.D.

Organization, Study Skills, and Time Management

(C). J. Mele-McCarthy, DA, CCC-SLP 2017
Planning Strategies

Get ready, Do, Done, Get done (ward)

https://www.youtube.com/watch?v=c-dEm5gxlgM

short video with super heros that illustrate executive functioning components

https://www.youtube.com/watch?v=SyMeHZN7TsA

short video with super heros that illustrate executive functioning components
How to Solve Addition and Subtraction Problems

Math procedures journal; use reference sheets for all multi-step math calculations so students have a visual of the steps instead of relying upon faulty memory. Eventually, they internalize the correct steps.
Comprehension Homework

This week, you will be responsible for reading this passage and answering the comprehension questions attached. Be sure to take your time and read carefully because your answers are due until Friday! It's important that you remember to answer in complete sentences and type your responses. You will lose points if your answers are not well-developed and written using the "best checklist" below.

**MY BEST CHECKLIST:**
- handwriting names, dates, & subject
- answered in complete sentences
- typed and printed or emailed to the teacher
- capitalization, punctuation, and grammar

Comprehension Homework

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---

**The Story Grammar Marker**

**Main Character:** Who is it? What is the story about?

**Setting:** Where and When does the story take place?

**Initiating Event (kick-off):** What happens to start the story? What does it want to do or want to have?

**Internal Response:** What did the character feel about what happened?

**Plan:** What does the character decide to do? Why will they do it? Do they change their mind?
**Hoof Prints with Comprehension Strategies**

**Background:** This week we reviewed 4 useful strategies that help us understand what we read better.

**Directions:** As you read for Hoof Prints over the weekend, check off the strategies you use that help you comprehend (understand) what you're reading. You must practice at least two of the strategies. Use the attached post-it notes to mark the page on which you used the strategy:

- Prior knowledge
- Visualize
- Ask questions
- Re-read

**Checklist:**

- I used these strategies to help me understand the text:
- [ ] Prior knowledge
- [ ] Visualize
- [ ] Ask questions
- [ ] Re-read

Which comprehension strategy did you use the most? *complete sentence*

Which comprehension strategy did you find most helpful? *complete sentence*

---

**Retelling to Build Comprehension**

**Steps to follow for each story:**

1. Read the entire story and make a sequence frame to show the important events.
2. Take notes on the retelling grid.
3. Do a cold retelling with a teacher and record your score.
4. Use the rubric to improve your retelling.
5. When you are ready, do a hot retelling and record your score.
Retelling Grid

Take notes to guide your retelling.

<table>
<thead>
<tr>
<th>Task</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction with title and setting</td>
<td></td>
</tr>
<tr>
<td>Give character names and explain how they are related to each other</td>
<td></td>
</tr>
<tr>
<td>Identify antagonists and protagonists</td>
<td></td>
</tr>
<tr>
<td>Tell main events in correct sequence</td>
<td>Make a sequence frame and attach it to this grid</td>
</tr>
<tr>
<td>Include important supporting details</td>
<td>Use detail bubbles on your sequence frame</td>
</tr>
<tr>
<td>Discuss main conflict or problem in the story and identify the type of conflict</td>
<td></td>
</tr>
<tr>
<td>Explain how the main conflict was resolved</td>
<td></td>
</tr>
<tr>
<td>Connect this story to another story or your life</td>
<td></td>
</tr>
<tr>
<td>Include your personal response to the story</td>
<td></td>
</tr>
</tbody>
</table>

Reading Reflex, McGuinness & McGuinness, 1999
EmPOWER writing process, Architects for Learning, Singer & Bashir

Comparing/Contrasting
Sequencing
Writing process, Architects for Learning, Singer & Bashir

Sequencing
Idea generation
Organization and planning
Motivational and fun
Predictable format

Bubble Gum Paragraph

BACKGROUND KNOWLEDGE

Bubblie gum is a delicious treat. It usually tastes like fruit or mint. The chewy texture makes it easy to blow bubbles with.

Watch this short video about the history of bubble gum to learn more about it's history. It's really interesting!

DIRECTIONS

Write a paragraph to sequence the steps of blowing a bubble. Use transition words and clear language.

SKILLS

We will use the step-by-step writing process called EmPOWER.

RESOURCES

Frashing Your Thoughts, starter words, Word Sense charts, brain frame posters, teacher's pictures, transition words

THOUGHT BUBBLE

Predicate expansion, transition words and descriptors will help you expand and add details to your writing.

(C) J. Mele-McCarthy, DA, CCC-SLP 2017
What’s a parent to do????

EMPOWER PRACTICE:

Directions: Using the writing prompt below, complete the outline, make a plan, and organize steps of brainstorm.

Writing Prompt:
If you could be any character from a movie or from TV, tell who it would be. Describe how your life be different if you were that character.

• Evaluate
  o What do you have to do?
  o How many parts will your paper have?

• Make a Plan
  o What’s your job?
  o What true names should you use? (Sketch one below)

• Organize (Make your brain frame on attached piece of paper)
Home-Based Strategies

Organization

- Post home routines
- Prepare ahead
- Make and use lists
- Use rubrics for steps to a process
- Develop action plans, evaluate periodically

Home-Based Strategies

Time Management

- Develop a daily schedule
- Discuss changes in schedule with child
- Calendar tracking: birthdays, trips, etc.
- Estimate time needed for tasks
Home-Based Strategies:

Remember homework assignments and materials
- Develop a system to record and track homework with child and school staff;
- Utilize positive reinforcement to encourage consistent use of the tracking system;

Difficulty initiating homework
- Set regular schedule
- Positive incentive plan
- Praise
- Younger children may need help with transition to homework time - give prompts 5 - 10 minutes before
Children with Executive Function: Integrating Theory and Therapies

This is not a problem you fix or cure
You address it in every area of programming
You adapt, modify, circumvent
Work as part of a team to build strengths and confidence
Utilize a case manager or faculty mentor to help student “negotiate” his way through the school day
The overall educational program must be integrated and cohesive, with consistent organizational strategies, teaching strategies, and environmental design
Great Resources!


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Interventions

Barkley

https://www.youtube.com/watch?v=_tpB-B8BXk0
Interventions including meds

