

Executive functions in preschool and the early school years: Developmental considerations for the SLP and AUD

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The EF construct

- "Control, supervisory, or self-regulatory functions that organize and direct all cognitive activity, emotional response, and overt behavior."
- Deficits in various aspects of EF are central characteristics of many acquired and developmental disorders.

Why study EF development?

- Disagreement ... then agreement in research-
 - EF first studied only in adults due to neural substrate of the prefrontal cortex (later maturing)
 - EF measurements primarily geared toward adolescents and adults
 - Decreased developmental outcomes in pediatric neurological insult suggested importance of EF development
- Recent trends in research have tied EF skills to multiple outcomes
 - Neurodevelopmental
 - Social/ behavioral
 - Academic

Executive function for the SLP and AUD

- Many disorders involve EF dysfunction first manifested in preschool years
 - ASD
 - Hx of prematurity
 - TBI
 - ADHD
 - Others

Development of the executive functions

- Planning
- Organization
- Time management
- Working memory
- Metacognition

Specific abilities

- Response inhibition
- Emotional control
- Sustained attention
- Task initiation
- Flexibility
- Goal directed persistence

The developing brain

- Research trends
- Crystallized versus fluid intelligence
- The stress response system-- biomarkers of stress response
- Environmental considerations-- nature versus nurture

EF in infancy

- Emotional reactivity and self regulation may predict EF in early childhood
 - Infant regulation of emotional arousal
 - Infants with high emotional reactivity and low self-regulation had lower EF skills at age 48 months
- Brain stem related functions in infancy- insights from preterm infants
 - Mediated by sleep-wake cycles and the ability to self-soothe
 - Physiological homeostasis – neonatal vagal tone
 - Shown to predict regulatory outcomes to include
 - parent–infant co-regulation
 - cognitive development
 - regulation of negative emotions
 - fewer behavior problems at 6 years

EF before age 3

- Significant period of language, fine, and gross motor development
- In all EF development, cannot rule-out importance of environmental influences
- Changes parallel maturation of the PFC during the 2nd year of life
 - Enables the development of focused attention, delayed response, and effortful control (Diamond, 2002).
- Toddlers' attention regulation skills draw on both emotion regulation and physiological regulation processes (Feldman, 2009).
- The 2nd year of life is a distinct period of EF development - children exhibit very little coherence or stability across a battery of EF tasks
- By 38 months, a subset of child participants consistently passed the majority of EF tasks, and superior EF performance was predicted by 24-month representational abilities
 - language comprehension
 - initiating joint attention

(Miller & Marcovitch, 2015)

EF in preschool aged children

- Executive function skills highly associated with problem behaviors in preschool- independent of verbal ability- by age 4 (Hughes and Ensor, 2008)
- Relationship between inhibitory control and externalizing problems- children's IC ability in early childhood predicts EP in kindergarten (Utendale & Hastings, 2011)
- Modality specific EF development in preschool—
 - Rapid improvements between ages 3-5 with only moderately paced changes thereafter
 - Visual and auditory inhibition – measured in accuracy and reaction time (Guy et al, 2012)

Early childhood- elementary school years

- Executive function development highly correlated with verbal mental age (Hughes et al, 2011)
- As children transition to school, less able children (EF function) showed greater gains than more able peers- except children from low income families
- Household chaos and parenting responsiveness linked to decreased behavioral regulation in kindergarten
- Direct intervention- Training on inhibitory control and delayed gratification compared with controls who did not receive the training (ages 5-6)
 - Separate study on parent training indicated EF training with parents as interventionists/coaches may have implications for longer term EF changes as child develops- changes noted in children aged 3-7 in
 - Metacognition
 - Attention
 - Self-regulation

Clinical practice-- Preschool and elementary school years

Continued development

- Self-regulation
- Attention control
- Working memory
- Task shifting and planning

- Measurement/ assessment
- Intervention strategies
- Developmental outcomes and applications



General assessment considerations

- Parent and teacher ratings + Child interviews + Observation + Structured measures
- Behavior checklists
 - BRIEF
 - Brown scales for ADHD
 - CBCL
 - BASC-2
 - Informal checklists

Developmental tasks requiring self-regulatory skills

- SR/ Inhibitory control – also emotional control
 - Inhibition of behaviors
 - **Preschool**- don't touch stove, run into street, grab desired items, hitting, biting, etc.
 - **K- 2nd grade**- Follow safety rules, use appropriate language, wait turn to speak, keep hands to self
 - **Grades 3-5**- Behave when out of "adult view," inhibiting rude comments, temper tantrums, manners

Measures of response inhibition

- May include:
 - Connors Continuous Performance Test-2
 - NEPSY-2
 - Delia-Kaplan
 - KABC-II
 - Stroop Color Word Test
 - Tests of Everyday Attention

Response inhibition deficits in testing

- Impulsivity in answers
- Quickly "giving up"
- Giving quick answers and quickly changing them
- Answering questions before they are asked
- Beginning task without all instructions

Emotional control difficulties in testing

- Easily upset or frustrated
- Displaying wide range of emotions
- May not admit having difficulty or unsure of answer
- Anxiety

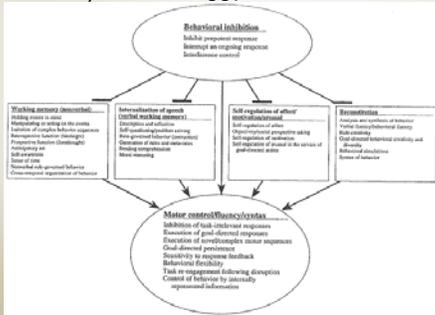
Self regulatory intervention strategies

- Environmental modifications
 - Increase external controls
 - Increase supervision
 - Cue the child for impulse control
- Teach the skill
 - Explain self control and practice with immediate reinforcement; ignore disinhibited response as able
 - Teach in "cold" versus "hot" situations

Developmental tasks requiring attention control

- **Preschool**- Performing simple chores and self-help tasks with verbal direction
- **K- 2nd grade**- Completing homework assignments- 20 min. max.
- **Grades 3-5**- Perform chores independently for 15-30 minutes; homework max 1 hour
- Attention control difficulty in less preferred activities across all ages!

Barkley's model (1997)



Attention control

- Sustained attention
- Goal directed persistence
- Shifting/ alternating attention- follows into flexibility and task shifting

Measurement of attention

- Lower scores on any working memory tasks
- Also may include-
 - Sustained attention
 - NEPSY-II- Auditory attention, Auditory response set
 - WISC-IV- Coding
 - Auditory continuous performance test
 - Test of Everyday Attention
- **Always consider testing/assessment validity and measurement considerations!**

Intervention strategies for attention

- Environmental modifications
 - Giving start and stop times
 - Incentive systems
 - Breaking tasks into subtasks
 - Self-monitoring cues/alarms
 - Reinforcement of completion and on task behaviors
- Teaching the skill
 - Practice incentive reward systems- preferred task upon completing of less desirable task
 - Tasks broken into short achievable time frames with eventual progression
 - Increase metacognitive awareness and "focus triggers"
 - Let child participate in the written plan

Developmental tasks for task shifting and planning

- **Preschool**- with guidance, engage in "countdown" activities to special days, shift between environment and activity with minimal avoidance
- **K- 2nd grade**- Bring papers to/ from school; deciding how to spend money
- **Grades 3-5**- Bring necessary books, papers, assignments to and from school, plan simple project (i.e. book report); keep track of daily changing schedule; plan how to earn and spend money
- **Impulse control**

The measurement of task shifting/ flexibility

- May be unable to generate multiple answers for one question
- May adjust slowly to tasks when directions change
- Difficulty learning new approaches to old problems
- Also-
 - Wisconsin Card Sorting Task
 - WISC-IV- Matrix reasoning and comprehension (for items requiring multiple responses)

Assessment for planning

- As with all other measures, it cannot be assumed that children who do well on standardized assessments will also have functional planning skills in everyday situations.
- Measures may include-
 - NEPSY-2 (Clocks)
 - WISC-IV (Block design)
 - WJ-III (Planning)

Strategies to facilitate transition and planning skills

- Organization strategies and checklists- fading cues for accountability in older ages
- Earlier ages- adult formulate plan with assistance to complete steps
- Break long term plans into gradual increased complexity and smaller steps
- When teaching planning/ transition skill
 - Multiple opportunities across environments key
 - Start with a feasible plan that will ensure child success
 - Concrete time lines helpful

Developmental tasks requiring working memory

- **Preschool**- Following simple verbal directions- most complex = out of sight objects
- **K- 2nd grade**- Following 2-3 step verbal directions without repetition
- **Grades 3-5**- Following multi-step directions with time delay or distance independently

Measurement of working memory

- Poor WM may manifest as decreased organization or receptive language deficits (forgetting to bring items to/ from school; missing all or part of verbal directions...)
- Some structured measurements include—
 - WISC-IV (Digit span & Number-letter memory)
 - WRAML2 (Verbal + Symbolic working memory)

Working memory intervention

- Storage devices
- Cueing devices
- Teaching the skills— with younger children- offer range of options for compensatory strategies
- Mental rehearsal/ imagery of association between cues and WM- followed by *in vivo* rehearsal
- Identify learner's strengths and weakness and utilize as appropriate
- Continually evaluate monitoring systems
- *With all intervention strategies and discussions – be cognizant of expectancy values and learning*

Outcome considerations and discussion

- EF skills correlated with
 - SES
 - School attainment
 - GPA
 - Performance on high stakes testing
 - Socialization
 - Teacher/ parent interactions
- Intervention models and service delivery

Questions/ comments?

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