

# Executive Function Deficits & EBD: Implications for the Classroom



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# Overview

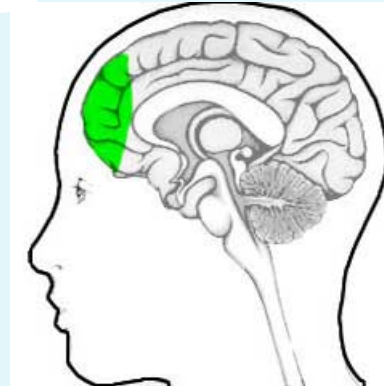


- Recent research links EBD with deficits in executive function and how these deficits affect school performance and social-emotional functioning.
- Understanding these connections is of great importance to the field of special education, as we seek effective means of assessment and intervention for students with EBD.

# Executive Function – What does it really mean?



## Prefrontal cortex










Executive function (EF) is a neuropsychological construct that refers to a group of related cognitive processes that “depend importantly on the integrity of neural systems involving the prefrontal cortex (PFC)... although it is also clear that other brain regions are involved.”

(Zelazo & Cunningham, 2006)

# Executive Function is...

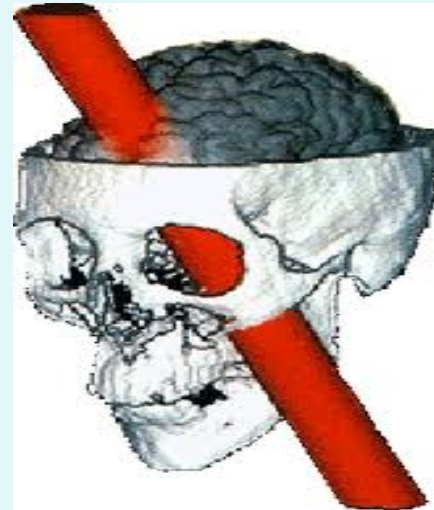


-  an umbrella term used to describe a complex set of higher-order cognitive processes necessary for:
-  Interpreting and navigating novel and difficult situations
  -  planning future actions
  -  problem solving
  -  self-monitoring
  -  mental flexibility/attentional shift
  -  inhibition of well-learned and familiar or habitual patterns of behavior

# PFC Damage & Behavior



- Insight into the impact of EF deficits on **behavior** came about through studies on people with pre-frontal damage (TBI).
- Phineas Gage incident



# Developmental Aspects of EF



- Differences in cognitive and behavioral function in elderly populations led to the assumption that EF develops and declines over time.
- Significant cause for the difference between the child and the adult resides in the unfolding of executive functions (Denckla, 1996). EF:
  - emerges early in infancy
  - continues into the early to mid 20's

# Developmental Aspects of EF



EF development through childhood and adolescence:

- Infants
  - ✦ are stimulus-bound
  - ✦ tend to “live in the present”
- Preschool aged children
  - ✦ can think about the past and plan for the future
  - ✦ can represent multiple aspects of a problem and choose the best alternative, but...
  - ✦ may not act on what they know
- School age children
  - ✦ Able to navigate progressively more complex situations

# Developmental Aspects of EF



- EF growth spurts coincide with maturation growth spurts
  - ✦ birth to age 2
  - ✦ 7 - 9 years of age
    - Majority of functions come “on line” around age 8.  
(De Luca et al, 2002)
  - ✦ 16 - 19 years of age
  
- Different developmental trajectories for different functions



# Developmental Aspects of EF

## Cambridge Neuropsychological Test Automated Battery (CANTAB)

Age Groups: 8 – 10; 11 – 14; 15 – 19; 20 – 29; 30 – 49; 50 - 64

Task	Skill	Results
Spatial Span - assesses spatial short-term memory capacity	Short-term memory capacity & sequencing ability	Poorest in youngest (8-10) and oldest (50-64) groups. Markedly longer memory spans in 15 – 19 and 20 - 29 year olds.
Spatial Working Memory - This task assesses the ability to hold, manipulate and update information to direct moment-to-moment behavior	Working memory	Poorest in youngest (8-10) and oldest (50-64) groups, with 11 – 14 year olds slightly better and 15 – 19 and 20 - 29 year olds performing significantly better than all other groups.
Tower of London	Strategic planning & organisation of goal-directed behaviour	Reach height at 20 to 29 YOA. Youngest group found to be cognitively immature, with significant deficits in planning, organization and task completion.
Intradimensional/Extradimensional Set-Shifting (ID/ED)	Attentional set-shifting	No significant differences between groups confirms adult levels of set-shifting competence in 8 to 10 year olds; suggests that this neural circuitry is connected/activated earlier than other executive systems

### Overall Results:

- Results are consistent with developmental theories of early acquisition of EF.
  - Immature executive system available to the child as young as 8–10 years of age
  - Psychological/neural networks develop at different times and rates
  - The efficiency of the executive system improves with age,
  - These cognitive processes become more comprehensive, abstract and flexible in early adulthood

# Brain Plasticity and EF



- Through training, we can create new, and strengthen existing, neural pathways and processes.
  - “*Cells that fire together, wire together.*” (Hebb, 1949)
  - Interventions that target EF based skills can alter the negative trajectories of students with EBD (Ford et al., 2011)

# Why Focus on EF & EBD?



- EF deficits contribute significantly to chronically aggressive and antisocial patterns of behavior.
- EF skills are fundamental to the self-regulation of emotions and behavior and are predictive of future school success.

- (Landrum, Tankersley, & Kauffman, 2003)

# EF Components Related to Behavior



- Working memory
- Attentional flexibility (set shifting)
- Inhibitory control

# Working Memory



*Working memory* refers to the capacity to hold information in one's mind and to manipulate that information to assess situations and choose appropriate responses.

# Attentional Flexibility



*Attentional flexibility* or “set shifting” refers to the ability to change from one way of analyzing and responding to a problem to a different way of responding.

# Inhibitory Control



*Inhibitory control* refers to the ability to suppress familiar or habitual responses.

# Stroop Test – A Test of Inhibitory Control



- Neuropsychological task to measure response inhibition
- Also measures working memory and attentional shift; key components in the neuropsychological processes that affect emotion and behavior.
- Practice:

○ Read the word - **BLUE**

○ Read the color of the word - **BLUE**



# Stroop Test – A Test of Inhibitory Control



RED	GREEN	BLUE	YELLOW	PINK
ORANGE	BLUE	GREEN	BLUE	WHITE
GREEN	YELLOW	ORANGE	BLUE	WHITE
BROWN	RED	BLUE	YELLOW	GREEN
PINK	YELLOW	GREEN	BLUE	RED

# Stroop Test – A Test of Inhibitory Control



RED	GREEN	BLUE	YELLOW	PINK
ORANGE	BLUE	GREEN	BLUE	WHITE
GREEN	YELLOW	ORANGE	BLUE	WHITE
BROWN	RED	BLUE	YELLOW	GREEN
PINK	YELLOW	GREEN	BLUE	RED

# Language Development



- Social-emotional language & EF skill development are linked with improved self-regulation and social-emotional competence, for students with EBD.
- Primary importance is placed on the developmental integration of cognition, affect and emotion language. (Riggs et al., 2006)
- It is proposed that metacognitive thinking strategies may help advance verbal mediation of complex tasks and self-regulation of behavior. (Marlowe, 2000)

# Potential Outcomes for Students with EBD



- In 1994, the U.S. DOE reported that...
  - more than 50% of students with EBD drop out, and only 42% of those who remain in school graduate with a diploma
  - within 3 years of leaving school, more than 50% have had at least one arrest (Lewis, J. T. & Sugai, G. 1999)
- **Students with EBD vs. other disabilities**
  - earn lower grades
  - make less academic progress
  - experience more disciplinary actions (Lane, Wehby & Barton-Arwood, 2005)

# How Can EF-based Interventions Help?



EF has been directly implicated in children's ***maladaptive behavior***... e.g., distractibility, impulsivity, failure to delay gratification and recognize consequences of actions.

(Riggs et al, 2006; Zelazo, Philip D. & Cunningham, W.A., 2006)

# Intervention Components



## EF & language skills related to behavior difficulties:

- Working Memory
- Attentional Flexibility
- Inhibitory Control
- Social-emotional Vocabulary Development



## Improved Self-Regulation through development of:

- Emotion Regulation
- Goal Setting
- Problem Solving
- Social-Emotional Language



## Improved school and life outcomes through:

- Improved Social Cognition
- Improved Social Relationships
- Improved Pro-Social Behaviors
- Decreased Anti-Social Behaviors

# Interventions Affecting EF Related Skills



- Grounded in cognitive or EF-based skill development
- Improve self-regulatory ability of students with EBD
  - ✦ PATHS
  - ✦ Second Step
  - ✦ Cognitive Behavioral Research Group at the University of Florida
    - Tools for Getting Along
    - Social Emotional Learning Foundations (SELF)
    - I Control

# PATHS



- The PATHS (Providing Alternative THinking Strategies)® Curriculum is a program for educators and counselors that is designed to facilitate the development of self-regulation through EF skills that improve:
  - self-control
  - emotional awareness
  - interpersonal problem-solving skills.

<http://www.prevention.psu.edu/projects/PATHS.html>



# Second Step



- **Second Step: A Cognitive-Behavioral Approach**
  - Teaches social and emotional skills for violence prevention
    - ✦ Empathy
    - ✦ Problem-solving skills
    - ✦ Risk assessment
    - ✦ Decision-making
    - ✦ Goal-setting
  - Aims to:
    - ✦ reduce impulsive and aggressive behaviors
    - ✦ increase protective factors and social competence

<http://www.cfchildren.org/programs/ssp/overview/>

# Cognitive-Behavioral Research Group at UF



- Focus on prevention and intervention strategies for students with and at risk for significant behavioral problems.
- Prevention and intervention projects are based on teaching students to alter problematic responses to life situations by increasing awareness of their thoughts, interpretations, and assumptions to promote more adaptive ways of responding.
- Common thread is the relation between cognitive or executive processes and behavior difficulties.

# Tools For Getting Along



- Teaches social problem solving through cognitive/EF skill building
  - Upper elementary level curriculum designed to:
    - ✦ establish a positive, cooperative classroom atmosphere
    - ✦ enable students to become more self-reliant, effective, proactive problem solvers
    - ✦ Includes generalization of learned skills
  - Helps students learn how to:
    - ✦ Recognize and manage anger
    - ✦ Use problem-solving steps to generate, implement, and evaluate solutions to problems they face every day.

<http://education.ufl.edu/conflict-resolution/tools-for-getting-along-curriculum/>

# Project SELF



- Project SELF (Social-Emotional Learning Foundations)  
An EF based social-emotional learning and literacy curriculum that includes:
  - ✦ Social problem solving for grade K-1 students (e.g., recognizing emotions, understanding consequences, making positive choices)
  - ✦ Children's stories that focus on emotions and behavior
  - ✦ Dialogic reading and vocabulary development instructional strategies

# I Control



- An EF-based intervention to foster self-regulation and improve social-emotional outcomes for middle school students with EBD
- Taps EF skills such as:
  - inhibition of impulses
  - planning
  - strategy switching
  - maintaining information in working memory
- That are fundamental to:
  - goal setting
  - emotion regulation
  - problem solving

<http://education.ufl.edu/i-control/>

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