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Session 305: Effective Strategies for Improving Executive Function
Angela Ingram, OTD, OTR/L

Objectives
1. Define Executive Functioning
2. Define Self-Regulation
3. Functional Difficulties Due to Self-Regulation Problems
4. Interventions & Supports
Executive Function

- Mental skills
- Higher order processes
- Help brain organize info.
- Act with functional result
- In current/ changing environment

(Jurado & Rosselli, 2007)

Executive Functioning Skills

- Attention
- Controlling Impulses
- Initiation, Planning, & Completing
- Prioritization & Organization
- Recalling & Problem Solving

(Roberts, Robbins, & Weiskrants, 1998; Struss & Knight, 2002)

- Response Inhibition
- Working Memory
- Fluency or Flexibility
- Self-Regulation
- Metacognition

(Antshel, Hier, & Barkley, 2014; Barkley, 2012)

Behavior

- Attention
- Self-Regulation/Monitor
- Inhibition/Control Impulses
- Flexibility/Shift

(Griss, Siqueland, Guo, & Kenworthy, 2012)
Metacognitive

- Memory
- Plan/Prioritize/Initiate
- Complete
- Materials Organization

(Giota, Inzlicht, Guy, & Kernswhitry, 2013)

Brain: Prefrontal Cortex

- Located at front of frontal lobe
- Decision making more medially
- Behavioral Control more laterally
- (Yuan, & Raz, 2014)

Pre-frontal Cortex

- Planning
- Predicting
- Decision Making
- Setting and Working Toward Goals
- Making Choices
- Socially Appropriate Behaviors
- Perceptual Organization

(Yascher et al., 2009)
Self-Regulation: Cognitive

- Complicated Processes
- Adaptable Control
- Emotion, Behavior, and Cognition
- Using Goal Setting, Feedback Loops & Self-Monitoring (Vohs, & Baumeister, 2016)
- Requires Insight & Coordination of
  - Thoughts, feelings, actions, language
  - Appropriate Responses to
  - Internal & external environments
  (Bronson, 2000)

Self-Regulation

- Inhibition Allows Delayed Emotion to Events
- Underlying Concepts
  - Understanding Feelings & Dealing with Emotions
  - Processing Sensory Information
- Task Performance Effected
  - Organizing, Planning, & Transitioning
  - Cognitive & Emotional Flexibility
  (Anastopoulos et al., 2011)

Self-Regulation: Sensory

State of Alertness:
Attaining, Remaining in, & Change
(Brunswics & Edelbrunner, 1949)

- Increased neuron activity to maintain alertness
- Adequate arousal levels needed to support attention & learning
  (Fletcher, Langner, Böhm, & Brocke, 2003)
Self-Regulation & Effortful Control

- **Effortful Control (EC)**
  - Measured as part of Self-Regulation
  - Linked in brain to same areas as S-R
  - Better EC had more empathy
- **Sensory Connection**
  - During conflict, anterior cingulate correlate w/ sensory and emotion systems
  
  [Posner & Rothbart, 2007]

Foundation Difficulties

- Self-regulation skills set the stage for:
  - Social Skill Acquisition
  - Emotional Maturation
  - Cognitive Development
  - Engaging in Learning Activities
  - Adjusting to the Learning Environment
  
  [Blair & Raver, 2015]

Self-Regulation Development

- Significant growth in preschool
  
  [Blair 2002; Diamond & Lee 2011]
- Development of S-R During Preschool
  - Critical for promoting school readiness
  
  [Blair, Sevigny, & Haywood, 2013]
- Novel tasks: excited and interested in trying
  - Pay attention
  - Follow directions
  - Do not be distracting or disruptive
  - Be mindful of others feelings
  
  [Blair & Raver, 2015]
Difficulties

- Addictive
  - Correlates with increased chances of addictive smart phone use (van Deursen, Bolle, Hegner, & Kommers, 2015)

- Social difficulties
  - Exclusion increases likelihood impaired self-regulation
  - Lack self-regulation increases likelihood of exclusion (Ridgway, Frone, Bruch, & Winkelkemper, 2016)

- Academic achievement
  - Increased metacognitive self-regulation correlated with better performance
  - (Repp, Ren, Gonzalez-Nurisendi, & Rubinto-Rella, 2016)

Common Self-Regulation Difficulties for Children with ASD

- Sleep patterns
- Feeding difficulties
- Poor self-soothing
- Lack of orientation to important people in environment
- Difficulty with functional attending to caregivers
- Behavioral difficulties
  - Lengthy tantrums, aggression toward others
  - Self-injurious behavior (Reebye & Elbe, 2009)

Theory & Intervention

- Behavioral:
  - Social Learning and Social Thinking® Therapy
- Physical:
  - Sensory Integration Therapy (Gillenhall and
- Cognitive:
  - Cognitive Behavior Management
- Development:
  - Vygotsky’s Zones of Proximal Development
Where To Begin?

3 Part Supports:
- Cognitive
- Behavioral
- Physical

Professionally Developed Interventions
- The Zones of Regulation® (Kupers, 2011)
- SCERTS Model® (Prizant et al., 2006)
- Superflex® and other curricula that focus on anxiety and behavioral support
- The ALERT Program for Self-Regulation (Shellenberger & Williams, 2002)
- PATHS (Kusché, & Greenberg, 1994)
- Tools of the Mind (Bodrova & Leong 2007)

The Zones of Regulation Summary
- Ties in aspects of Social Thinking®
- Visuals Supports
- Self-Management
- 4 Color-Coded “Zones” Classification System:
  - Arousal, Feelings, & Emotions

Used with permission by The Zones of Regulation
The Zones of Regulation

- Facilitates Recognition of Feelings
- Categorizes Feelings
- Communication about Feelings
- Aids in Self-Regulation
- Perspective Taking

The Zones of Regulation

- Uses Cognitive Behavior Management in Learning
- Facilitate Independent Self-regulation

http://zonesofregulation.com/index.html

Zones of Regulation Ongoing but not Peer Reviewed Research

*Intervention to Increase Self-Regulation in Kindergarten Students (Yack, n. d.)*

- Found: Interpret with Caution
- Overall Positive Change
- Functional Relationship between Self-Regulation and the Intervention
(SCERTS) Model
Social Communication, Emotional Regulation, & Transactional Support
- Fosters spontaneous communication
- Developmentally appropriate goals and the needed skills for max enjoyment and independence
- Natural routines provide tx context
- All behavior viewed as purposeful
- Social partners are as much a part of problem as solution
- (Prizant et al., 2006)

SCERTS Model
- Social Communication & Emotional Regulation
- Supports emotional regulation and physical arousal level
- Facilitates self monitoring physical arousal and emotional state
- Transactional and environmental support
- (O’Neil et al., 2010)

SCERTS Research
- Functional Improvements: Study of 4 Children with ASD
  - Joint Attention
  - Symbol Use
  - Mutual Regulation
  - Self-Regulation
- (O’Neill, Bergstrand, Boxman, Elliott, Mavin, Stephenson, & Wayman, 2010)
The Superflex™ Curriculum (SC)
- Intervention Program
- Uses pre-made lessons to teach children to identify
  - Social expectations
  - Monitor their behaviors
  - Modify them as needed
- Kindergarten through grade 5 (Madrigal & Garcia, 2008)

Superflex (SC) Research
- Analyzed Effect of SC On:
  - Social & Perspective Taking Skills
  - Students with ASD & ADHD
- Functional Improvements:
  - Listen to others by actively looking
  - Physically waiting quietly during listening
  - Allowing others to finish before speaking
  - Demonstrating understanding by nonverbal or verbally responding
  (Madrigal & Garcia, 2008)

The Alert Program
- Teaches how the right amount & kind of sensory input generates optimal state
- Program Focus
  - Recognizing, Maintaining, & Changing Alertness Levels to Match Task
- Teaches
  - Use of sensory strategies effecting arousal
  - Using 5 main senses
  (Shellenberger & Williams, 2002)
The Alert Program

How Does Your Engine Run?

Image by Angela Ingram

The Alert Program History
- Initial Design
  - Pediatrics: 8 – 12 years old
  - Broader Applications Show Promise
  - Pre-K to Adults
- Implemented
  - Individuals or Groups
  - By teachers, parents, or therapists
  - Supervision: By therapist knowledgeable in SI recommended
  (Shellenberger & Williams, 2002)

Alert Program Research
- Children with ADHD & ASD
  - 7 students: 6 ASD, 1 ADHD
  - Alert Program for six weeks
  - Post-intervention:
    - Improved focus in class
    - Increased focus on educational tasks, per teacher report
    - Articulated strategies used to self-regulate
  (Zeidler, 2012)
The ALERT Program

- SPM-C Total Score
- Significant differences between groups
- Conclusion:
  - The Alert Program might have more benefit for those identified with self-regulation difficulties
- Effects of AP not lasting from K to 2nd grade, for at risk
- Yearly Implementation of AP Recommended
- Prevent decreases in functioning of the “at risk” children

(Powell, 2013)

The Alert Program Research with Fetal Alcohol Syndrome

- 29 FASD (TX) or Delayed-tx Control (DTC)
- 19 Typical Develop Children (CT)
- Measure: MRI & Neuropsych.
- TX Grp: 12 weekly 1.5-h Alert Program
- Base: TX & DTC reduced GM compared w/CT
- TX Grp: Sig. Increase GM left
- TX & CT: Larger GM vol. than DTC
  - GM smaller in FASD group baseline

(Suh, Siskic, Rash, Stevens, Turner, & Rovet, 2015)

(PATHS) Promoting Alternative Thinking Strategies

- Pre-School & Kindergarten
- Core Strategies
  - Self-Talk
  - Dramatic Play
  - Aids for Memory & Attention
- Vertical Control & Horizontal Communication
  - Control-Communication of prefrontal cortex & limbic system
  - Insight- Communication of two hemispheres
PATHS Visual Aide

- Control Signals
- Traffic Signals: Red, Yellow, & Green
  - (Riggs et al., 2006)

PATHS Program Research

- RCT in 20 PK classrooms for 9 months, Weekly Lessons
- Increased emotion vocabulary & feeling identification
- Significantly reduced children’s anger attribution bias
- No sig.: Inhibitory control, attend, or problem solve
  - (Domitrovich, Cortes & Greenberg, 2007)

PATHS RESEARCH

- Gen. Ed. 2nd & 3rd Grade
  - Intervention: 3x per Week 20-30 min. 6 mo.
  - Significant improvements: Behavior, Inhibition, Verbal Fluency
  - (Riggs et al., 2006)
  - Significant effects for teacher report measures
  - Decreased internalizing & externalizing behavior problems
  - Decreased self-report depression in special needs children
    - (Kam et al., 2004)
Tools of the Mind

- Cognitive Self-Regulation
- Thinking about learning
- Scaffolding
- Quality & Quantity of Learning Depends on Independent Self-Regulation
- Paying attention
- Flexibility
- Recall
- Content is practice not the end goal of learning
  - (Baehr & Levy 2007)

Tools Research

- Group/School-Based Curriculum
- Teacher-directed exercises
- Targeting social pretend play
- Increased self-regulation in at-risk preschoolers
  - (Diamond, Barnett, Thomas, & Munro, 2007)

Action & Thinking Feedback

- Self-Regulation Feedback Cycle
Interventions

- Mindfulness
- Yoga
- Games
- Sensory Interventions

Mindfulness

"the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience”
(Kabat-Zinn 2003, p. 145)

Mindfulness Training Results

- Disadvantaged Children:
  - 12 weeks
- Improved:
  - Attention
  - Self-regulation
- Skills and benefits maintained at later testing
(Poehlmann-Tynan et al., 2016)
**Mindfulness & Breathing**

**Hoberman Ball**

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**Mindfulness Tasks**

- Mindfulness of Breath Sounds
- Breathing & Bring Mental Awareness to Present
- Simple
  - Blow out finger candles
  - Be a tree
  - Pinwheels

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**Rectangle Breathing**

- Breath In 1, 2, 3
- Hold 1, 2, 3
- Breathe Out 1, 2, 3
- Wait
Mindfulness

- Focused Attention
  - Pay close attention
  - Looks, Feels, Smells, Tastes

- Body Scan
  - Notice Rhythm
  - Bring attention to body
  - Guide awareness to parts of body
  - No judgment

Mindfulness

- Intervention Training
  - Mindfulschools.org
  - Variety of CEU classes

Mindful Yoga & Breathing

- Pre-school: 29 (3-5 year olds)
- 10 progressing to 30 min Day
- 40 hours over 25 weeks
  - "Peace" - Breath in deep 5 sec. then whisper peace breathing out
  - Take Five - Breath in count each finger going up, then out and down

(Razza, Bergen-Cico, & Raymond, 2015)
Yoga Poses Used
- Animal Poses
  - Cat/Cow
  - Downward Dog
  - Child's Pose
  - Happy Puppy
  - Shy Polar Bear
- Nature Poses
  - Standing Mountain
  - Tree
  - Moon
  - (Razza, Bergen-Cico, & Raymond, 2015)

Yoga
- 20-session yoga group or a control group
- 19 boys ADHD on medication
- Decreased oppositional, restless, and impulsive behavior,
- More home practice
- Greater attention and affective lability
  - (Jensen & Kenny, 2004)

Self-Control & Games
- 3 Major Skills in Executive Function Effecting Self-Regulation
  - Attention
  - Inhibition
  - Working-Memory
  - (Healey & Halpern, 2012)
Self-Control Games

- “Simon Says”
  - Attend to commands
- “Freeze Dance”
  - Exert control on actions when “freeze” is heard and music stops
  - Begin dancing again when music begins
- “The Opposite Game”
  - Inhibit action commanded
  - Set-shift to do the opposite
  (Healey & Halperin, 2012)

Go & Stop Game Video

Image by Angela Ingram

Games

- Building Toys
- Blocks or Legos
- Tinker toys
- Gobi Sets
- Marble runs
- Games
  - Memory & Go Fish
  - Uno
  - Jenga
  - Distraction

Structure
- Review Self-Regulation Techniques
- Set Goal
- Set Time
- Review Results
- Reflect
Games with Time Prediction

Element

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Deep Pressure to the Skin

- Clothes - Compression
- Heavy blanket
- Weight in backpack
- Rub skin: Self massage & Fidget textured items
- Big hug
- As Part of an Overall SI therapy Intervention Program

(Roley, Bissell, & Clark, 2009)

Heavy Work Guidelines

- Resistance Training:
  - 2 times per week minimum
  - 20 minutes
  - Careful with kids under 8, study on kids 8-12 ADHD

- Findings:
  - Increased muscular endurance, power, aerobic capacity, shorter reaction times
  - Better interference control (inhibition)

(Tsay, Huang, Tsai, Huang, & Hang, 2008)
Heavy Work Chores

- Carry laundry
- Sweep/Mop
- Clean toilet/tub
- Vacuum
- Wash off tables
- Wash windows
- Carry out trash or recycling
- Stapling
- Cutting up papers

Games/Fun

- Tug of war
- Push each other’s hands
- Push up, sit up, planks
- Loaded Bucket Relay
- Wipe off erase board
- Wheelbarrow races
- Paper basketball
- Jump on trampoline

Weighted Equipment

- Systematic Review
  - Single-sensory strategy; to influence arousal
  - Few positive effects in sensory-based studies
  - Why they may not be effective:
  - Did not follow recommended protocols
  - Or target sensory processing problems
  - Case-Smith, Weaver, & Fristad, 2015
- SPD, ID, ASD, DD Small Studies
  - Not Improved seat behavior w/vest
  - No reduction stereotypy or increase attention
  - Improvement with NCR
  - Cox, Gant, Luczak, & Ayres, 2009; Kane, Luczatk, Deardon, & Young, 2004

ADHD Studies

- Improved: Attention, Speed, & Executive mgt.
  - Lin, Lee, Chang, & Hsing, 2014
- No diff: Impulsivity & Noise making
- On-task behavior increased 18% to 25% in the 4 students while wearing weighted vest
  - VandenBerg, 2001
DIY Weighted Lap Pad

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Weighted Ball

Image used with permission from Angela Ingram

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Weighted Blanket

- Mood & Behavior Measures of 13 children
- ASD & ID
- Six showed statistically significant benefits
- 5 showed benefits across all domains
- 1 showed benefits on three out of five domains
- Careful monitoring of tolerance and response is necessary and deep pressure discontinued when not a benefit

(Bestbier, & Williams, 2017)
Pressure Vest

Limited Studies Available
- 1 Child with Developmental Delays
- Vest Used as Consequence for Negative Behaviors by Teachers Prior
- Data showed moderate variability
- No routine differences found in engagement with vest
- Problem behavior increased with vest
  (Reichow, Barton, Good, & Warley, 2009)

Massage

General Recommendations
- Client is fully clothed
- Duration: 5-30 minutes per day depending on tolerance
- Intervention ranging from 5 days to 5 months
  (Yunus, Liu, Bissett, & Penkala, 2015)

Movement

Aerobic Exercise
- Case studies found 20-30 Minutes daily
- Improved:
  - Inhibition
  - Shifting/task-switching
  - Working memory
  - Mood
  (Geerloes, Kohnhauser, Schmid & Stadler, 2014)
Fidgets Research

- **Hand Fidget**
  - Children with ADHD
  - Used STM More when Fidgeting
  - Used as Noncontingent Reinforcement
  - To Facilitate Remaining Seated During Circle Time
  - 3 PK Children with Developmental Disabilities

- Used with permission from Abilitations

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**Hand Fidgets**

- Tangle Jr.
- SeasonSqueeze Fidget Kit

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**Foot Fidgets**

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Visual

- Doodling Group: 18-55 year olds
  - Recalled 29% more info. on memory test (Andrade, 2010)
- 12-13 year olds
  - Doodler’s grades significantly outperformed control (Tadayon & Afhami, 2016)

Doodling Effectiveness

- Memory retrieval recognition over recall
- Benefit independent of doodling amount (Singh & Kashyap, 2015)

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Adult Coloring Book Pages

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Doodle Notes Page

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Visual Input

Indications
- Staring off
- Appears unavailable
- Begins when adult standing with them but unable to sustain
- Staring intensely

Intervention
- 2 minutes 1-2 times per day
- Glitter jar
- Sand timer
- Kaleidoscope
- Prism
- Liquid Timer

Visuals

- Visual Record Chart or Feedback
  (Shellenberger & Williams, 2002)
- Play Plans
- Writing Plans
  (Rodrigeux & Leong 2007)

Visual Plans

- Play
- Writing
- Functional Tasks

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Visual Feedback

- ADHD Difficulty with:
  - Error Processing of Problems
  - Impulsivity
  - Selective Attention

- Address with: If/Then Plans
  - If I see the teacher’s hand go up Then I will stop talking and get back to work.
  - Reviewing, Practicing & Using If/Then Plans
    - Makes Initiating Goal Directed Action More Automatic
      (Hung & Gawrilow, 2016)

Sound & Emotional Regulation

"Tuned In" Program
- Emotion regulation intervention
- Participant selected music to evoke emotions
- To teach Regulation skills

Study on Adolescents
- Significant Results for:
  - Emotion awareness
  - Emotion Identification
  - Self-regulation
  - \( p < 0.01 \) to \( p = 0.06 \) in the smaller “at risk” sample and all \( p < 0.001 \) in the mainstream school sample.
(Dehn, Rodger, & Kunde, 2016)

When to Use Sensory Strategies: Prepare & Prevent

- Prepare: Embed into routine
  - Heavy Work Chores
  - Deep pressure to skin before bath or dressing
  - Going for a jog before homework
  - Sitting on a movement chair during homework
  - Yoga built into academics
Prevent
Notice need before problems happen
- Weighted ball catch before overly frustrated with homework
- Visual timer during dressing if running out of time
- Glitter jar and big hugs before going to the doctor as part of “if/then” plan
- Slow hand massage & deep breaths before cake at birthday party

Full Program Example
- Prep- Mindfulness
- Cognitive: Client Discuss (Use picture/video)
- Physical or Game
  - Yoga, I Spy, Jenga
- Behavioral
  - Set up (remove distractions, review goals/rules, if/then)
  - Positive reinforcement & self-regulation strategies (Tamm, Nakonezny, & Hughes, 2014)

Case Study
- Carter, 3 years old, Autism
- Assessments:
  - Sensory Profile- Low Registration
  - PDMS-2- Grasp and Visual Motor
- Functionally: Moves slowly, poor visual monitoring, poor initiation and inhibition, does not notice if touched, does not notice env. cues, poor motor planning, slumps/leans, withdrawn, apathetic, more limited affect
Intervention:
-Visual Shift
-Colors
-Weighted
-Movement
-Crawling

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Classroom Sensory Schedule
- Enters to “Big Hug” & Visual Schedule
- Checks in with Engine Dial
  - Bounce or rock on ball & blow chimes
- Circle Time: Movement Cushion & Lap pad
- Singing & Body Movement Imitation
- Hold Vibrating Toy During Transitions
- Checks Engine Before Seated Work
- Rub hands, Shake head, Compression Vest, Joint Compressions to Hands Before Table Top Tasks

Questions?
- “Do not let the behavior of others destroy your inner peace.”
- Dalai Lama

Image from Angela Ingram
References

References


