

Executive Function:

Why is it important & how can you intervene?



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Learning Objectives

- Describe executive functioning
- Discuss common executive functioning difficulties experienced by children with hearing loss
- List strategies to improve executive functioning



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What are Executive Functions (EF)?



Complex cognitive processes foundational for flexible, goal-directed behaviors, including organizational and self-regulatory skills



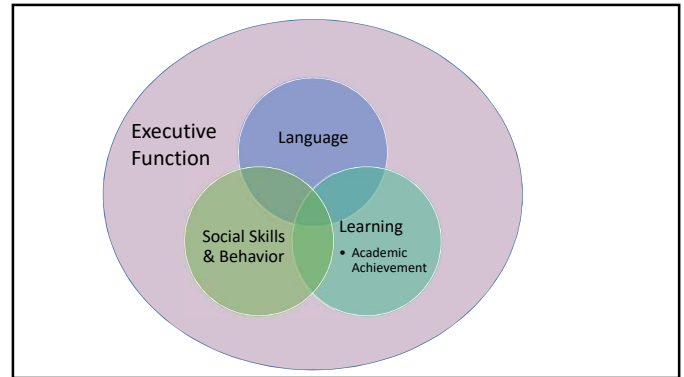
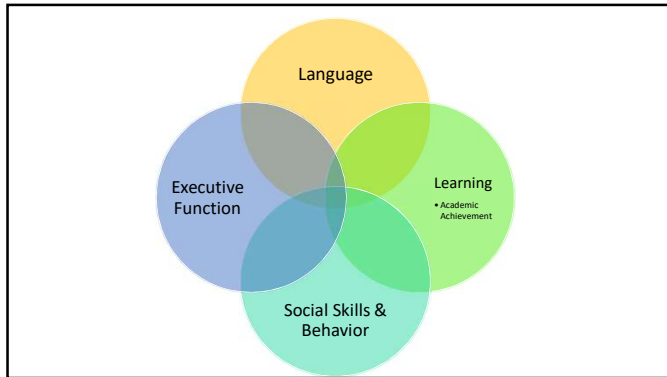
Guide behavior, thoughts & emotions



Command & control center



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The 2 Core Strands of EF

Social/Emotional/Behavioral Regulation

- Response inhibition* (impulse control)
- Emotional control
- Adaptability

Metacognition

- Goal setting
- Planning/strategizing*
- Sequencing
- Organization of materials
- Time management (PS)
- Task initiation
- Goal directed attention
- Task persistence
- Working memory*
- Set shifting

EF Skills Academic and Social Impact

Reading: decoding, fluency, comprehension

Writing: prewriting, writing, revision

Math: read signs/problems, follow multiple steps, alternative solutions, math facts, errors

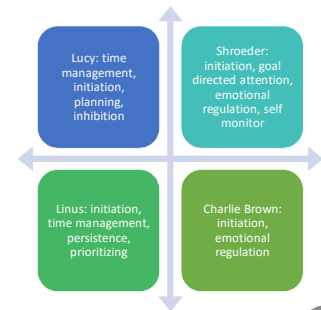
Study skills: organization, homework, time management, note taking, projects

Social skills: self awareness, consequences, turn-taking, impulse control, emotional self modulation/frustration tolerance, adaptability

What Do Executive Functions Look Like?

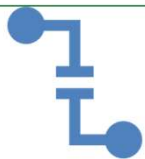


What about
the book
report?



10

Compared to hearing children



- D/HH students show a significantly higher problem rate for EF: inhibition, WM, shift, emotional regulation (Hintermair, 2013; Botting, 2017, Hall, 2018)
- 3 domains delayed in children with a CI
 - Verbal working memory
 - Inhibition-concentration
 - Controlled fluency-processing speed (Beer et al, 2014; Kronenberg et al, 2014)

11

Executive Function in DHH Preschoolers

"Preschoolers with CIs showed significantly poorer performance on inhibition-concentration and working memory compared with peers with NH and with national norms" (Beer, Kronenberg, Castellanos, Colson, Henning & Pisoni, 2014)

"No group differences were found in visual memory or organization-integration" (Beer, Kronenberg, Castellanos, Colson, Henning & Pisoni, 2014)

EF Skills in Preschool...

Predict SAT scores, attentiveness, concentration, self control and ability to cope with stress and frustration in adolescence

Are associated with physical health, financial well-being and criminal outcomes in adulthood (Moffitt, 2011)

After controlling for language, growth in WM, inhibitory control and attention shifting between preK and K uniquely predicted reading and math achievement in K (Welsh, 2010)



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Academic Outcomes in Deaf and Hard of Hearing Students

Reading Outcomes



- Average deaf learner graduates from high school with a reading comprehension level at about a 3rd or 4th grade level
- Mean vocabulary is below average when compared with hearing peers (De Diego-Lazaro, D., Restrepo, M.A., & Yoshingaga-Itano, C. (2018)
- Children who received intervention by 6 months had significantly higher vocabulary than children who started intervention later



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Reading Outcomes and Cochlear Implants

- Children with cochlear implants are often reported as having better literacy outcomes than deaf children without implants (Knoors & Marschark, 2019)

***But... why are other children performing below grade-level?**



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Math Outcomes

- 50% of DHH students scored "basic" or "below basic" on math subtest of Stanford Achievement Test (Traxler, 2000)
- Of 23 studies on DHH student's math performance, most studies found a 1 to 4 year delay compared to hearing peers (Gottardis, Nunes & Lunt, 2011)
- "DHH students have been found to have difficulty with number comparisons, calculation, rote counting, number facts, numeral literacy, mathematical concepts, measurement, story problems, multiplication and fractions" (Knors & Marshark, 2019).



Higher Education

- 2010 US Census reported that 16% of DHH people ages 25-59 obtained a bachelors degree or higher compared to 30% of the entire US population



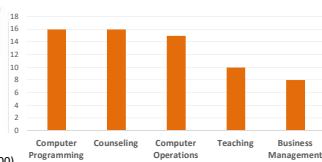
Career Attainment of DHH College Graduates

Table 5
Respondents's Occupations, by Hearing Status (by Percentage)

Occupation	Deaf	Hard of hearing	Total
Professional, managerial, technical	62.4	38.5	55.5
Clerical	23.8	25.0	24.2
Crafts, labor, machine operation	13.8	36.5	20.3
N	130	52	182

Note: Boldfacing highlights particularly significant findings.

- Of 195 employed respondents, 70 different occupations were reported



Schroedel, J.G. & Geyer, P.D (2000)

IQ in DHH Students



- In over 50 years of research comparing IQ of typical hearing and DHH children, it was found that DHH children's IQ is approximately the same as typical hearing children (Vernon, M., 2005)
- When looking at children with CIs, the same results were found (Cejas, Mitchell, Hoffman, Quittner, & CDaCI Investigative Team, 2018).

Why aren't these kids performing similar to their peers?



- Do they have appropriate access?
- How is their language?
- Do they have other learning challenges?
 - Behavioral/social concerns, **executive function**, learning disabilities

Social Skills and Executive Functioning



- There is a significant relationship between executive functioning and social maturity for high school and college students (Marschark, M., et al, 2017)
 - No statistical difference between CI users and nonusers

Executive Function Research

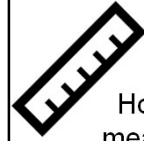
- Hintermair, 2013
 - Administered Behavior Rating Inventory of Executive Function (BRIEF) to teachers of DHH children
 - Inhibition: 22% of DHH children had elevated scores
 - Working Memory: 31% of DHH children had elevated scores
 - Cognitive Flexibility: 29% of DHH children had elevated scores
 - Emotion Regulation: 26% of DHH children had elevated scores

Executive Function Research

- Botting et al., 2017
 - Administered nonverbal executive function tasks to 108 DHH children ages 5-12
 - DHH children scored significantly worse in visual-spatial working memory, inhibition and flexibility compared to hearing children
- Kronenberger, Colson, Henning and Pisoni, 2014
 - Participants: 64 deaf children with a cochlear implant and 74 age and intelligence matched hearing children
 - Results: Deaf children performed significantly worse on verbal working memory and inhibition but not visual-spatial working memory

Executive Functioning and Language

- Botting and colleagues (2017) found that language mediates executive functioning performance in DHH children
- "Language ability and the development of executive function are related (e.g., Kronenberger, Colson et al., 2014; Sikora, Roelofs, Hermans, & Knoors, 2016; Vygotsky, 1978)... Marschark, et. al., 2017



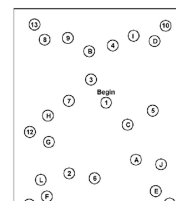
How do we measure EF?

- Neuropsychological tests
- Interviews and case reviews
- Rating scales (BRIEF2, BASC3, Brown, Conners3)
- Behavior observations (classroom, testing)
- Work samples and performance reviews

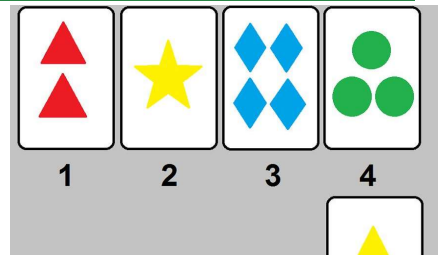
Neuropsychological tests of EF

- CPT (Conners, TOVA, Attemo)
- Cancellation
- Color word interference
- Complex figure drawing
- Mazes
- Towers
- Trail making
- Card sorting
- List learning and memory
- Fluency

Trail Making



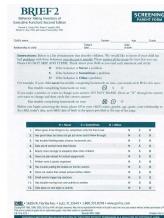
Wisconsin Card Sorting Test



Rating Scales for EF

- Behavior Rating Inventory of Executive Function, 2nd Ed (BRIEF2) 5-18, preschool, adult
- Behavior Assessment System for Children, 3rd Ed (BASC3) 2-18 content scales, EF index
- Brown Attention Deficit Disorder Scales 6 Fs
- Conners, 3rd Ed (C3) 6-18 EF scale


BRIEF 2



What behaviors could indicate EF difficulties

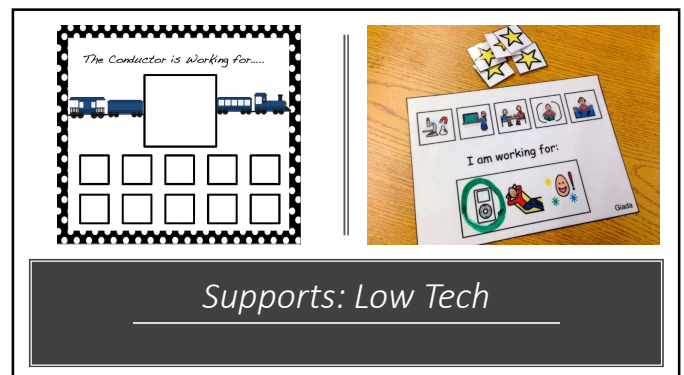
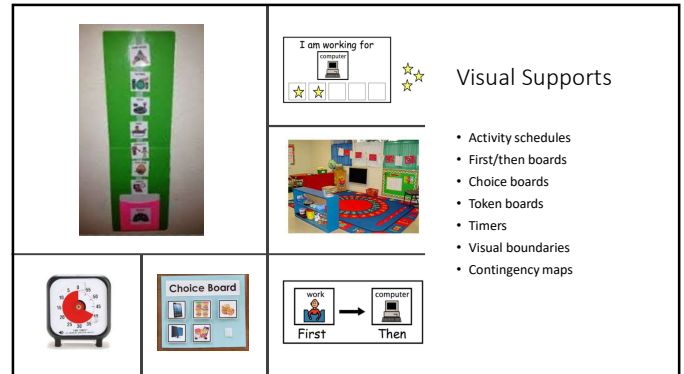
- | | |
|---|----------------------------|
| 1. Difficulty making decisions B C | A. Goal directed attention |
| 2. Requires numerous cues/reminders A D I | B. Prioritizing |
| 3. Complaints/calls out G H | C. Planning/organization |
| 4. Stubborn, oppositional G F | D. Initiation |
| 5. Loses train of thought I | E. Persistence |
| 6. Lack of effort/fatigues E J | F. Cognitive flexibility |
| 7. Can't put ideas on paper C I | G. Inhibition |
| 8. Sloppy, erratic work H | H. Self monitoring |
| 9. Prefers to "wing it" C | I. Working memory |
| 10. Difficulty recalling key elements I | J. Time management |
| 11. Distractible/daydreams A | |
| 12. Unable to follow multiple steps I | |
| 13. Cannot wait turn G | |
| 14. Difficulty reading connected text A I C | |
| 15. Never finishes E J | |
| 16. Can't seem "to get the ball rolling" B D | |

How do we improve EF?

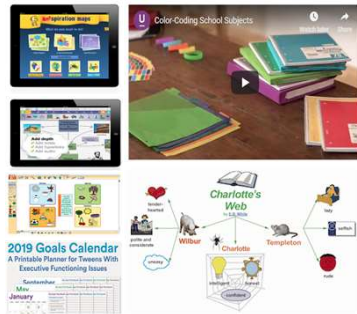
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|--|--|
| • Organize environment | • Give reminders  |
| • Set an example | • Use calendars |
| • Praise self initiation | • Stay calm and supportive |
| • Organize time | • Avoid negative labels |
| • Provide structure | • Provide breaks |
| • Create opportunities for guided practice | |

How do we accommodate EF difficulties?

- Organized environment
- Explicit expectations (consistent, predictable routines, classroom rules)
- Systematic, explicit instruction (models, demos, I do...)
- Minimize demands on WM (GO, checklist, calendar, template, timer, visual schedule)
- Anticipate problems
- Teach inhibition by inserting delays
- -adapted from C Kaufman, 2010

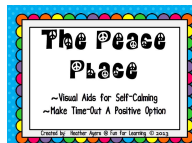


Supports: Organization

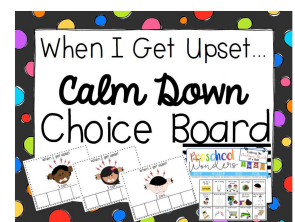
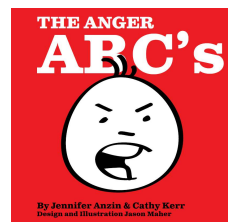


Supports: Working Memory

To School	To Home	Morning Checklist		
Do I have: <input type="checkbox"/> Completed homework? <input type="checkbox"/> Lunch/lunch money? <input type="checkbox"/> Binder/notebooks? <input type="checkbox"/> Books? <input type="checkbox"/> Gym clothes? <input type="checkbox"/> Daily planner? <input type="checkbox"/> _____ <input type="checkbox"/> _____	Do I have: <input type="checkbox"/> Homework assignments? <input type="checkbox"/> Lunch box? <input type="checkbox"/> Binder/notebooks? <input type="checkbox"/> Books? <input type="checkbox"/> Dirty gym clothes? <input type="checkbox"/> Daily planner signed? <input type="checkbox"/> Graded work/teacher's notes? <input type="checkbox"/> _____ <input type="checkbox"/> _____	<input type="checkbox"/> Unpack backpack at desk <input type="checkbox"/> Put materials you don't need in your locker <input type="checkbox"/> Check in your homework <input type="checkbox"/> Turn in papers <input type="checkbox"/> Pack up		
Monday	Tuesday	Wednesday	Thursday	Friday

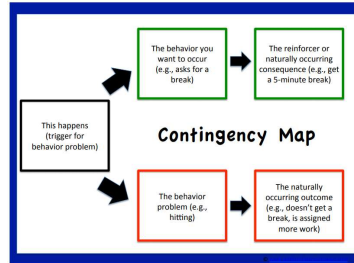


Supports: Self-regulation



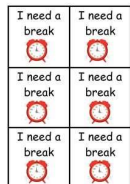
Supports: Self-regulation

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Technology oriented interventions

- Computer assisted, speech generating devices (SGDs), smartphones, tablets
- Video modeling



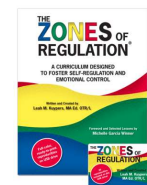
Sooner than later

- A way to communicate without acting out
- AAC tools (T2S)
- AAC strategies
- Core vocabulary



EF Curricula

- SuperFlex (ages 7-10+)
- Zones of Regulation (preK+)
- SMARTS (gr 6-12)
- Tools of the Mind (preK/K)
- Unstuck and on Target (8-11)
- PATHS/promoting alternative
- Thinking
- (preK-gr 6)



Thank



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