Executive Functions

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Agenda

- Definition
- Neurological Basis
- Executive Functions
- Executive Function: Skills for Life and Learning
- EF Development
- How EF is Supported at School
- How EF can be Supported at Home
- Big Five Strategies
Definition of Executive Functions
“An array of mental processes responsible for regulation of cognitive functioning during purposeful, goal directed problem solving behavior” - (Dehn, 2013)

“Temporal organization of behavior” (Kolb & Whishaw, 2015)

“Set of directive capacities that facilitate a person’s ability to engage in purposeful processing of perceptions, emotions, thoughts and actions” - (Miller, 2013, pg 339)

“Control and coordination of cognition processes during performance of complex tasks” (Kolb & Whishaw, 2015)
What is Executive Functioning?

Executive functions consist of several brain-based skills that help the brain organize, act on information, initiate, and perform tasks.

These skills enable people to plan, organize, remember things, prioritize, pay attention and get started on tasks.

They also help people use information and experiences from the past to solve current problems.
Neurological Basis of Executive Functions
**Frontal lobe**
Executive functions, thinking, planning, organising and problem solving, emotions and behavioural control, personality

**Motor cortex**
Movement

**Sensory cortex**
Sensations

**Parietal lobe**
Perception, making sense of the world, arithmetic, spelling

**Occipital lobe**
Vision

**Temporal lobe**
Memory, understanding, language
Front Lobe Development

The last part of the brain to fully develop

- The connections in our brain are strengthened through synaptic pruning
- Brain activity changes from diffused to focal activity
- This process helps our thinking become more efficient
- Pruning and myelination continues throughout adolescences

If Children Do Not USE It, They Can Lose It
5-year-old brain  Preteen brain  Teen brain  20-year-old brain

*Dorsal lateral prefrontal cortex* ("executive functions")

**Front**

**Top view**

**Back**

**Red/yellow:** Parts of brain less fully mature

**Blue/purple:** Parts of brain more fully matured

Sources: National Institute of Mental Health; Paul Thompson, Ph.D., UCLA Laboratory of Neuro Imaging

Thomas McKay | The Denver Post
Kinds of Executive Functions
<table>
<thead>
<tr>
<th>Response Inhibition</th>
<th>Working Memory</th>
<th>Emotional Control</th>
<th>Flexibility</th>
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<td>The capacity to think before you act.</td>
<td>The ability to hold information in memory while performing complex tasks.</td>
<td>The ability to manage emotions to achieve goals, complete tasks, or control and direct behavior.</td>
<td>The ability to revise plans in the face of obstacles, setbacks, new information, or mistakes.</td>
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<td>The capacity to keep paying attention to a situation or task in spite of distractibility, fatigue, or boredom.</td>
<td>The ability to begin projects without undue procrastination, in an efficient or timely fashion.</td>
<td>The ability to create a road map to reach a goal or to complete a task.</td>
<td>The ability to create and maintain systems to keep track of information or materials.</td>
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<td>Goal-Directed Persistence</td>
<td>Metacognition</td>
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[Image of a man juggling clocks, a calendar, and papers, representing time management.]

[Image of a bow and arrow, pointing at a 'GOAL' text, representing goal-directed persistence.]

[Image of a mind with a light bulb, thinking, representing metacognition.]
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<td>The capacity to estimate how much time one has, how to allocate it, and how to stay within time limits.</td>
<td>The capacity to have a goal, follow through to the completion of that goal, and not be put off or distracted by competing interests.</td>
<td>The ability to stand back and take a bird’s-eye view of yourself in a situation, to observe how you problem-solve.</td>
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InBrief: Executive Function: Skills for Life and Learning
"Center on the Developing Child at Harvard University"
Development of Executive Functions
Developmental Spurt
Attentional Capacity

Developmental Spurt
Working Memory

Developmental Spurt
Goal Setting Skills

From around 15 years old
Working memory, shifting attention and inhibitory control relatively stable and close to adult level.

Years
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22+
Executive Function Skills Build Into the Early Adult Years
Working Memory Development

- **7-9 MONTHS** Develops ability to remember that unseen objects are still there (toy hidden under a cloth); learns to put two actions together in a sequence (remove cloth, grasp toy)
- **9-10 MONTHS** Can execute simple means-to-ends tasks and two-step plans; also able to integrate looking one place and acting (e.g., reaching) at another place
- **3 YEARS** Can hold in mind two rules (e.g., red goes here, blue goes there) and act on the basis of the rules
- **4-5 YEARS** Comprehends that appearance does not always equal reality (e.g., when given a sponge that looks like a rock)
- **5-16 YEARS** Develops ability to search varying locations, remember where something was found, then explore other locations
- **ADULT** Can remember multiple tasks, rules, and strategies that may vary by situation
Inhibition Control Development

- **6 MONTHS** Rudimentary response inhibition (able to not touch something when instructed)
- **8-10 MONTHS** Begins to maintain focus despite distractions during brief delays in a task
- **9-11 MONTHS** Able to inhibit reaching straight for a visible but inaccessible reward, such as a toy on the other side of a window, and instead delay a moment to recognize the barrier and detour around it
- **4-5 YEARS** Reductions in perseveration (persisting with following a rule even when knowing that the rule has changed).
- **7 YEARS** Children perform at adult levels on learning to ignore irrelevant, peripheral stimuli and focus on the central stimulus
- **10-18 YEARS** Continues to develop self-control, such as flexibly switching between a central focus and peripheral stimuli that may or may not need attention
- **ADULT** Consistent self-control; situationally appropriate responses
Cognitive Flexibility

- **9-11 MONTHS** Develops ability to seek alternate methods to retrieve objects beyond directly reaching for what’s in view

- **2-5 YEARS** Succeeds at shifting actions according to changing rules (e.g., takes shoes off at home, leaves on at school, puts on boots for rain)

- **10-12 YEARS** Successfully adapts to changing rules, even along multiple dimensions (okay to shout on playground, not okay in school, okay sometimes in theater rehearsal)

- **13-18 YEARS** Continued improvement in accuracy when switching focus and adapting to changing rules

- **ADULT** Able to revise actions and plans in response to changing circumstances
Supports for Executive Functions
How is EF Supported in the Classroom?

- To-Do checklists
- Generating homework plans
- Setting priorities
- Structured daily routine
- Offering incentive and positive reinforcements to increase motivation

- Illustrate note-taking skills (outlines/sentence starters)
- Demonstrating metacognition skills by thinking through the process out loud
- Graphic organizers
- Transition questions
- Provide word banks
How is EF Supported in the Classroom?

- Add writing cues
- Minimize short answer and essay questions
- Have child make suggestions of task alterations
- Provide scoring rubrics
- Verbal prompts or reminders
- Visual cues
- Schedules & lists
- When checking work start with last complete problems
- Audiotape cues
- Alarms
- Work though initial problems with child then have child work more independently
Scaffolding

- Breaking up learning into chunks
- Providing a tool/structure for each chunk
- Different than differentiation
- Changing your vocabulary from

  “They should be able to do this” to “What can they handle?”
Part - to - Whole

- Doing activities in smaller sections that later come together as a whole
  - Reducing packets - work on one sheet at a time instead
    - “Hanging Folder” in room to keep rest of papers
  - Assign separate due dates for smaller parts of big projects

- Planning projects as “pieces”
  - First working on introduction.
  - Then working on body.
  - Finishing with conclusion.
Time Visualizations

- Using visuals to represent time
List

1. Math - page 14.7
   25 min.

2. History - read pgs. 16-32 and take notes
   45 min.

3. L.A. - write 2 paragraphs reflecting on today's reading
   75 min.
Executive Functioning Issues


Executive Functioning Issues: Strategies You Can Try at Home


Teaching Organization

- https://www.understood.org/en/school-learning/learning-at-home/teaching-organizational-skills#

How to Break Down Assignments


Homework and Study Tips

- https://www.understood.org/en/school-learning/learning-at-home/homework-study-skills
My Five Big Strategies

1. Make checklists
2. Set time limits
3. Use planners and calendars
4. Explain yourself
5. Let your child explain, too
Frequently Used Connections
Strengthen with Use!
Learning Opportunity

Washington State Department of Early Learning Executive Function Module

http://deltraining.com/courses/Executive_Function/content-frame.htm
Questions
References


References


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