Executive Functioning and Metacognition: Improving Students' Learning Outcomes

Jennifer Sullivan

ConnCASE

October 2024 Conference

- **Author of 3 college readiness books (with EF focus)**
  - Workbook (skillbuilding lessons for transition skills class, transition program, college-bound students with disabilties)
  - Book (30 tips for college-bound students, 25 tips for families)
  - Videogame ebook (includes discussion questions for educators)

- **22 yrs experience in higher education & transition programs including Thames @ Mitchell College**
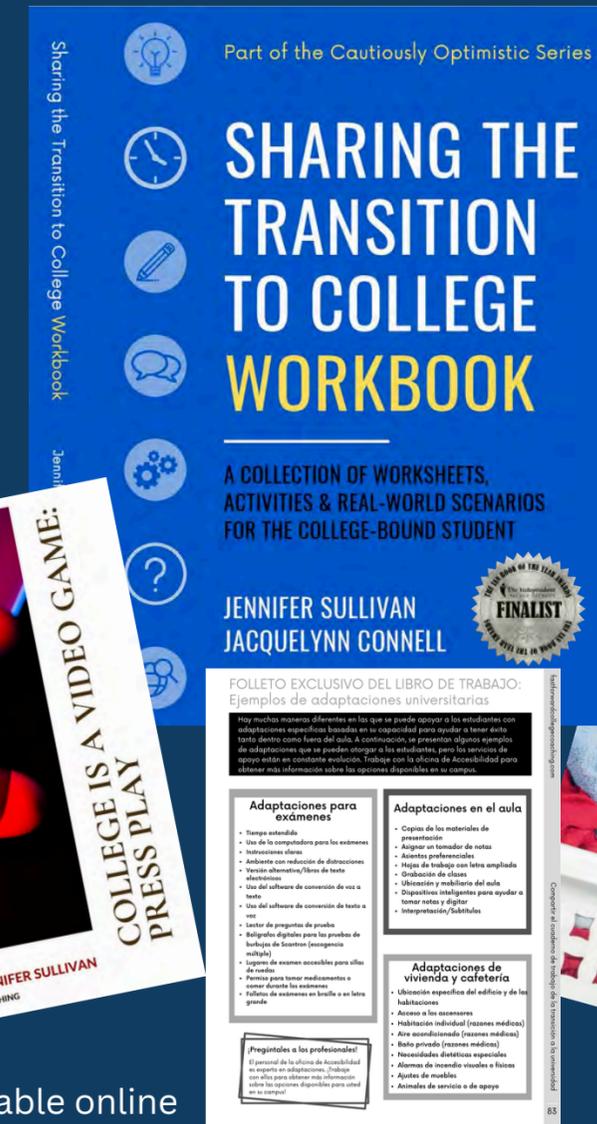
- **Owner, Fast Forward College Coaching (executive functioning & college readiness coaching in Waterford, CT)**
  - Free presentations for public schools & families
  - Navigating the accommodations process in college
  - Resources, videos for schools & families
  - PD for districts
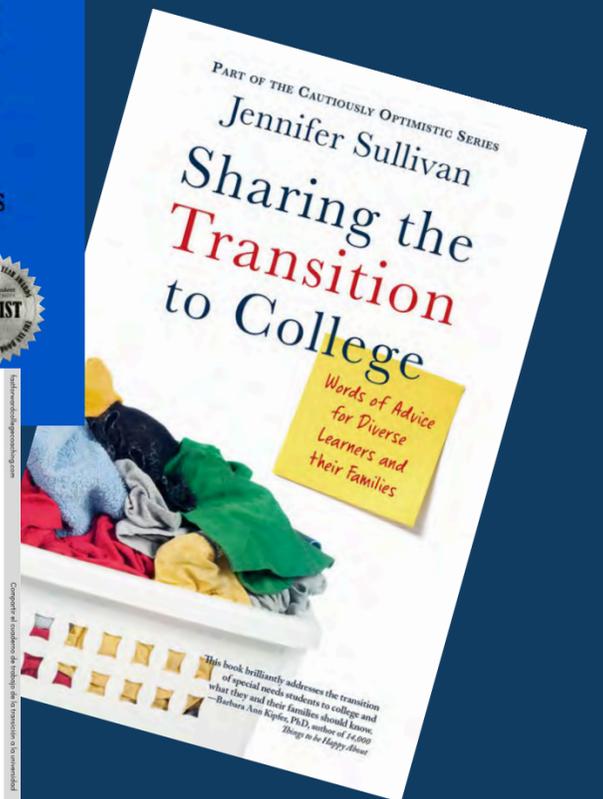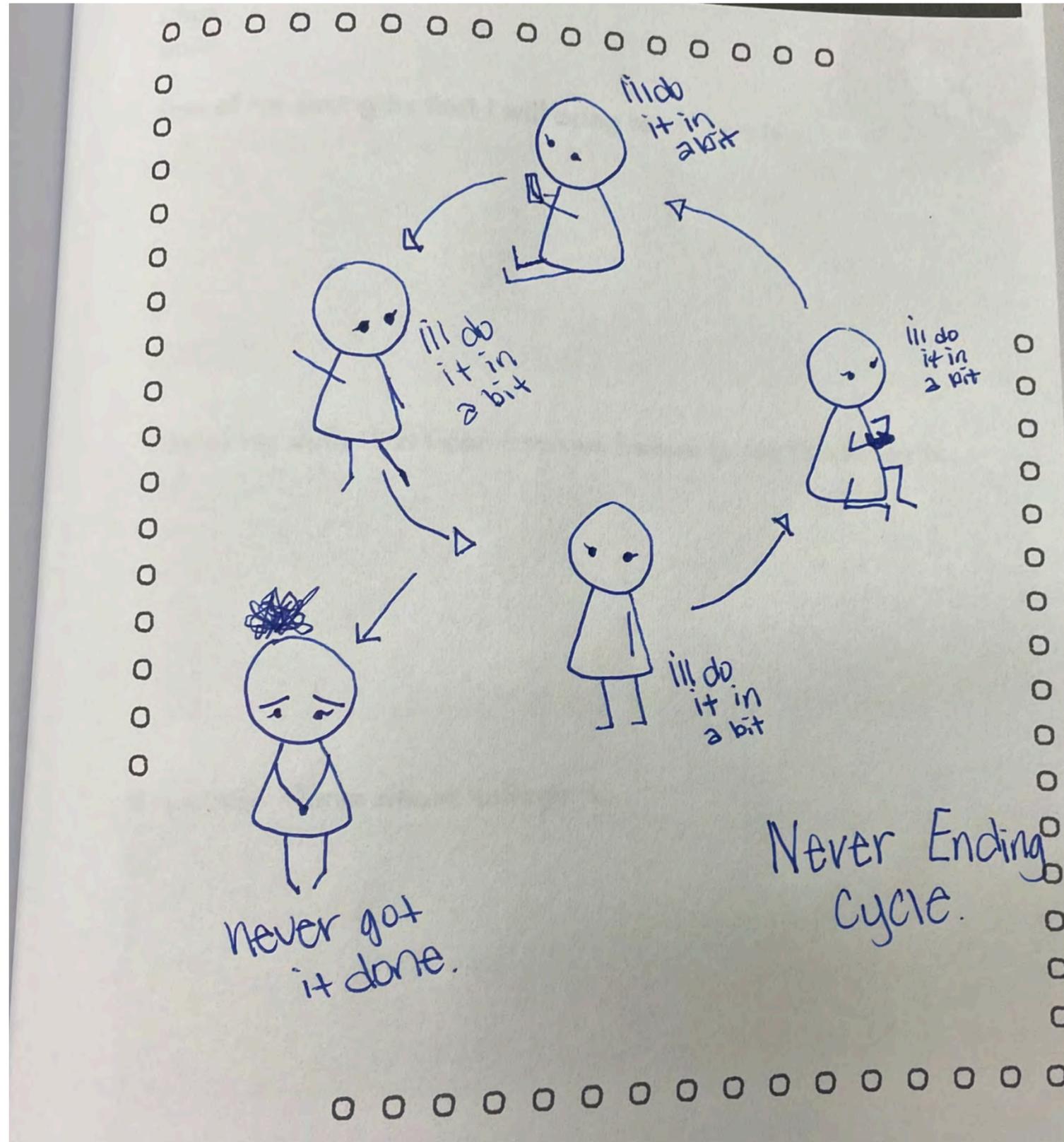 - Resources for first-generation college students

- **Charting the Lifecourse Ambassador for CT**
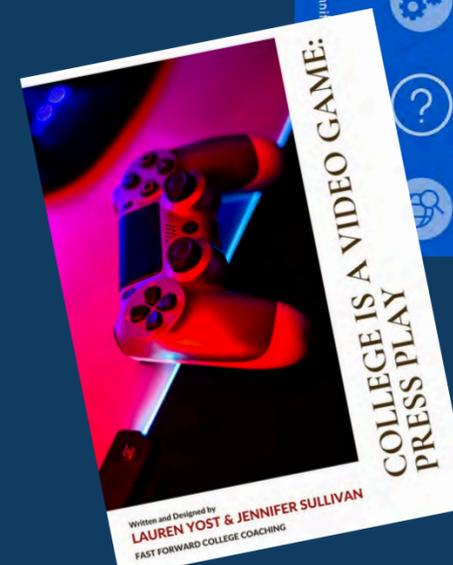
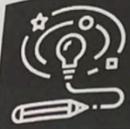Free - Available online

Resources available in Spanish

ETHANOL FREE   DIESEL
3.55 ⁹/₁₀   3.22 ⁹/₁₀
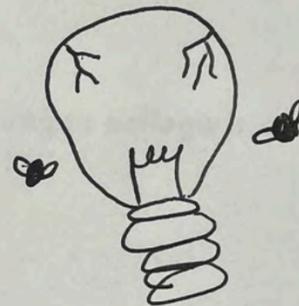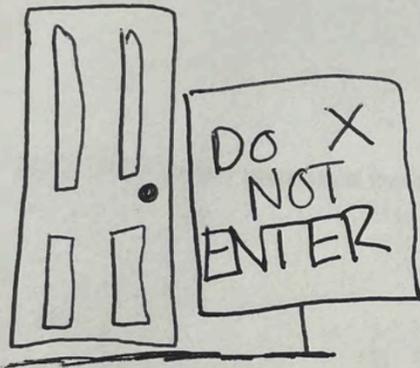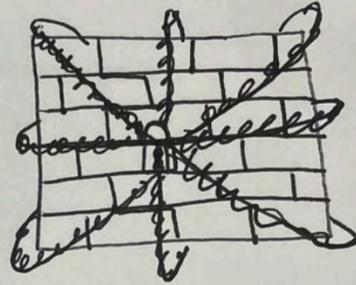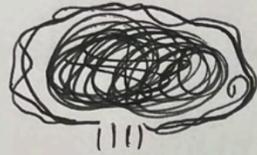HOW MANY
CHUGGAS
BEFORE THE
CHOO CHOO

EXCLUSIVE WORKBOOK ACTIVITY:
Express Yourself: Procrastination

Prompt: What does procrastination feel like?

Draw pictures, shapes or words in the space below

fastforwardcollegecoaching.com

Sharing the Transition to College Workbook
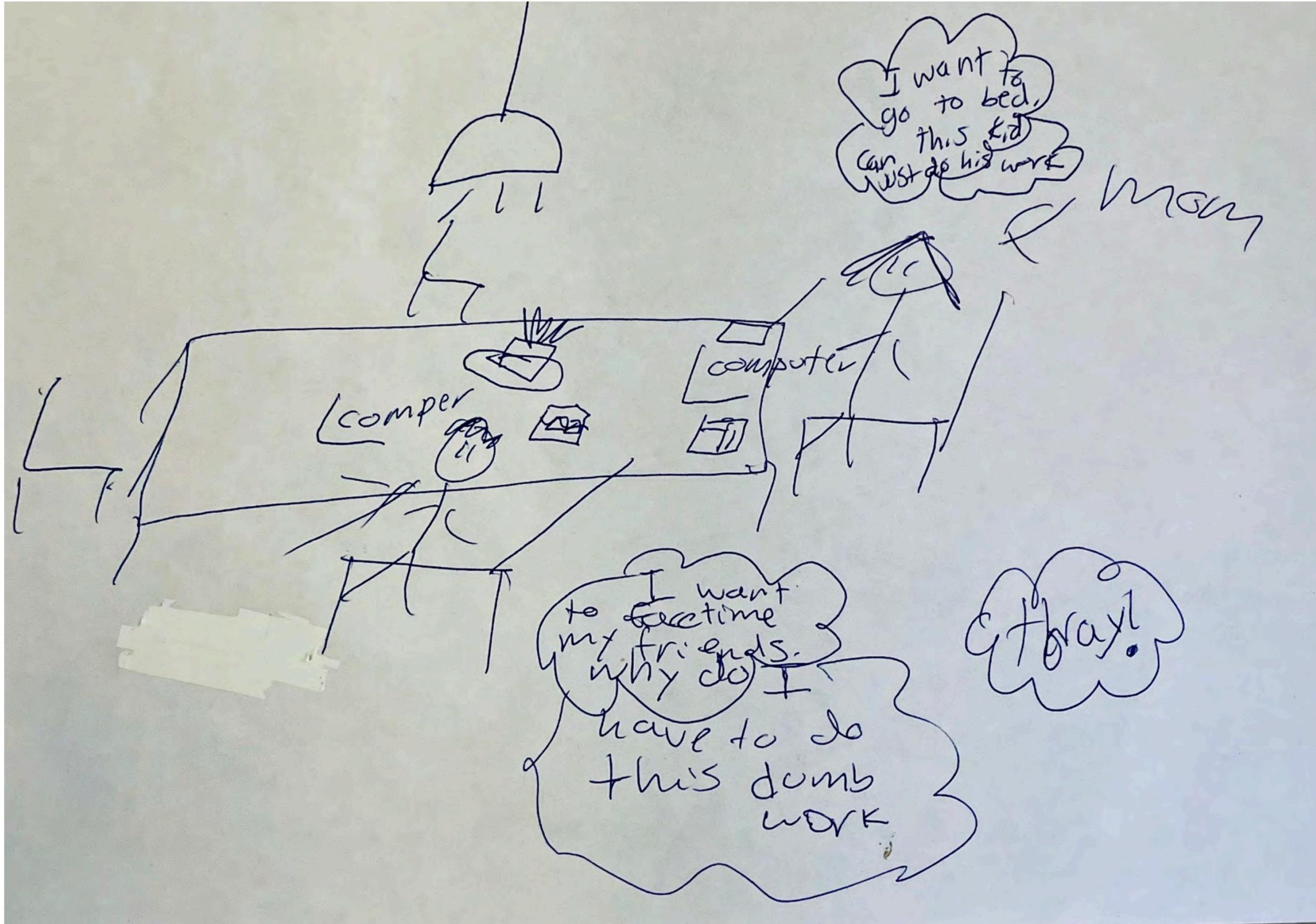
The Good News

"Neuroplasticity, the brain's ability to rewire in the face of new experience. This means that we are designed to change and adapt throughout life - we never stop learning! New experience prompts our brains to adjust and adapt, to create new pathways, and we can influence the quality of and direction that those pathways take. By the choices you make, the experiences you seek, and the skills you cultivate through repeated practice, you are already literally rewiring your brain."

(Staying Sharp, p. 8)

Go to menti.com and enter code
2704 1709

or scan this QR code

Brain Development

Frontal lobe

Parietal lobe

Occipital lobe

Temporal lobe
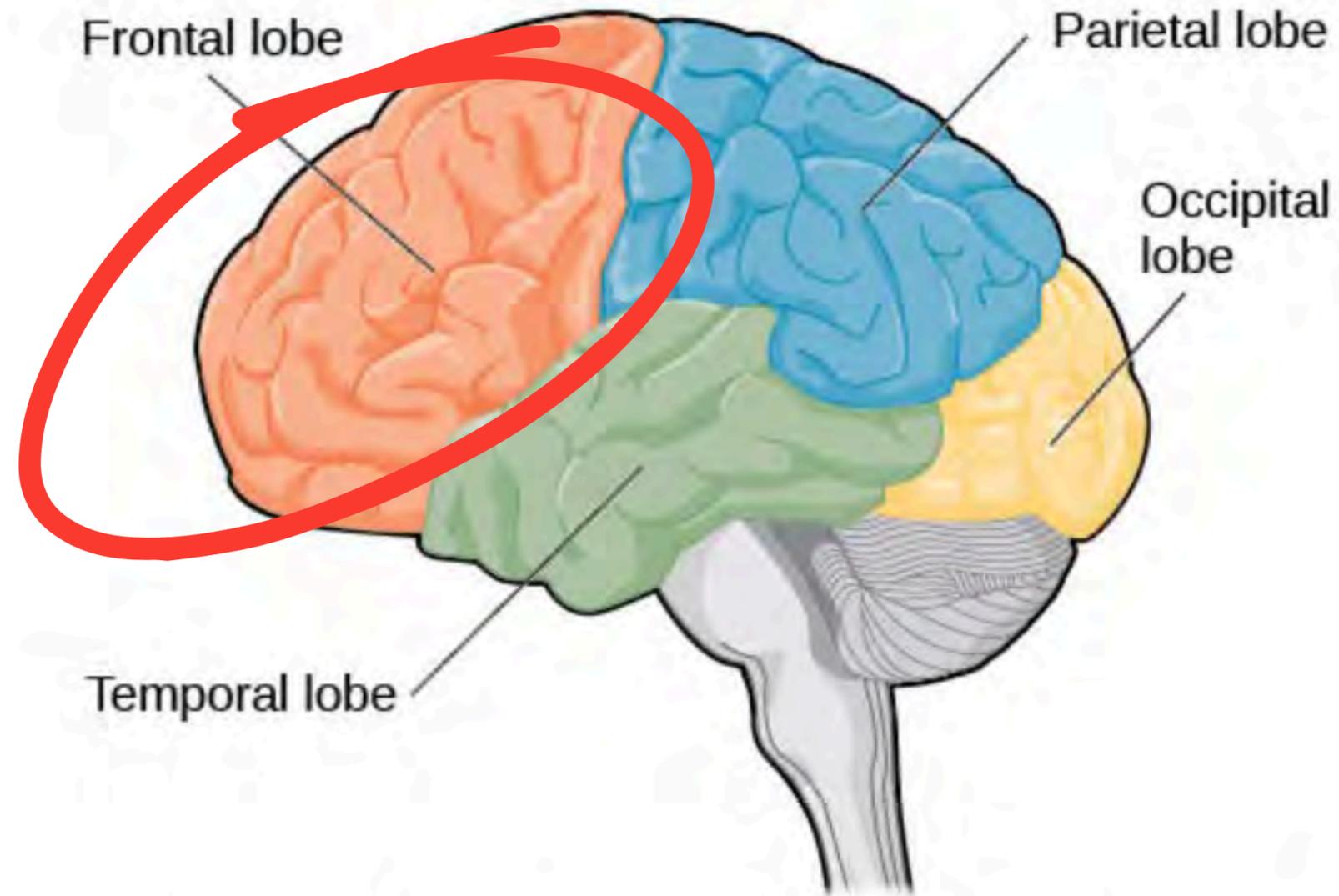
Brain growth and connections happen from the back to the front, EF is last area of the brain to mature and connect

Executive Functioning Development

Children aren't born with EF skills—they are born with the potential to develop them.

- Genes and experiences work together to construct brain architecture, reinforced by repeated use

- If children do not get what they need from their relationships with caregivers, environment or toxic stress = can disrupt brain architecture and impair the development of executive function

Executive Functioning Development

The brain's ability to change in response to experiences

The amount of effort such change requires

2 4 6 8 10   20   30   40   50   60   70

AGE   SOURCE: LEVITT (2009)

Center on the Developing Child 🛡 HARVARD UNIVERSITY   www.developingchild.harvard.edu
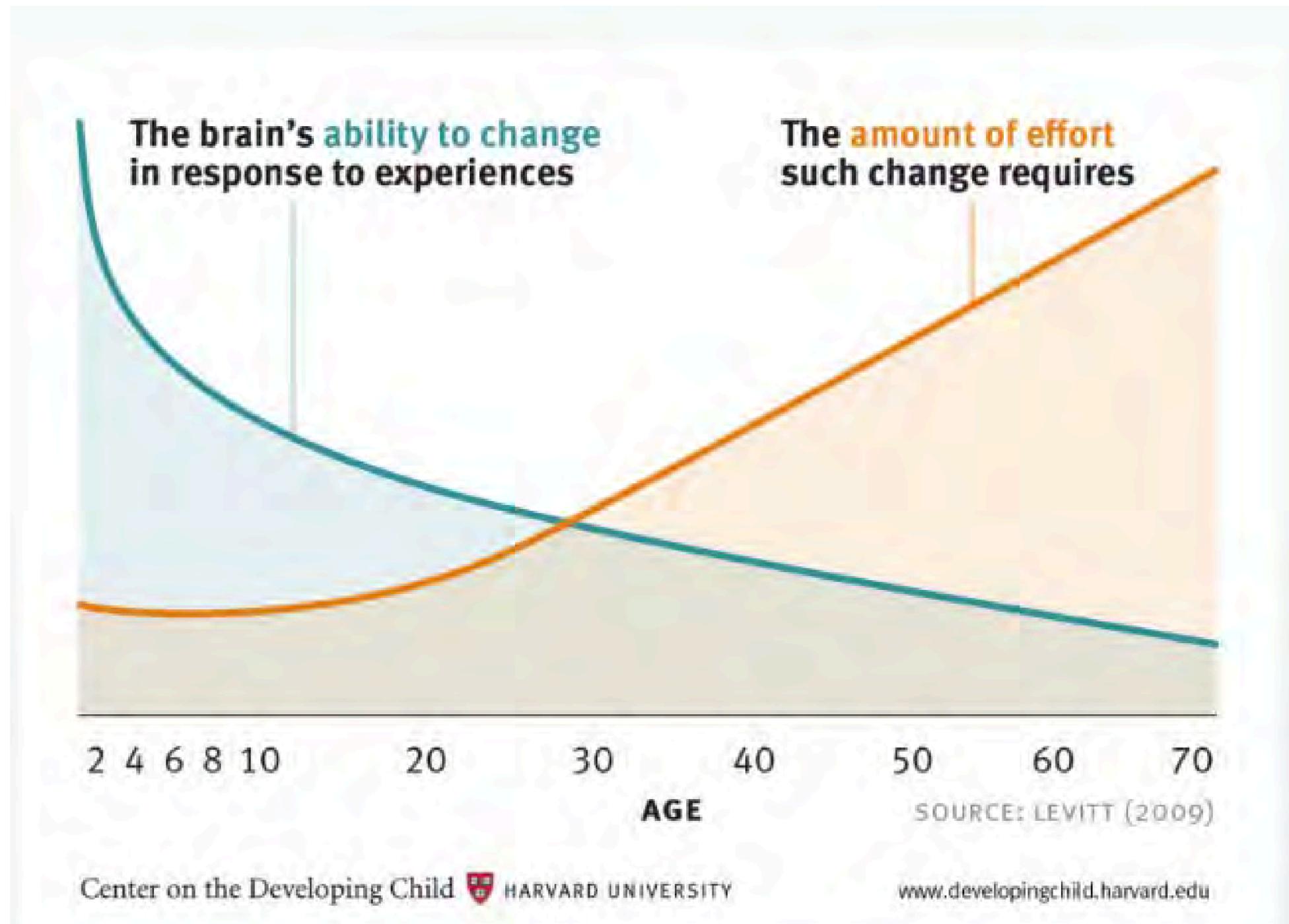
Executive Function Skills Build Throughout Childhood and Adolescence

McCloskey, George. "Improve Executive Capacities: Strategies to Change the Brain and Change Behavior," October 2018, CABE.

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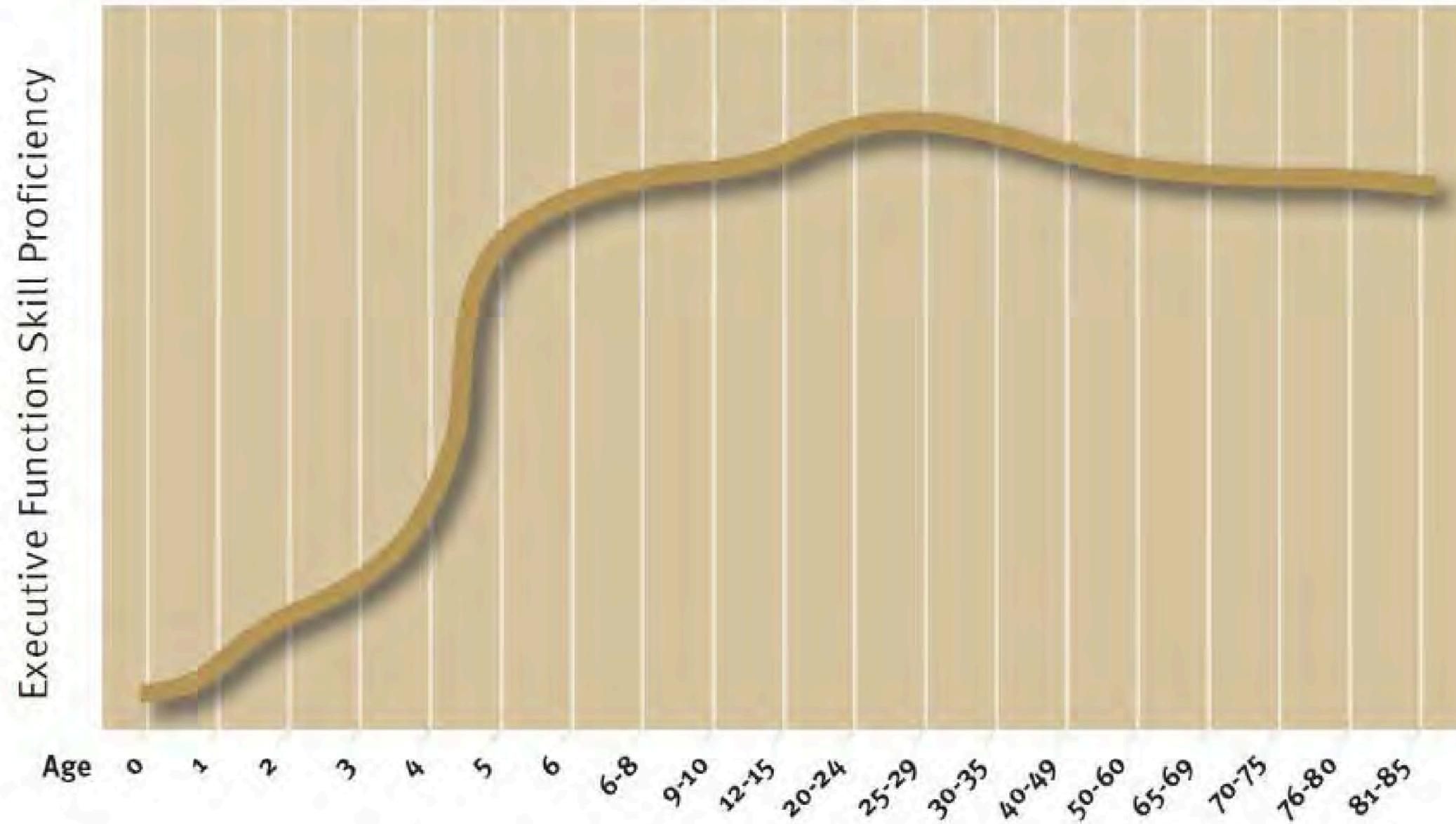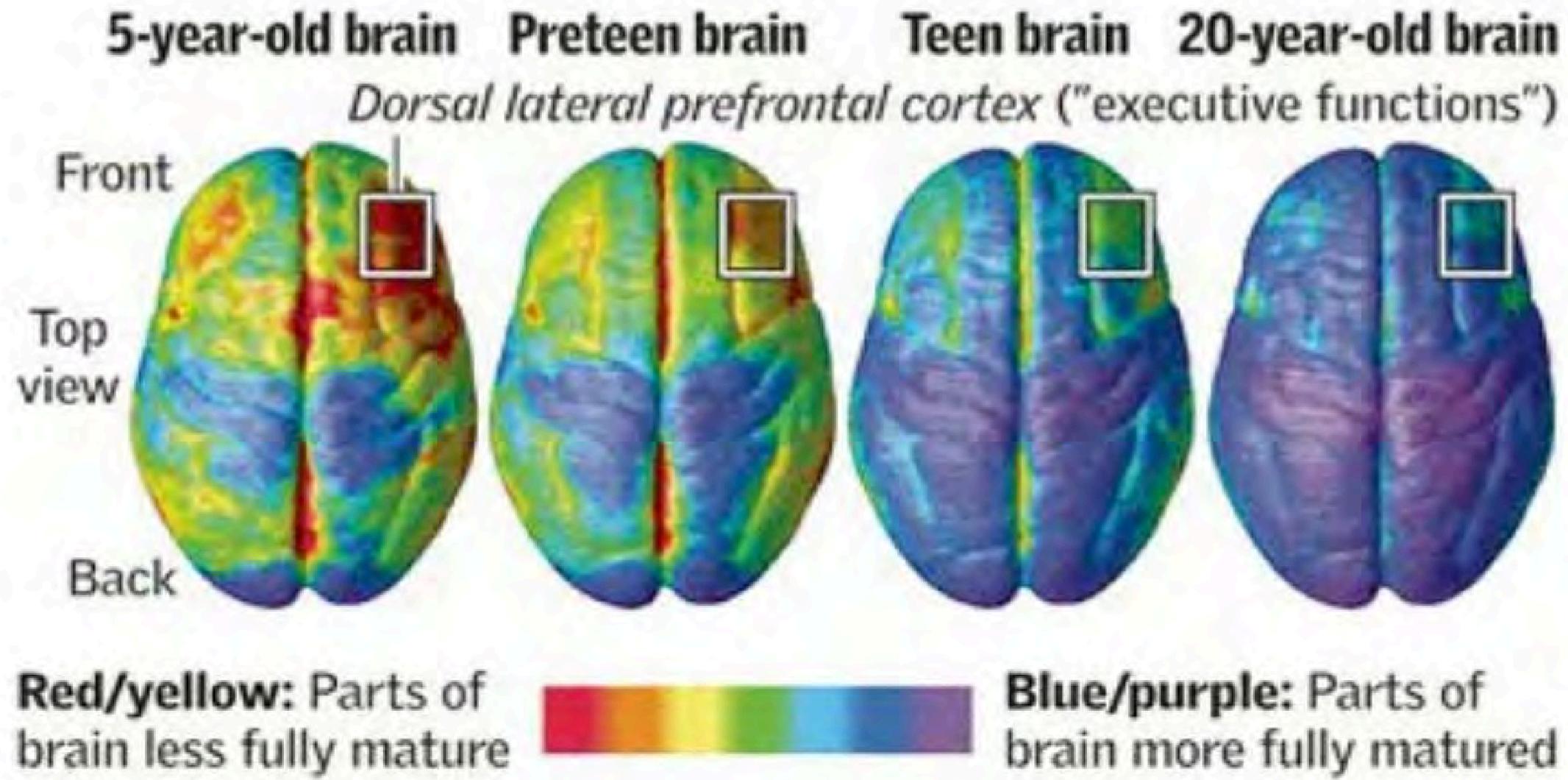
Sources: National Institute of Mental Health; Paul Thompson, Ph.D., UCLA Laboratory of Neuro Imaging

Thomas McKay | The Denver Post

The brain architecture game can be played in small or large groups in about 75-90 minutes.

If you're wondering whether The Brain Architecture Game would be appropriate for your outreach or education event, here are some things to consider.

✓ **Introduces core concepts from developmental science.**

Players will leave with an understanding that the architecture of the brain is built starting in the earliest years of life, and that experiences shape the structure for better or worse.

✓ **Easy to understand and simple to play – but hard to forget.**

By engaging players in a carefully designed, hands-on, group experience, the game helps people see and feel the implications of the science of early brain development.

✓ **Establishes a strong, shared frame for productive conversations on a range of early childhood issues, policies, and programs.**

A facilitated discussion concludes the game. The shared concepts and vocabulary help people focus on shared, civic responsibility for creating the environments in which young children develop.

✓ **Works for small or large events.**

The game can work with groups as small as 4 players, and has been played effectively in conference-style settings with groups as large as 300. People should be seated at tables of 4-6 players. You'll need one game set per table.

Institutional Partners

The Brain Architecture Game's intellectual property belongs to a not-for-profit partnership between:

- Creative Media & Behavioral Health Center @ University of Southern California
- Center on the Developing Child @ Harvard University
- Clinical & Translational Science Institute @ the University of Pittsburgh
- FrameWorks Institute

Production and distribution of The Brain Architecture Game were generously sponsored by the **Palix Foundation.**
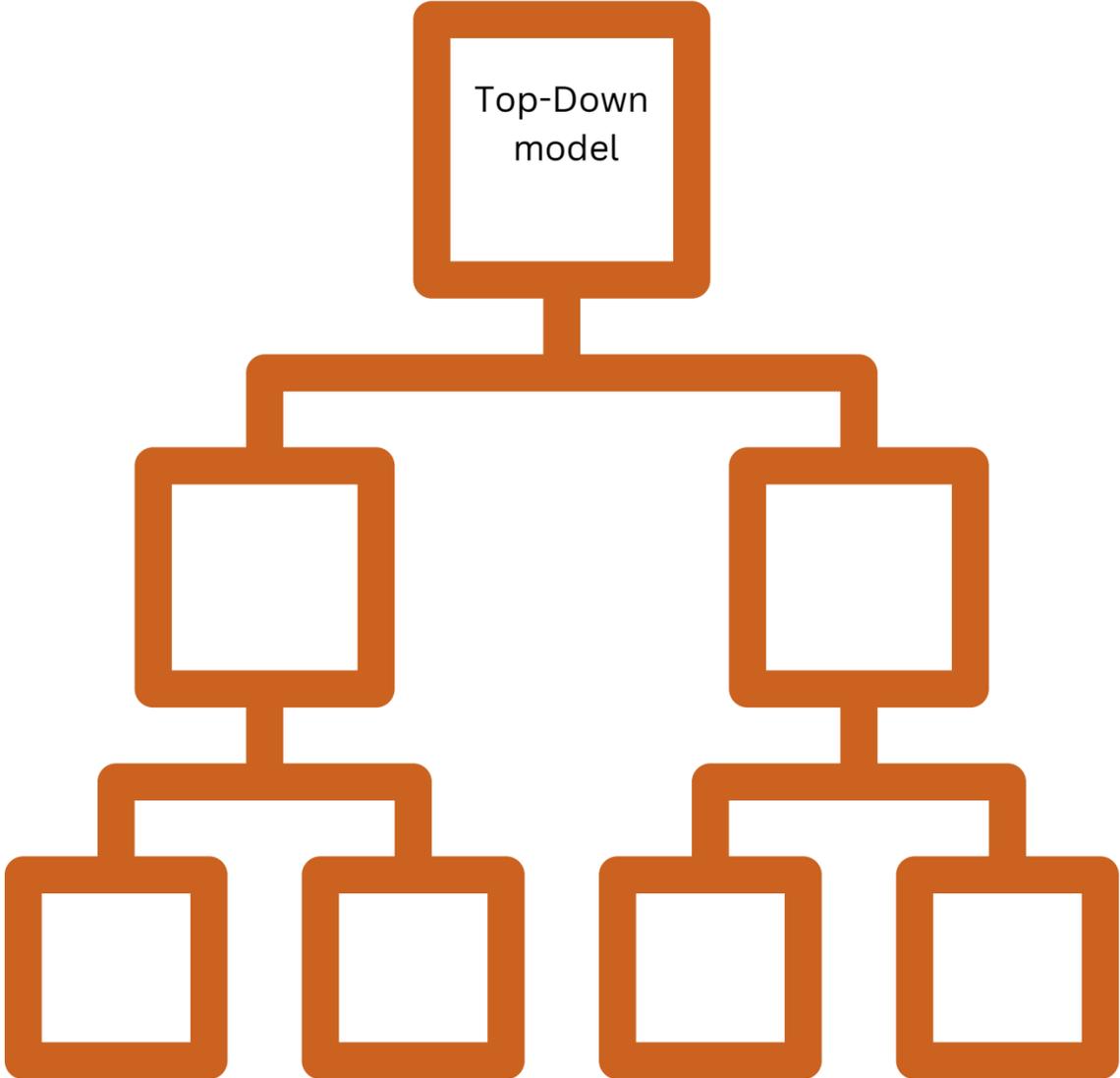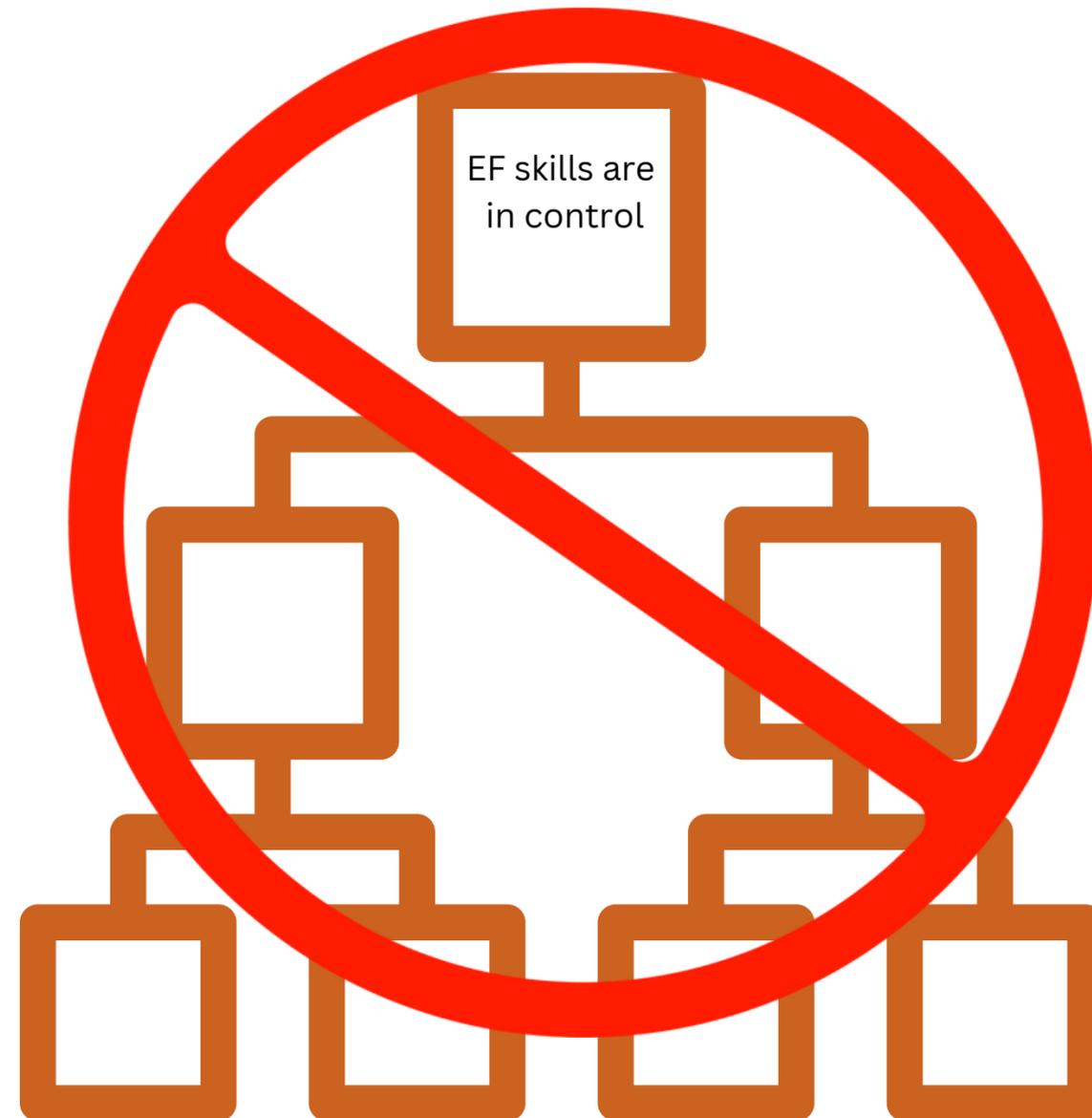
https://dev.thebrainarchitecturegame.com/
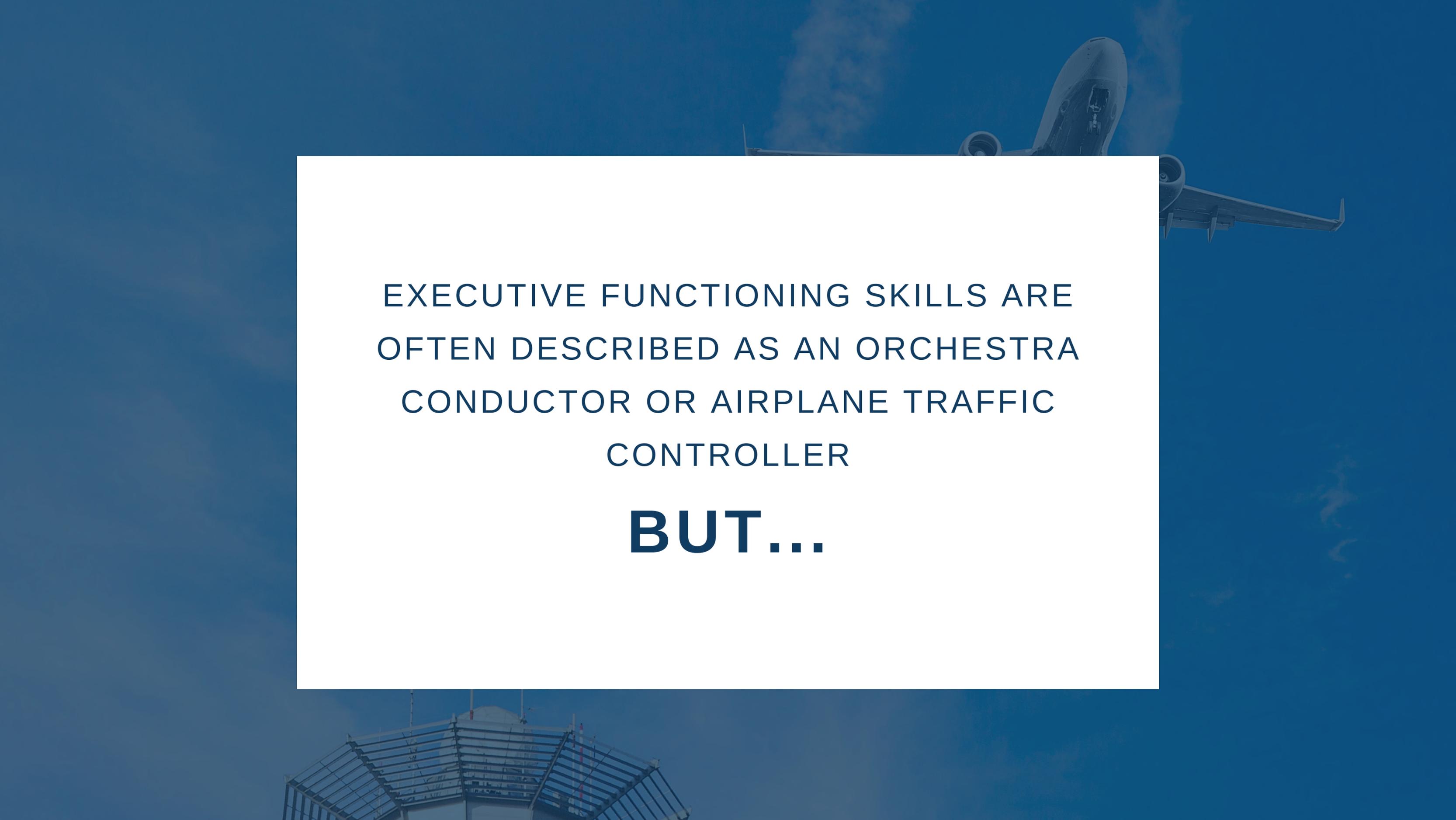
EXECUTIVE FUNCTIONING SKILLS ARE OFTEN DESCRIBED AS AN ORCHESTRA CONDUCTOR OR AIRPLANE TRAFFIC CONTROLLER

BUT...

Heirarchical Model of Executive Control
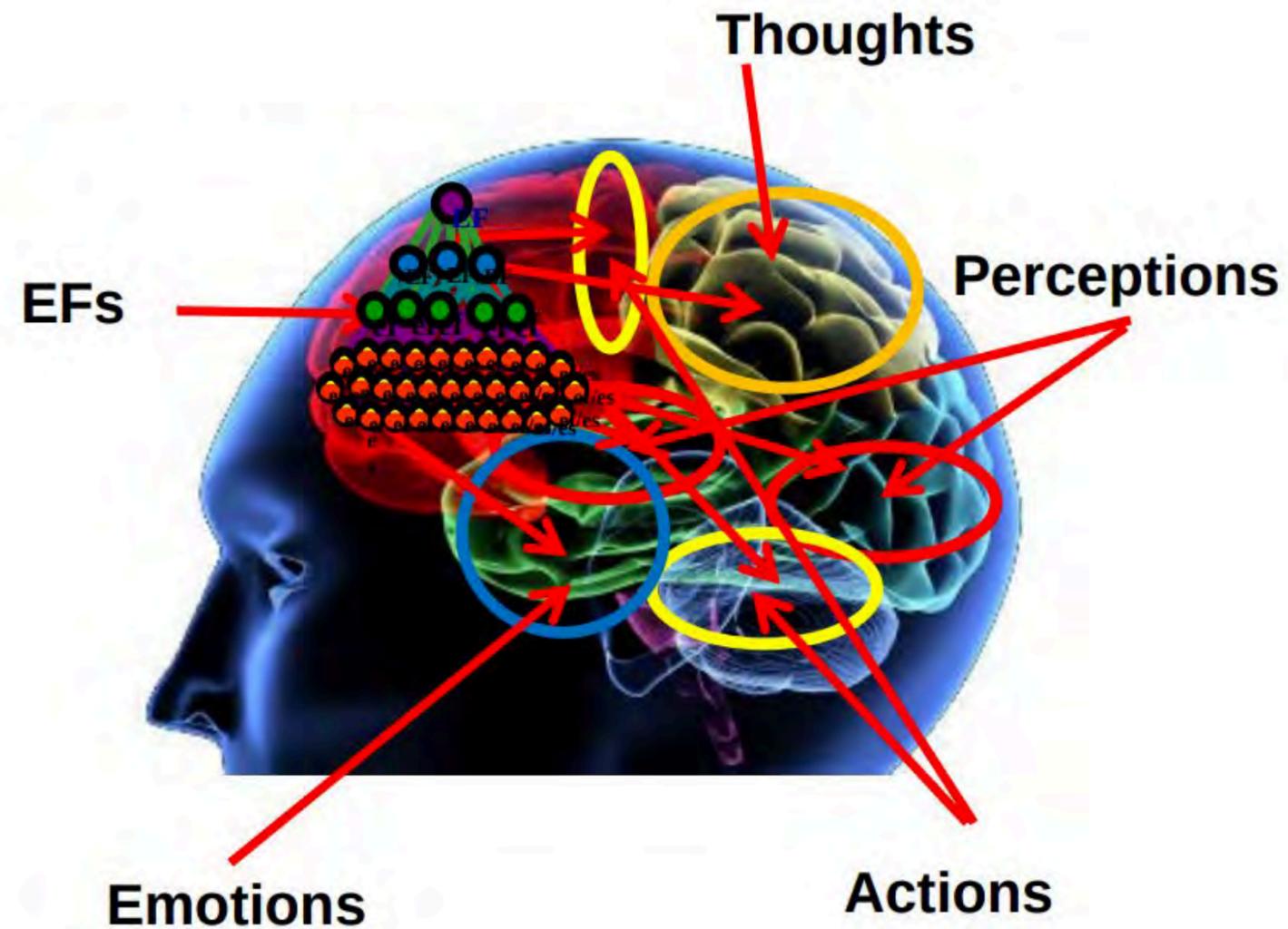
Heirarchical Model of Executive Control
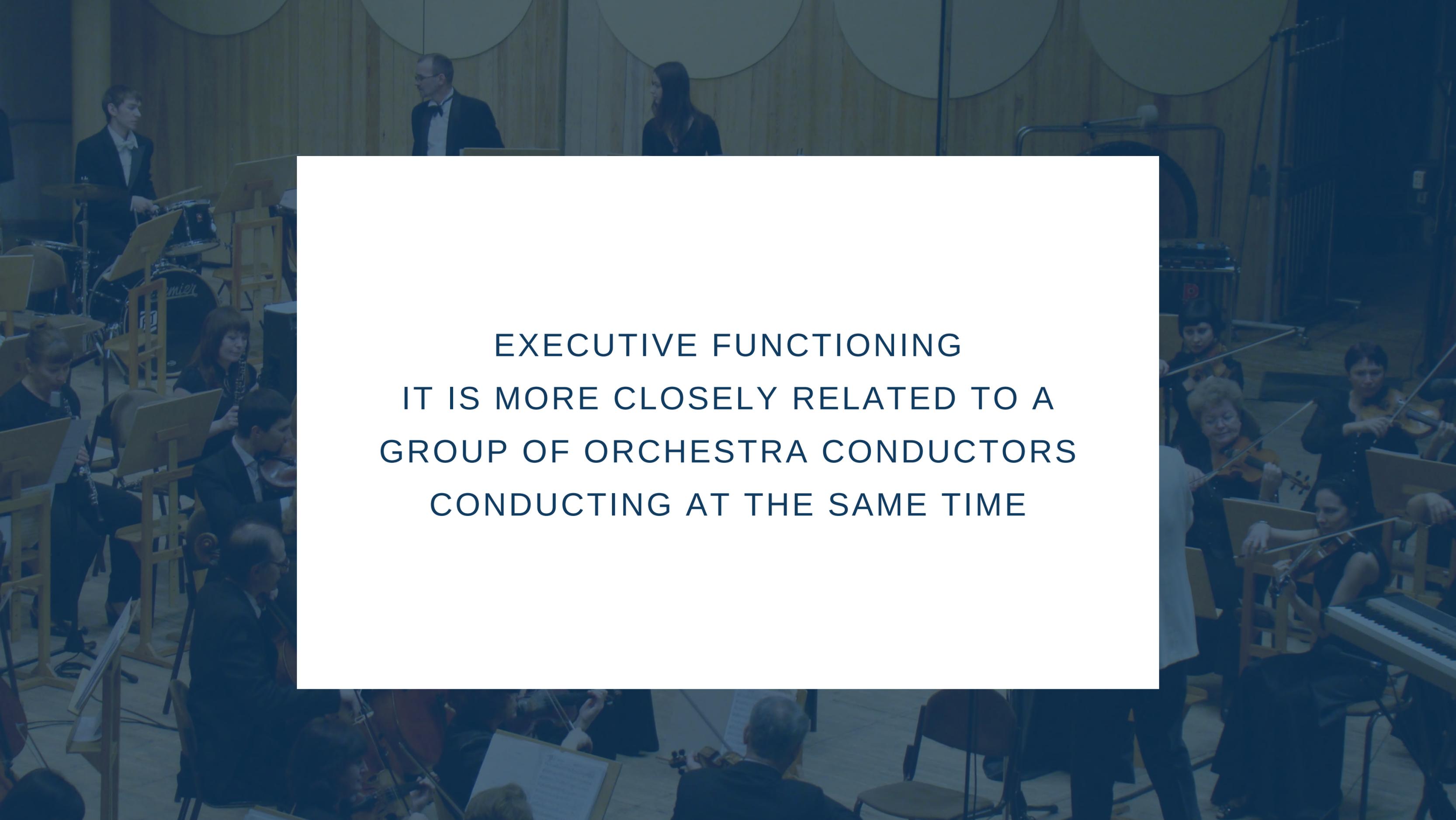
EF skills are in control

EXECUTIVE FUNCTIONING
IT IS MORE CLOSELY RELATED TO A
GROUP OF ORCHESTRA CONDUCTORS
CONDUCTING AT THE SAME TIME

Holarchical Model of Executive Control

McCloskey, George. "Improve Executive Capacities: Strategies to Change the Brain and Change Behavior," October 2018, CABE.
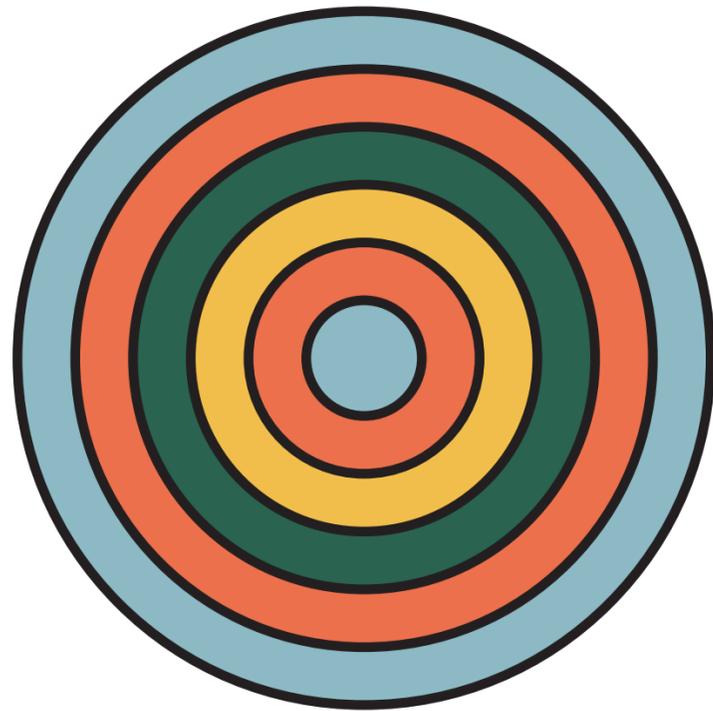
Executive functioning skills develop holarchically across levels rather than heirarchically
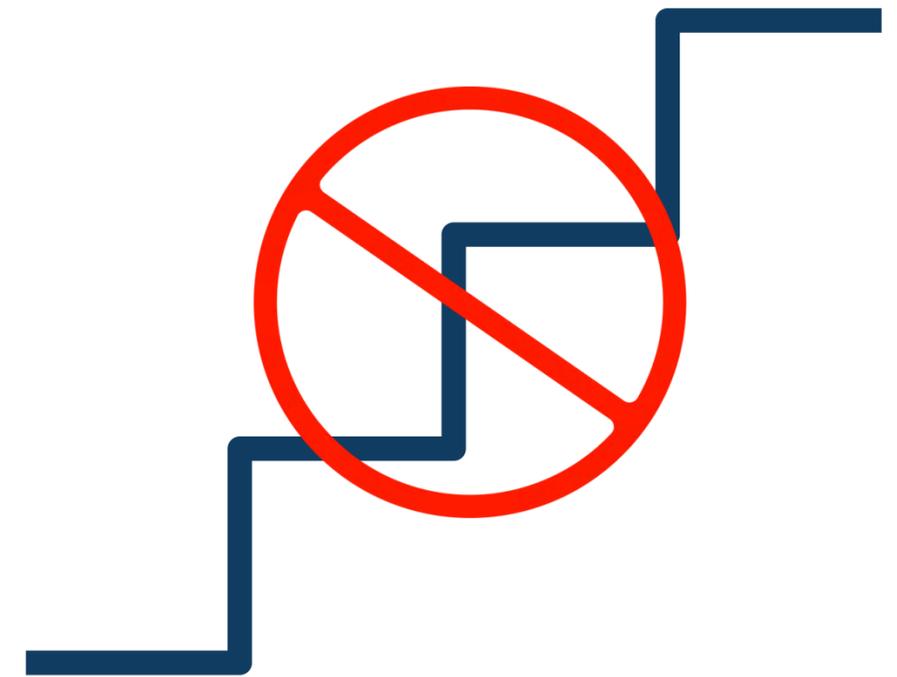
Variation Between Students

- A student may have some well developed EF skills & other underdeveloped EF skills **at the same time.**

- Individuals of the same age can vary considerably with EF skill development.

EXECUTIVE FUNCTIONING SKILLS

Metacognition

Organization

Task Initiation

Sustained Attention

Time Management

Emotional Regulation

Goal Planning / Prioritization

Working Memory

"I have a student who struggles to turn in homework"

Possible underlying EF skill weaknesses:

- Because they forget to bring home needed materials (working memory, organization)
- Delay starting homework (task initiation)
- Quit before work is done (sustained attention)
- Give up at the first obstacle (emotional control)
- Doesn't know how to actually do assigned work (planning, organization, metacognition)

Learning Difficulty
vs.
Producing Difficulty
(EF skill weakness)

McCloskey, George. "Improve Executive Capacities: Strategies to Change the Brain and Change Behavior," October 2018, CABE.

McCloskey, George. "Improve Executive Capacities: Strategies to Change the Brain and Change Behavior," October 2018, CABE.
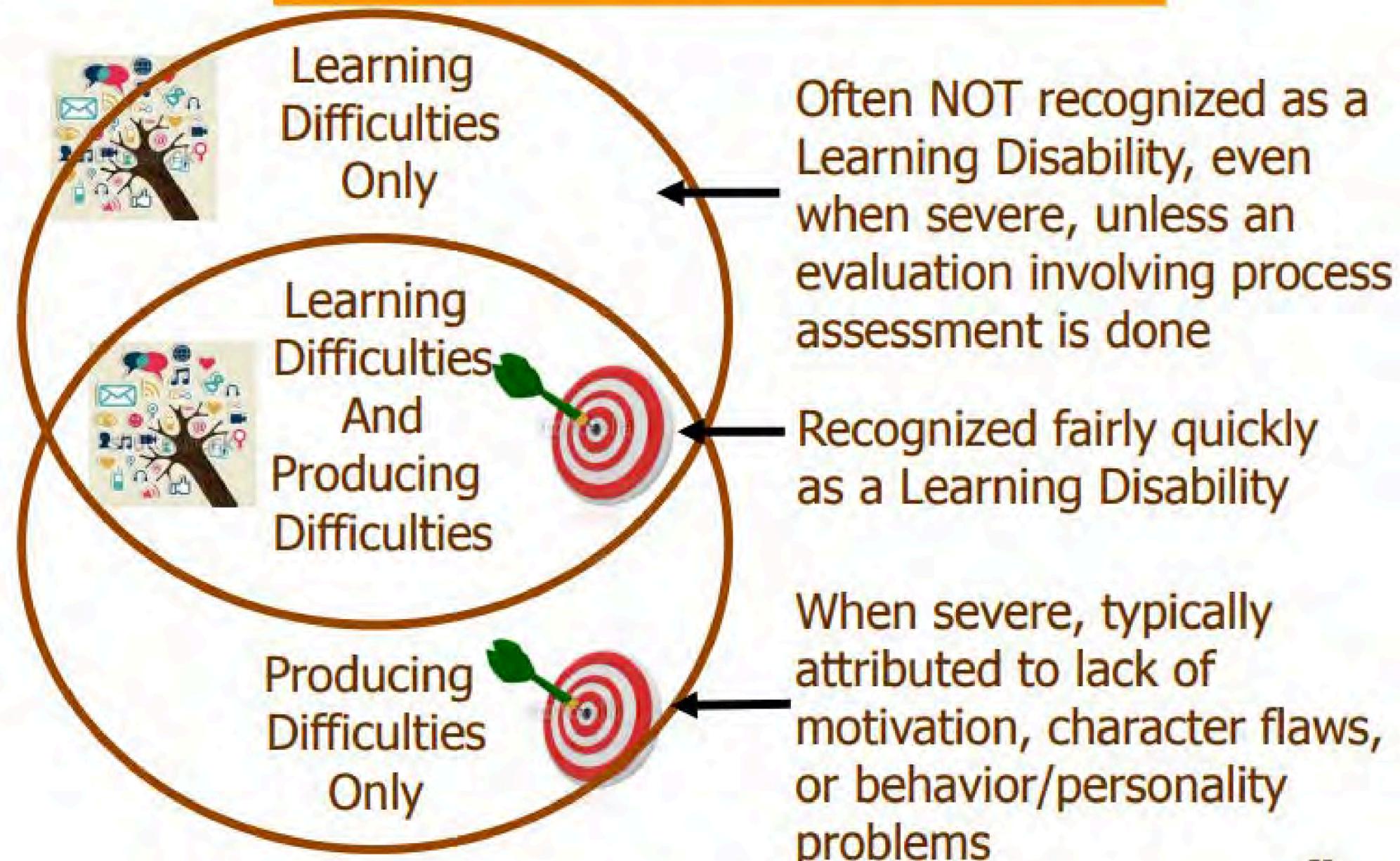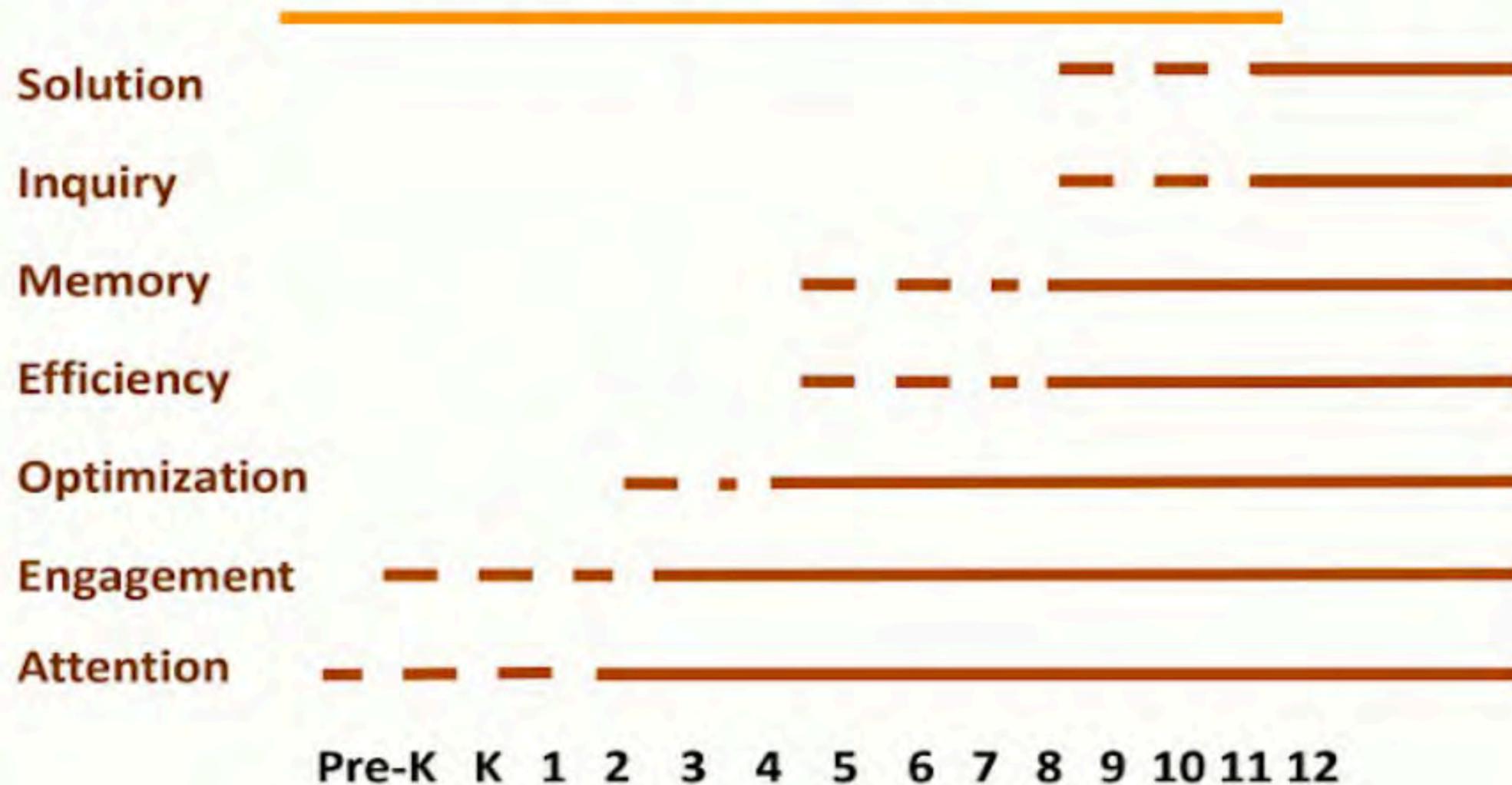
Cultural change points, when the school environment shifts and expectations may increase, (Educational transitions preschool, kindergarten, middle school, high school) can highlight EF developmental weaknesses.

A general
EF intervention goal =

Help students become
conscious of the EFs
needed and how to
engage them

Many EF Interventions

McCloskey, George. "Improve Executive Capacities: Strategies to Change the Brain and Change Behavior," October 2018, CABE.

Challenges with EF Interventions

- Instruction needs to **find a balance** between providing EF external strategies and not providing too much support to prevent students' own EF skill development

- It is **easy to overlook the multifaceted nature** of EF skill development and focus only on time management & organization

Questions to Foster Productive Dialogue About EF SKills With Your Team

- How would you describe your understanding of executive functioning skills, and which specific skills do you believe are most critical for our students?

- Can you share examples of how executive functioning challenges manifest in your students, and what specific behaviors or difficulties have you observed?

- What strategies or interventions have you implemented in your classroom that you have found effective in supporting students with executive functioning difficulties?

- What additional training or resources do you feel you need to better support your students' executive functioning skills, and how can we assist in your professional growth in this area?

CHANGE

- How did it feel when you were asked to cross your arms the other way?
- Did it come naturally or did you have to stop and think about it?
- Were you comfortable with doing this differently from your normal habit?
- What are some things that make people resistant to change?
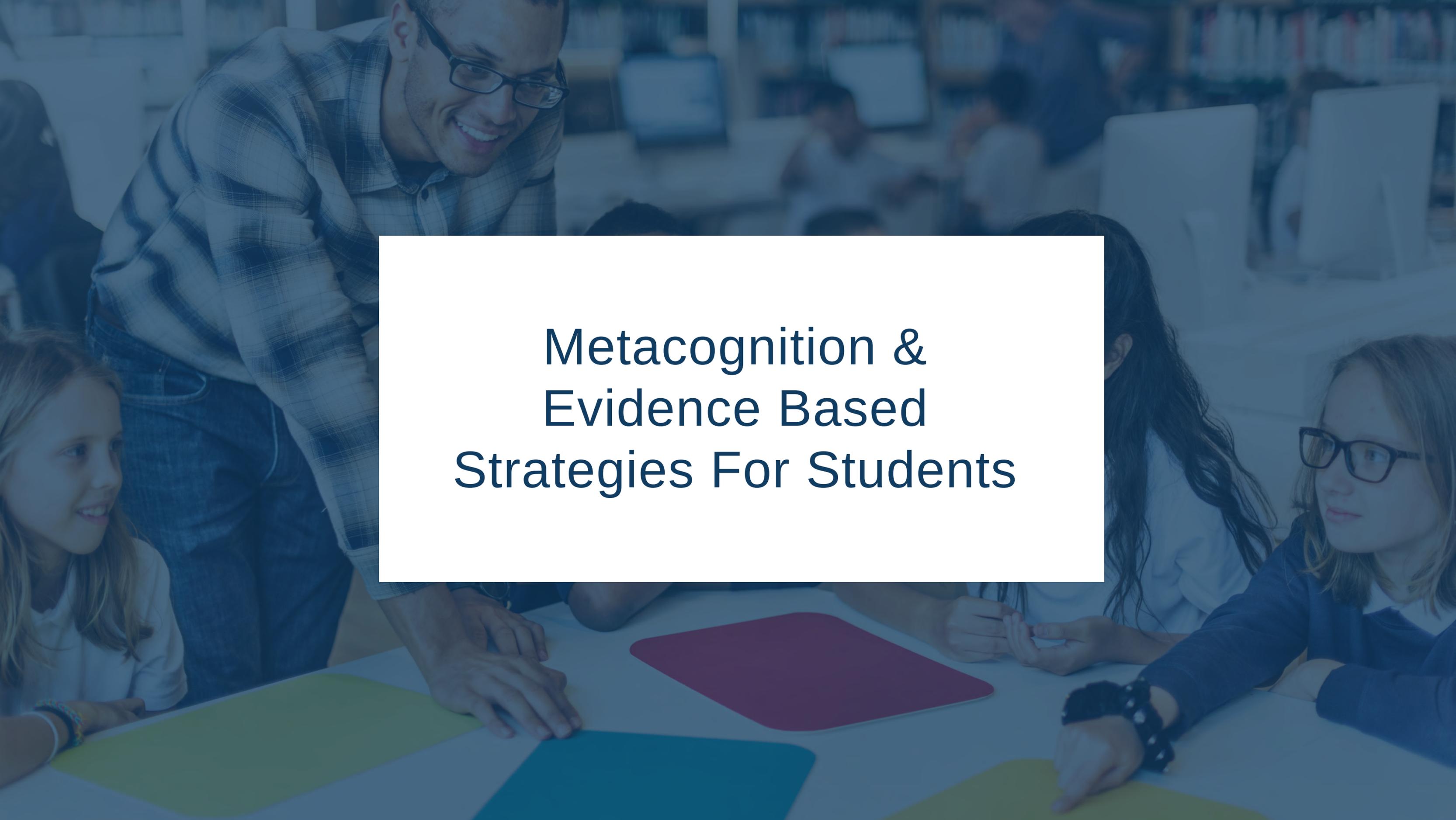
Metacognition & Evidence Based Strategies For Students

Why Metacognition?

Teaching metacognitive strategies are among the **top ten most influential factors** in student learning and success.

Interventions designed to increase academic performance by **improving metacognitive knowledge** and skills have been consistently **effective.**

Beach, Paul, Anderson, Ross, Jacovidis, Jessica and Chadwick, Christine. Making The Abstract Explicit: The Role Of Metacognition In Teaching And Learning. (2020)

Metacognition

The ability to:

- think about your own thinking

- be consciously aware of yourself as a problem solver

- plan, monitor, evaluate, and control your mental processing (e.g. "Am I *understanding* this material, or just *memorizing* it?")

- accurately judge your level of learning

- know what you know and what you don't know

Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. B. Resnick (Ed.), The nature of intelligence (pp.231-236). Hillsdale, NJ: Erlbaum

SIMPLE DEFINITION:

"What am I doing now?"

"Is it getting me anywhere?"

"What else could I be doing instead?"

What do I know or am unsure about?

What action steps should I take based on what I know or am unsure about?

Metacognition

Metacognitive Knowledge

Metacognitive Regulation

Declarative knowledge

Procedural knowledge

Conditional knowledge

Planning

Monitoring

Evaluating

Stanton, Julie Dangremond, et al. "Fostering Metacognition to Support Student Learning and Performance." CBE—Life Sciences Education, vol. 20, no. 2, June 2021, www.ncbi.nlm.nih.gov/pmc/articles/PMC8734377/, https://doi.org/10.1187/cbe.20-12-0289.

2 Categories of Metacognition

Metacognitive Knowledge

- What do you know about yourself as a learner?
- What do you know about learning strategies?
- What do you know about when/why to use learning strategies?

Metacognitive Regulation

- What strategies should I use for a future task?
- How effective are the strategies I am using for this task?
- How should I alter my plan (if I need to) in the future?

WHAT DO YOU THINK?

ACTION

Table 1. Sample self-questions to promote student metacognition about learning[a]

Activity	Planning	Monitoring	Evaluating
Class session	• What are the goals of the class session going to be? • What do I already know about this topic? • How could I best prepare for the class session? • Where should I sit and what should I be doing (or not doing) to best support my learning during class? • What questions do I already have about this topic that I want to find out more about?	• What insights am I having as I experience this class session? What confusions? • What questions are arising for me during the class session? Am I writing them down somewhere? • Do I find this interesting? Why or why not? How could I make this material personally relevant? • Can I distinguish important information from details? If not, how will I figure this out?	• What was today's class session about? • What did I hear today that is in conflict with my prior understanding? • How did the ideas of today's class session relate to previous class sessions? • What do I need to actively go and do now to get my questions answered and my confusions clarified? • What did I find most interesting about class today?

Tanner, Kimberly D. "Promoting Student Metacognition." CBE—Life Sciences Education, vol. 11, no. 2, June 2017, pp. 113–120, www.ncbi.nlm.nih.gov/pmc/articles/PMC3366894/, https://doi.org/10.1187/cbe.12-03-0033.

Active-learning task and/or homework assignment	• What is the instructor's goal in having me do this task? • What are all the things I need to do to successfully accomplish this task? • What resources do I need to complete the task? How will I make sure I have them? • How much time do I need to complete the task? • If I have done something like this before, how could I do a better job this time?	• What strategies am I using that are working well or not working well to help me learn? • What other resources could I be using to complete this task? What action should I take to get these? • What is most challenging for me about this task? Most confusing? • What could I do differently midassignment to address these challenges and confusions?	• To what extent did I successfully accomplish the goals of the task? • To what extent did I use resources available to me? • If I were the instructor, what would I identify as strengths of my work and flaws in my work? • When I do an assignment or task like this again, what do I want to remember to do differently? What worked well for me that I should use next time?

Tanner, Kimberly D. "Promoting Student Metacognition." CBE—Life Sciences Education, vol. 11, no. 2, June 2017, pp. 113–120, www.ncbi.nlm.nih.gov/pmc/articles/PMC3366894/, https://doi.org/10.1187/cbe.12-03-0033.

Metacognition & Your Teaching Team

Activity	Planning	Monitoring	Evaluating
Class session	• What are my goals for this class session? How did I arrive at these goals? • What do I think students already know about this topic? What evidence do I have for my thinking? • How could I make this material personally relevant for my students? Why do I think this? • What mistakes did I make last time I taught this and how can I not repeat these?	• What do I notice about how students are behaving during this class session? Why do I think this is happening? • What language or active-learning strategies am I using that appear to be facilitating learning? impeding learning? • How is the pace of the class going? What could I do right now to improve the class session?	• How do I think today's class session went? Why do I think that? What evidence do I have? • How did the ideas of today's class session relate to previous class sessions? To what extent do I think students saw those connections? • How will what I think about how today's class session went influence my preparations for next time?
Overall course	• Why do I think it's important for students pursuing a variety of careers to learn the ideas in my course? What are my assumptions? • How does success in this course relate to my students' career goals? How might I reveal these connections to them? • What do I want students to be able to do by the end of this course? Still be able to do 5 yr later?	• In what ways am I effectively reaching my goals for students through my teaching? How could I expand on these successful strategies? • In what ways is my approach to teaching in this course not helping students learn? How could I change my teaching strategies to address this? • How is my approach to teaching this course different from last time I taught it? Why?	• What evidence do I have that students in my course learned what I think they learned? • What advice would I give to students next year about how to learn the most in this course? • If I were to teach this course again, how would I change it? Why? What might keep me from making these changes? • How is my thinking about teaching changing?

Tanner, Kimberly D. "Promoting Student Metacognition." CBE—Life Sciences Education, vol. 11, no. 2, June 2017, pp. 113–120, www.ncbi.nlm.nih.gov/pmc/articles/PMC3366894/, https://doi.org/10.1187/cbe.12-03-0033.

What is Charting the LifeCourse?
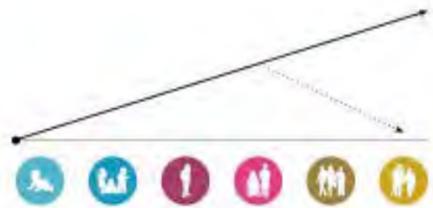
METACOGNITION!!!

Trajectory Across Life Stages

Life is a journey where each stage of life impacts the other and different life experiences bring us closer or further away from our "good life." In the LifeCourse framework, we use the term "life trajectory" to describe the path your journey takes. It helps a person to think about what has helped or hindered you in the past and what might work or may get in your way moving forward. The higher your expectations, the more opportunities and experiences you will have, and the closer you will get to achieving your goals and dreams. Every life stage is connected, and what happens in each, affects all the stages to come. The life experiences in each stage build upon one another and prepare a person for the future life stages.
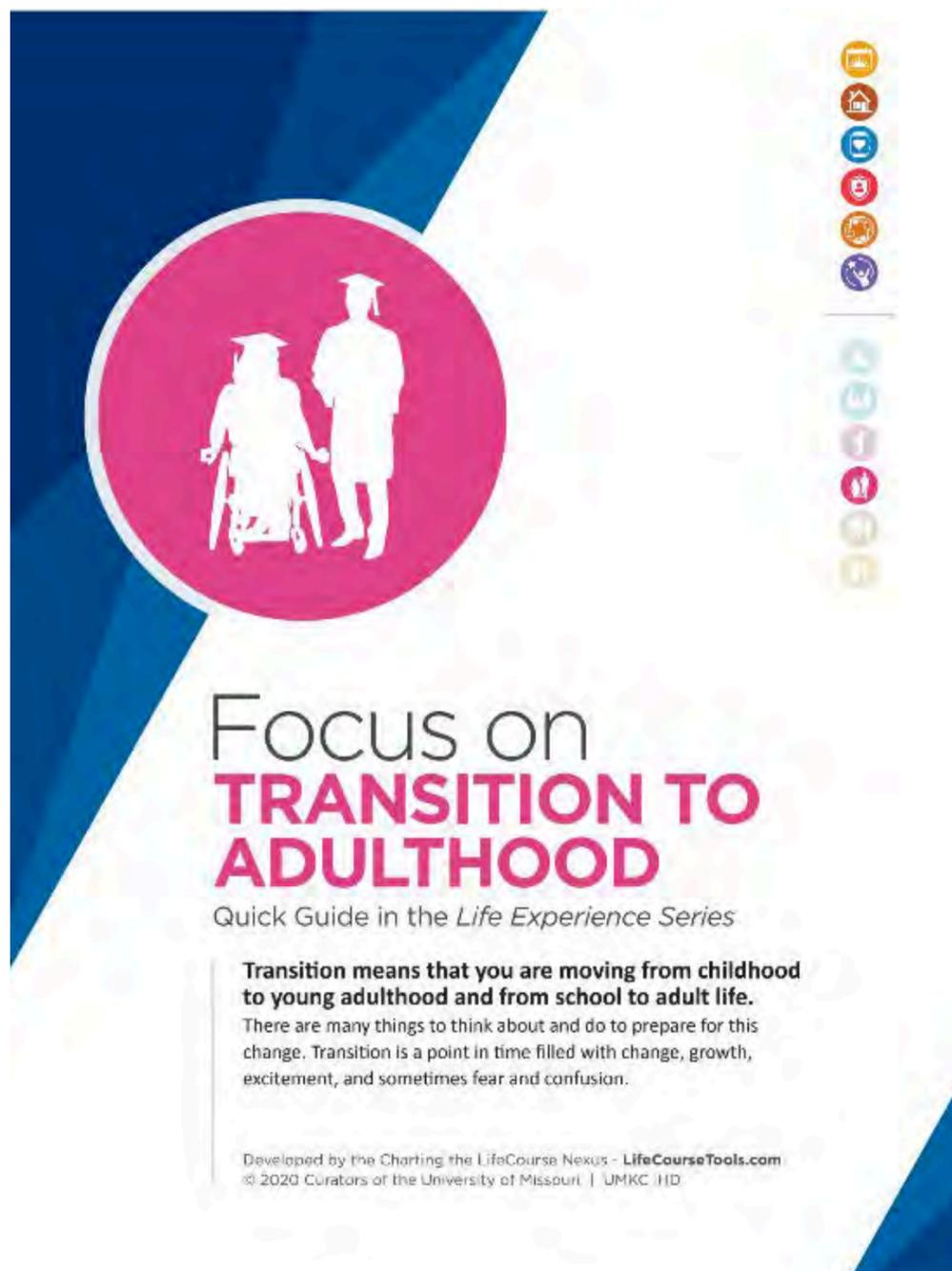
Focus on TRANSITION TO ADULTHOOD

Quick Guide in the *Life Experience Series*

Transition means that you are moving from childhood to young adulthood and from school to adult life.
There are many things to think about and do to prepare for this change. Transition is a point in time filled with change, growth, excitement, and sometimes fear and confusion.

Developed by the Charting the LifeCourse Nexus - **LifeCourseTools.com**
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FOCUS ON TRANSITION TO ADULTHOOD

DAILY LIFE & EMPLOYMENT

What a person does as part of everyday life– school, employment, volunteering, communication, routines, life skills

It may seem like it is a long way off, but sooner than you think, the bus will stop coming, and you will no longer be going to school during the day. Have you thought about what you will do during the day when school ends? Have you talked about what you want to do with your parents/family? What kind of changes might this mean for your family?

- Who is helping me create a transition plan that is truly individualized and prepares me for life after school ends?
- How does my transition plan include work or volunteer experience, as well as practicing how to look for, get and keep a job?
- What kind of job do I think I would like to try (what do I like to do or want to learn more about)?
- What supports will I need for either work or other daytime activities, and who will provide those supports?

COMMUNITY LIVING

Where and how someone lives– housing and living options, community access, transportation, home adaptations and modifications

Have you thought about where you might live as an adult? There are many options to consider– some are more traditional (for instance, a group home), but more and more, there are many "non-systems" community options emerging (like owning your own home). Anything is possible if you plan ahead, think creatively and believe!

- Where do I think I might want to live in the future (after school ends/when I am an adult)?
- How am I learning about different living options for when I am an adult?
- What technology or home modifications would help me function better or be more independent in my home?
- What supports will I need to either continue living in my family home or move into my own place after graduation?
- How will I get around in the community as an adult (drive, public transit, family, cab, car service, etc)?

SAFETY & SECURITY

Staying safe and secure– emergencies, well-being, guardianship options, legal rights and issues

Parents and other supporters often worry their loved one with a disability will be taken advantage of or harmed if they don't have a guardian. You may have been told by your school, doctor, or friend that you need a guardian when you turn 18. However, it is important to understand how guardianship may affect your life, as well as the many options and alternatives that exist before making a decision.

- What skills and abilities can I learn and practice now to prepare me to "be my own person" so I will not need a guardian to keep me safe when I turn 18?
- What are some supported decision making practices that will keep me safe without restricting my basic rights?
- Which life areas concern my parents and loved ones most in terms of my safety?
- What are my parents and others doing to help me be able to stay at home or be in the community alone or without additional support?
- What am I doing to know what to do in case of an emergency or disaster?

Developed by the Charting the LifeCourse Nexus - **LifeCourseTools.com**
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Help students identify and **close "the gap"**
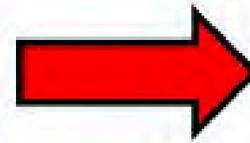
current *behavior* → current learning (and grades)

MIND THE GAP

productive *behavior* → desired learning (and grades)
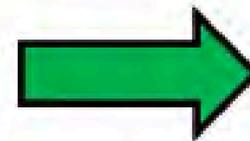
Macguire, Saundra . Metacognition: The Key to Improving Student Learning, [date unknown].

Transition

"What is My Current Behavior..."

Choose an Area of Transition

What are your current strategies/ behaviors/habits, etc.?

Are they working for you?

How do you know if they are working?

What else do you need to do / action you can take?
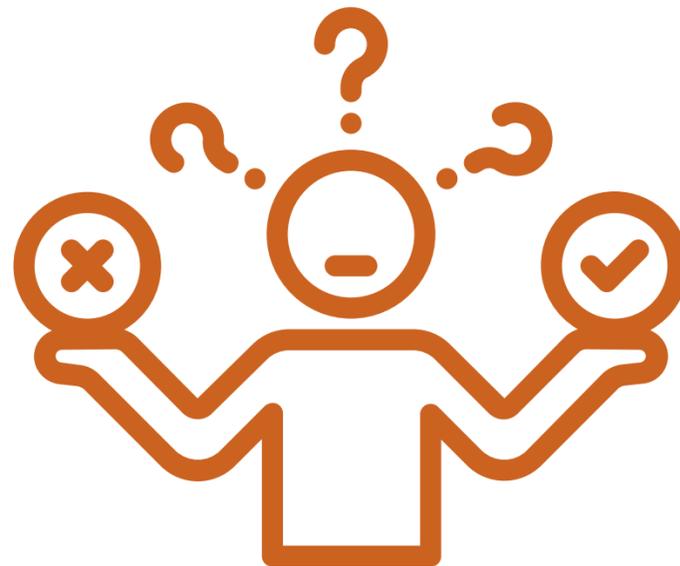
Low Metacognition = Overconfidence

"...low-performing students overpredict their exam performance because they are **unaware of the information they do not know**, and **unaware of the fact that they do not know the information..."**

Saenz, Gabriel D., et al. "Metacognition in the Classroom: The Association between Students' Exam Predictions and Their Desired Grades." Consciousness and Cognition, vol. 51, May 2017, pp. 125–139, https://doi.org/10.1016/j.concog.2017.03.002. Accessed 16 Feb. 2020.

Final Takeaway

"...**small metacognitive interventions** can have a **significant effect** on **student performance** in a range of disciplines and courses. Given the prompts require little additional preparation by the instructor, do not take much class time, and do not burden students time, consuming additional assignments, instructors are more likely to incorporate them in existing courses. <u>These simple exercises thus have the potential to be adopted broadly and to make a significant impact on student learning</u>."

(Domokos and Huey, 2023)

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