



EXECUTIVE FUNCTION

**MAKES THE
BRAIN GO
ROUND**

A guide to helping kids and teenagers succeed with the science of learning



HERE'S WHAT'S INSIDE

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For Teaching Students Who Struggle With Executive Function

EXECUTIVE FUNCTION INFO PACK

Based on Carnegie Learning, *Executive Function Makes the Brain Go Round*, 2022 and Bill Jenkins, *What is Executive Function and Why is it so important?*

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DID YOU KNOW?

VISUALISING THE SCIENCE OF LEARNING IN THE BRAIN

Brains are amazing!

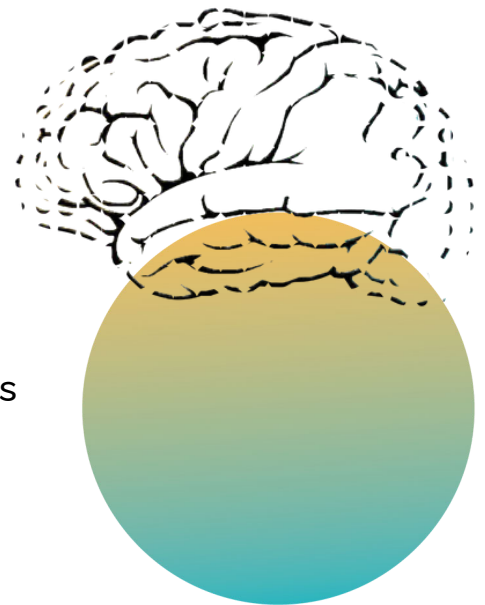
We know from the science of learning that every time you learn something new, your brain changes. When you learn and use a new word, for example, **new neural networks will form** and connect to other associated networks.

But if it's something more complex like a new language or academic subject, your brain will change even more.

For instance, taking a calculus class will impact parts of the brain that regulate language, perception, memory, and reasoning.

While our brains will continue to change throughout our lives, child and adolescent brains change much more rapidly than adult brains.

This means that teachers and parents are changing students' brains every day.



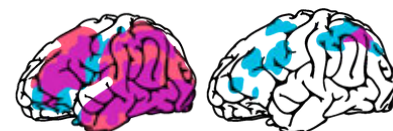
WHAT HAPPENS WHEN BRAINS LEARN?

COGNITIVE RESEARCH that contributes to the science of learning has shown where different kinds of learning happen in the brain

When learning happens, different parts of the brain connect. For instance, when a person learns to read, the parts of the brain that regulate vision, auditory processing, sequencing, pattern recognition, and attention link themselves to the parts.

WHAT THIS MEANS FOR YOUR STUDENTS

Since learning involves so many parts of the brain, consider that a struggling learner might need help building skills other than those that seem directly connected to the learning task. For example, a struggling reader may need to strengthen auditory processing and a student who finds maths challenging may need working memory support.

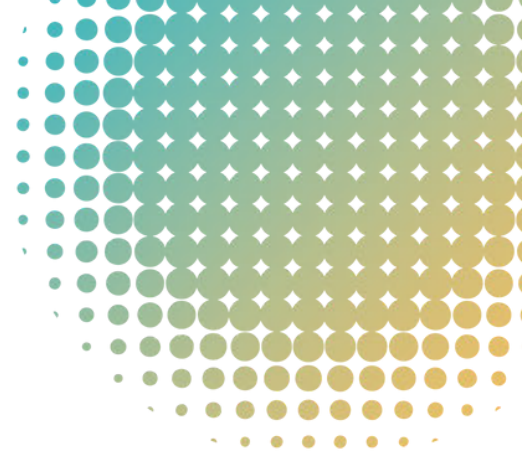


This is the brain on reading (left) and the brain on maths (right).

These illustrations combine a vast amount of data gathered with two imaging technologies. One technology is fMRI scans that show what parts of brains are activated while reading or doing maths. The second uses computational neuroscience approaches that track deep neural networks utilized during reading or while doing maths. This multifaceted research approach reveals just how deep and complex an impact reading and maths have in building brain interconnections. (The different colors are examples of data that have been derived from the different approaches.)

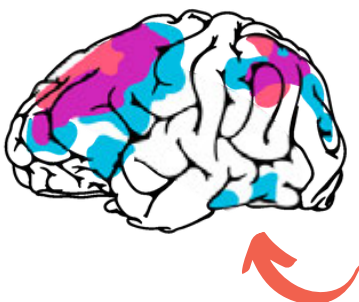
Reference: Jones, D., Lowe, V., Graff-Radford, J., Botha, H., Barnard, L., & Wiepert, D. et al. (2022). A computational model of neurodegeneration in Alzheimer's disease. *Nature Communications* 13(1). <https://doi.org/10.1038/s41467-022-29047-4>.

Children begin school with partially-developed prefrontal cortexes, meaning that the executive function skills that the prefrontal lobe regulates may not be strong enough to sustain attention, hold information in working memory, or regulate impulses.



WHAT THIS MEANS FOR YOUR STUDENTS

When students struggle with these executive function skills, teachers and parents should help build them rather than punish the students for what might be perceived as misbehavior. Remember that the prefrontal cortex doesn't finish developing until early adulthood, between the ages of 25 and 30. So be sure to be extra nice to your younger colleagues!



This is the brain while using working memory.

Just like the images on the previous page, this illustration combines a vast amount of data gathered with two imaging technologies: fMRI scans and computational neuroscience approaches.

Reference: Jones, D., Lowe, V., Graff-Radford, J., Botha, H., Barnard, L., & Wiepert, D. et al. (2022). A computational model of neurodegeneration in Alzheimer's disease. Nature Communications 13(1). <https://doi.org/10.1038/s41467-022-29047-4>.

The good news is that because of neural plasticity, which refers to the brain's ability to change its structure, students can practice and eventually improve weak executive functions.

As with all cognitive skills, practice is key. Repeatedly working on things like impulse control, goal-setting, and organization will strengthen the neural networks that regulate these capabilities.



THE GLUE THAT HOLDS LEARNING TOGETHER

THE BASICS OF EXECUTIVE FUNCTION

WHAT IS EXECUTIVE FUNCTION?

The brain's executive function is like an internal "air traffic control system".

An air traffic controller manages multiple aircraft in various stages of their flights – taking off, changing altitude, altering direction, landing, and so on.

Similarly, our brain's executive function helps us focus on multiple streams of information at the same time, monitor errors, make decisions in light of available information, revise plans as necessary and resist the urge to let frustration lead to hasty actions.



THE THREE AREAS OF EXECUTIVE FUNCTION



WORKING MEMORY

The ability to keep information in mind and use it



COGNITIVE FLEXIBILITY

The ability to think about something in more than one way



INHIBITORY CONTROL INCLUDES ATTENTION

The ability to ignore distractions and resist temptation

These three skills help us keep information in mind, master our impulses, and remain flexible in the face of change - and are crucial building blocks for the development of both cognitive and social interaction skills in young children.

WHAT EVERY PARENT AND TEACHER NEEDS TO KNOW

To learn effectively, we need to:

- **Pay attention** long and deep enough to engage with new skills and concepts.
- **Understand** the feedback and corrections and reflect on what we are doing well and what we need to keep working on.
- **Remember** what we learn.

**ALL OF THIS
REQUIRES
EXECUTIVE
FUNCTION.**

Executive function helps you to:

- **Pay attention** to what's relevant and filter out distractions
- **Process information quickly** and connect it to other relevant information
- **Recognize words** so you can use them to understand and learn
- **Organise and sequence everything** from ideas to tasks to time
- **Control emotions** so they don't get in the way of learning
- **Remember information** long enough to use it (working memory)
- **Generate** words, ideas, and concepts
- **Set goals** and make plans for reaching those goals
- **Self-regulate** so you can stick to tasks until they're complete. This is tied to impulse control
- **Shift** from one task to the next with minimal disruption



Executive function is not always developed automatically. Kids with autism, dyslexia, ADHD, and other learning differences often struggle with executive function. But it's important to remember that poor executive function skills are not correlated to low intelligence. In fact, most kids with executive function challenges have average or above-average IQs. It is a mistake to immediately brand a child who struggles with things like inhibitory control as a “bad kid”.

Understanding executive function gives you as a parent a better understanding of why your child is struggling when he or she is having difficulty controlling impulses, focusing on a given task, or understanding that different rules may apply at different times.

This will help you decide if outside help may be needed to help your child. Studies show that there are interventions that support executive function development.

TOP 10 TIPS

TIPS FOR TEACHING STUDENTS WHO STRUGGLE WITH EXECUTIVE FUNCTIONS

Refer to this quick list of classroom strategies to assist students in strengthening executive function skills

- 1 Make classroom organisation structures evident and consistent.**
For example, tasks and activities should be broken up into 20-minute chunks to sustain attention and support working memory.
- 2 Provide daily schedules/agendas** so students have an overview of how time will be spent.
- 3 Allow for 1-3 minute “brain breaks”** in between lessons or activities for students to rest, recharge, and refocus.
- 4 Call out transitions** before and while they happen, so students understand they will need to shift their attention to something new.
- 5 Set aside time in class for students to set goals** and make plans for achieving these goals.
- 6 Include understanding checks** such as regular low-stakes quizzes or writing assignments to help students process, review, and consolidate what they've learned.
- 7 Give students strategies for self-regulation**, i.e. deep breathing, stretching exercises, doodling, or time in a “chill out corner.”
- 8 Make your own thought processes clear** when helping students. For instance, when you see a student has left their book at home, walk them through your thinking: “It looks like you don't have your book. You'll need a book to complete this assignment. Where can we find a book for you to use?” When a student sees/hears your process, they'll be more likely to engage in a similar process themselves and do their own problem solving next time.
- 9 Provide multi-step instructions** in both oral and written form, so students have constant access to information they may have forgotten.
- 10 Look for educational technology** that teaches executive function skills like attention, self-regulation, and working memory, [EF Kids](#) for young children, or [Fast ForWord](#) or [Cogmed](#) for older children and adults.

YOU ARE YOUR CHILD'S BEST ADVOCATE AND SUPPORTER

Both parents and teachers have a tremendous opportunity to help shape a student's brain. This is exciting, but it's also hard work. Here are some resources to help tackle executive function challenges.

RESOURCES

FAST FORWARD

A reading and language program that simultaneously builds literacy skills and executive function skills such as working memory, attention, processing, and sequencing.

[Find out more](#)



BOOKS

How We Learn: Why Brains Learn Better Than Any Machine . . . for Now

by Stanislas Dehaene (2020)

How the Brain Learns (Sixth Edition)

by David A. Sousa (2022)

WEBINAR

["The Science of Learning: How the Brain Knows Best"](#) by Martha Burns, neuroscientist and speech-language pathologist

ARTICLES

Carnegie Learning Blog ["Can All Readers Be Our Best Readers? The Link Between Literacy and Executive Function"](#)

Carnegie Learning Blog ["How to Foster Executive Function in Every Grade"](#)

Edutopia ["Helping Students Develop Executive Function Skills"](#)