

# Leveraging what we've learned from Research to Help Every Child Succeed: Strategies and Activities to Aid the Development of Executive Functions



**Adele Diamond, PhD, FRSC**

**Canada Research Chair Professor of  
Developmental Cognitive Neuroscience**

**University of British Columbia (UBC)**

**[adele.diamond@ubc.ca](mailto:adele.diamond@ubc.ca)**

**Nowhere is the importance of social, emotional, and physical health for cognitive health more evident than with PFC & EFs.**

**EFs are the first to suffer, and suffer disproportionately, if we are lonely, sad, stressed, sleep-deprived, or not physically fit.**

To show the EFs they are capable of, to show the academic outcomes they are capable of, children need to...

- feel joyful and relaxed (not stressed)
- feel they are in a supportive community they can count on, and
- their bodies need to be fit and healthy.



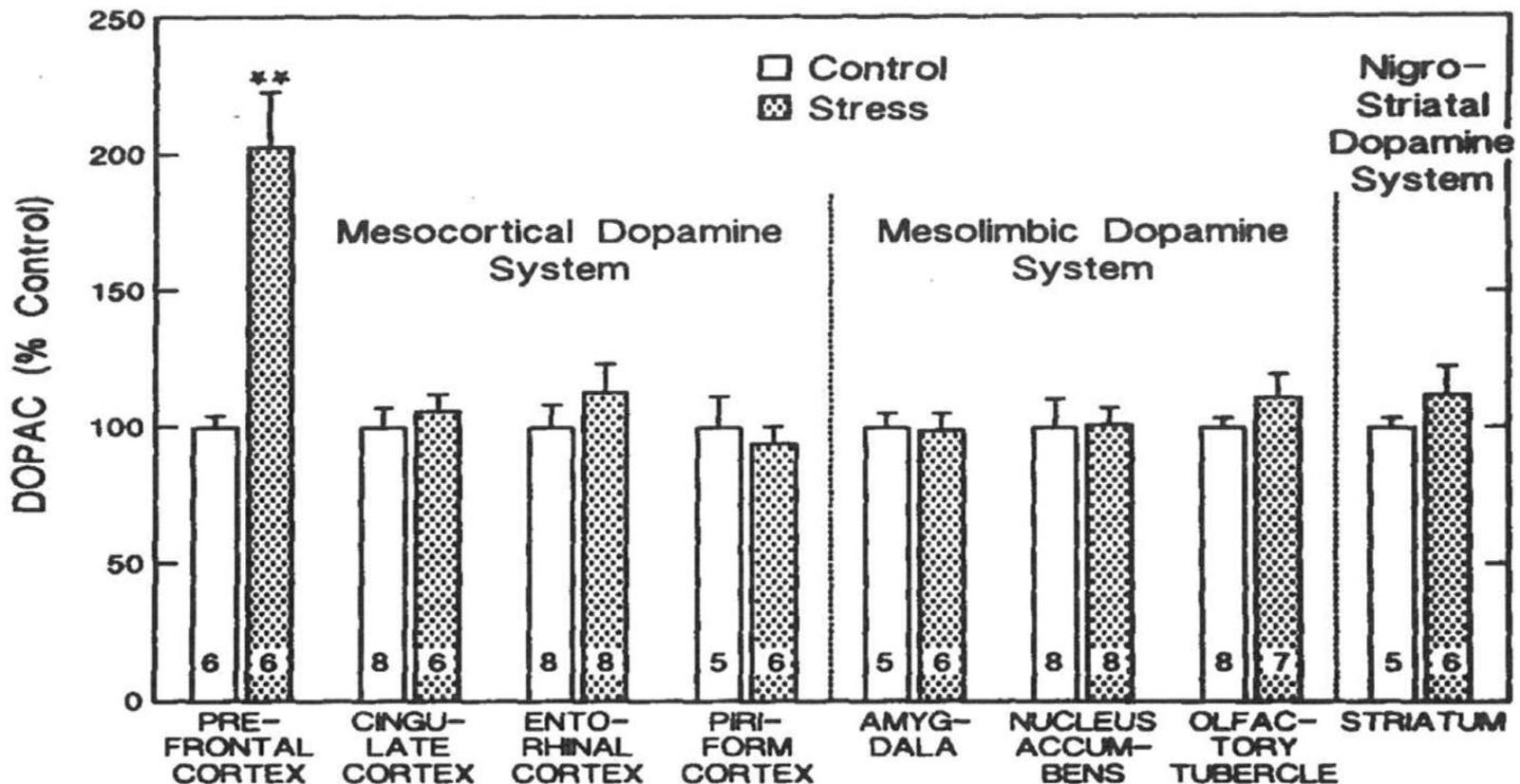
Our brains work better  
when we are not in a  
stressed emotional state.

Amy Arnsten, 1998  
The biology of being frazzled  
*Science*

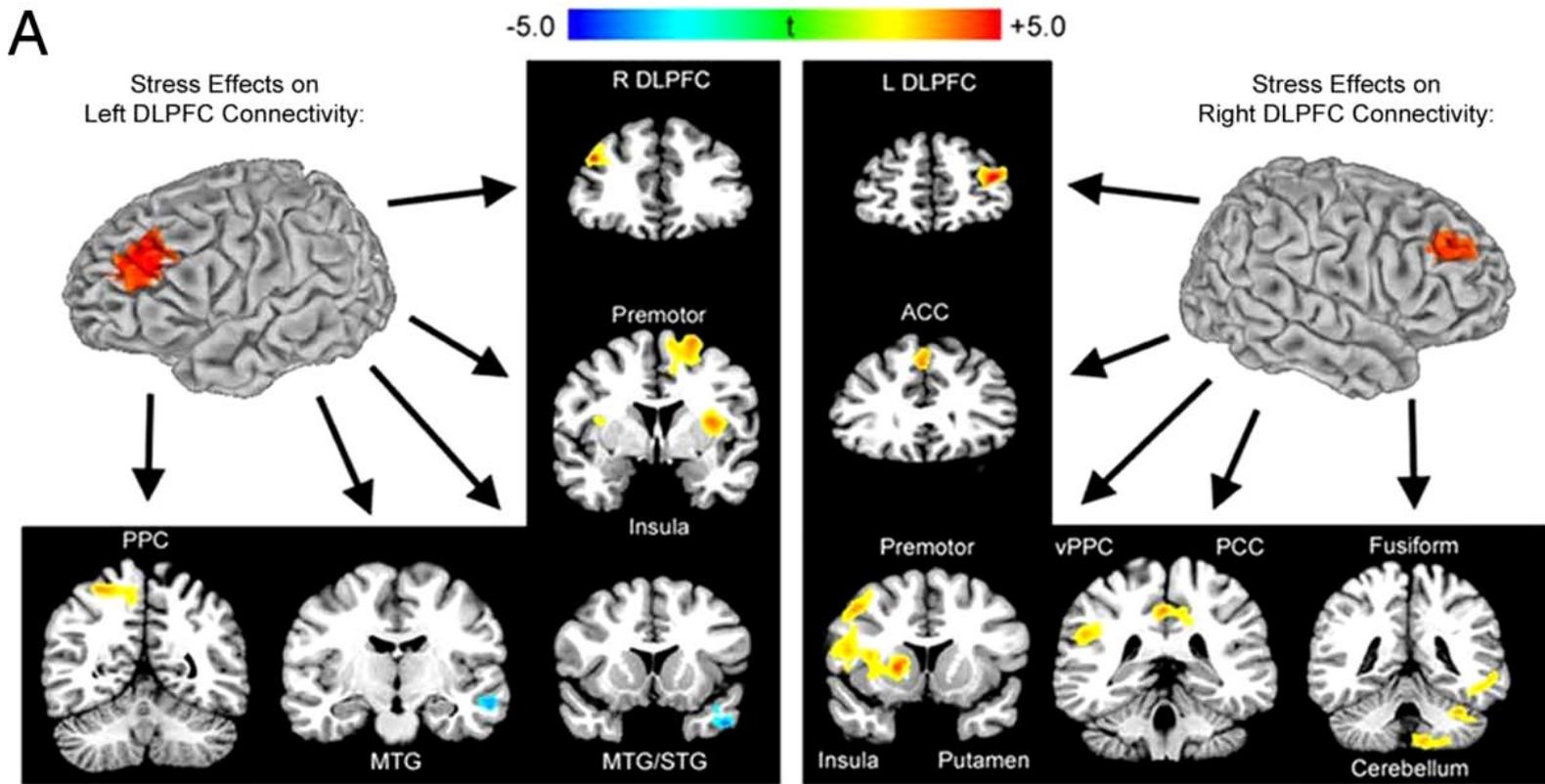
This is *particularly* true for PFC & EFs.

# Stress and Prefrontal Cortex

Even mild stress increases DA release in PFC but not elsewhere in the brain

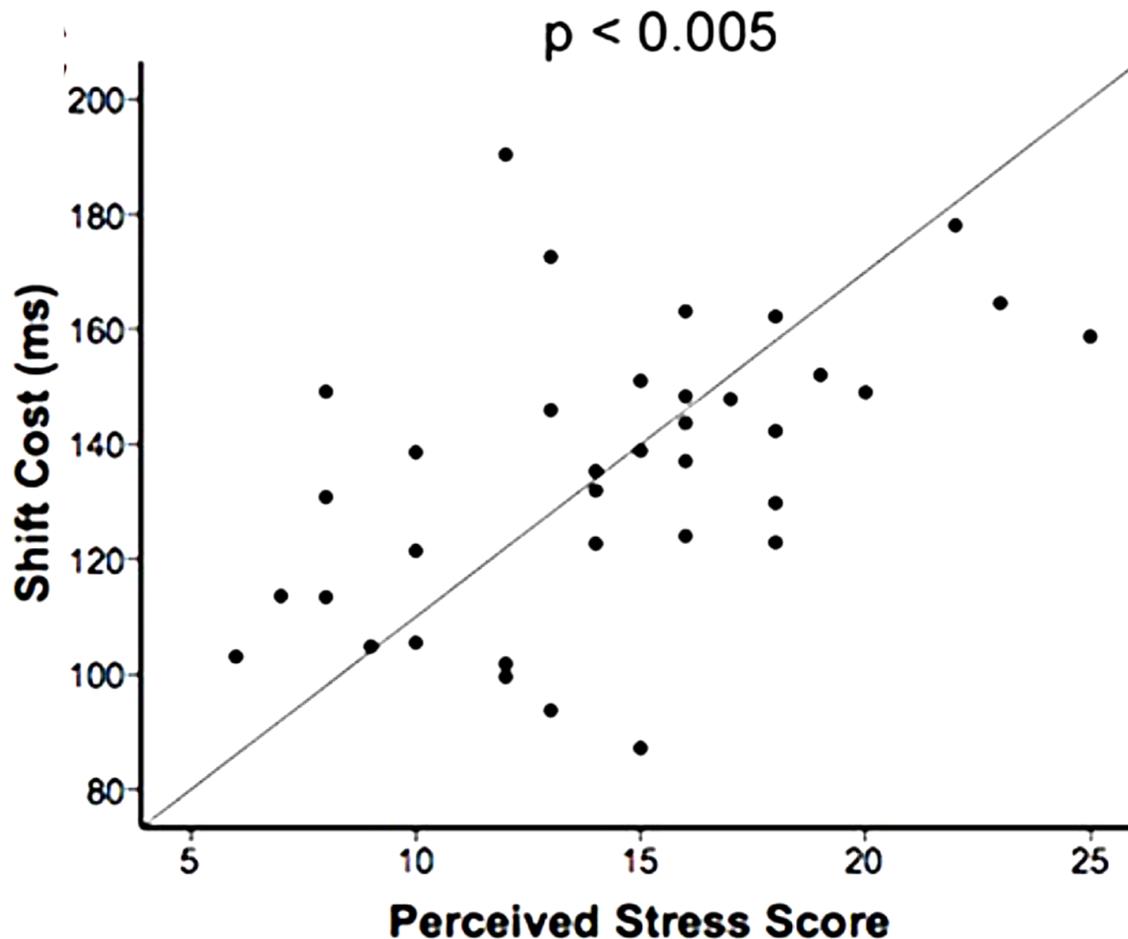


(Roth et al., 1988)



**In college students, one month of stress in preparation for a major exam disrupts prefrontal cortex functional connectivity.**

**Stress decreases coupling between left DL-PFC and right DL-PFC, and between DL-PFC and premotor cortex, the ACC, the insula, posterior parietal cortex (PPC), and the cerebellum.**



**Stress impairs their attention shifting (shifting between attending to color or motion).**

**Liston et al. (2009) *PNAS***

**When we are sad we're worse at filtering out irrelevant information (i.e., worse at selective attention).**

**Desseilles et al., 2009  
von Hecker & Meiser, 2005**

**When we are happy we are better at selective attention.**

**Gable & Harmon-Jones, 2008**

# People show more creativity when they are happy

THE most heavily researched predictor of  
creativity in social psychology is mood.

The most robust finding is that a happy mood  
leads to greater creativity (Ashby et al. 1999).  
It enables people to work more flexibly (Murray  
et al. 1990) & to see potential relatedness  
among unusual & atypical members of  
categories (Isen et al. 1985, 1987).

Hirt et al. 2008: 214

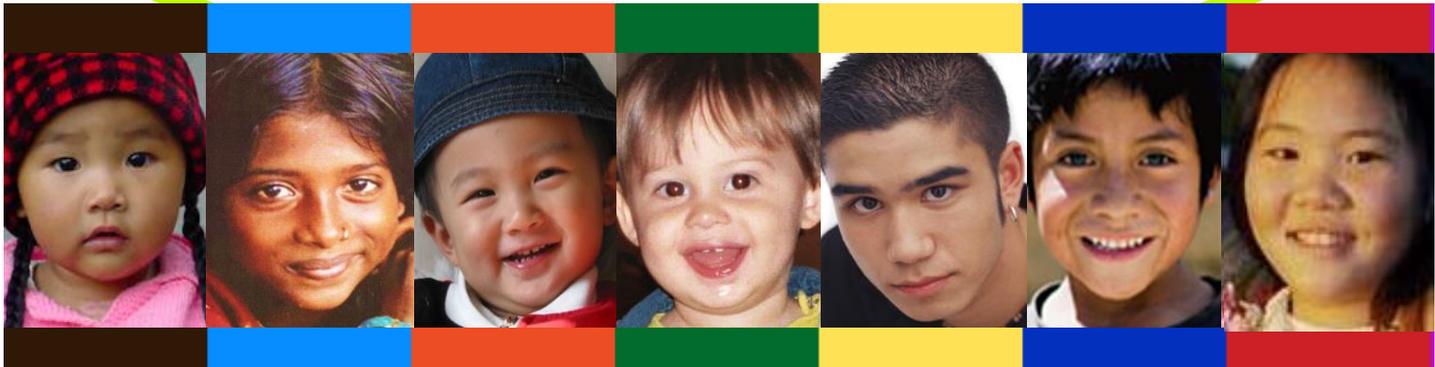
**We all want our children to do well.**

**But if they feel pushed or pressured, if they feel it would be terrible to make a mistake, if they feel they always have to be the best,**

**they will be stressed. Being stressed is detrimental to our children doing their best.**



**What a shame that so many children are so terrified of making a mistake that they are afraid to try anything new.**



**Anyone who has never  
made a mistake has never  
tried anything new.**

**- Albert Einstein**



**The only way to completely avoid making mistakes, is to stay with what you already know, to stop growing.**



**You're not perfect.**

**You're not the perfect  
parent or teacher.**



**And, that's perfectly OK.**

**You don't need to be perfect.**

**Besides, no one ever is.**



**And, I can guarantee 100% that worrying about whether you are a great parent or not will NOT improve your parenting – it will only make it worse.**



Stress is not only detrimental to your ability to be the parent you want to be, **your children will pick on your stress.** It will cause them to feel stressed. And if they're stressed, their executive functions will suffer and thus their school performance will suffer.



**It's important that you are not so stressed that they're unable to be the caring parent you want to be.**



It is extremely important to relax,  
and **SLOW DOWN**, so that you can  
take the time to give child your  
undivided attention. The  
importance of that cannot be  
over-emphasized.

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The most basic and powerful way to communicate to our children that we care about them is to listen to them. Truly listen.

Give them our time and our attention.

The quality of our listening, rather than the wisdom of our words, is often what has the most impact.

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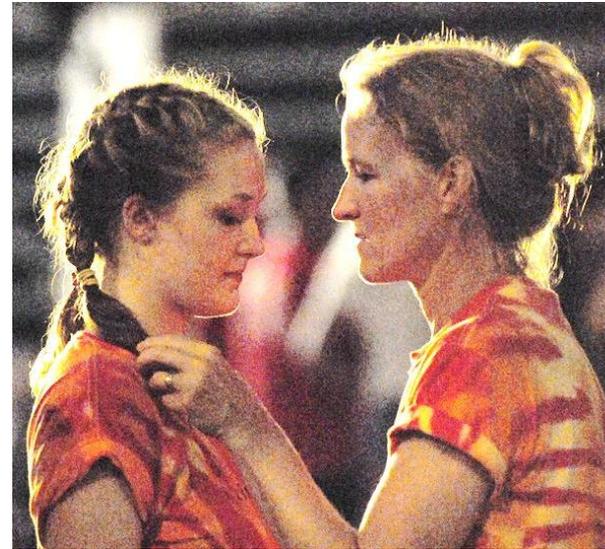
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**“Perhaps the most important thing we ever give each other is our attention. And especially if it's given from the heart...”**

**-- Dr. Rachel Naomi Remen**

**“The greatest gift  
I can conceive of  
having  
from anyone  
is  
to be seen by them,  
heard by them,  
to be understood.”**

**-- Virginia Satir**



Our brains work better when we are not feeling lonely or socially isolated.

*Loneliness: Human Nature and the Need for Social Connection*  
2008

a book by John Cacioppo & William Patrick

This is *particularly* true for PFC & EFs.



Roy Baumeister et al. (2002, *Journal of Personality and Social Psychology*)

- One group of subjects were told beforehand they'd have close relationships throughout their lives;
- another group was told the opposite;
- a third group was told unrelated bad news.

On simple memorization questions, the groups were comparable.

On sections involving logical reasoning (EF), subjects told they'd be lonely performed much worse.

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Campbell et al. (2006) found that during math tests there was Prefrontal Cortex worked less efficiently among participants who felt isolated.

**Children need activities where they can...**

**Help one another**

**Learn that each is an important part of  
the whole**

**Learn to collaborate**

**(as team members or partners)**

**Come to see the value of collaborating  
& cooperating.**





Relationship  
Relationship  
Relationship



Relationship



**Our humanity is more important than our knowledge or skill or doing the textbook-perfect thing.**



Results of a poll by the British Medical Journal:

The majority of respondents said:

“A good doctor, is first and foremost, a good human being.”

**Jerome Frank conducted a study comparing several different forms of psychotherapy to one another.**

**He concluded:**

**“A totally untrained therapist who exercises a great capacity to love will achieve psychotherapeutic results equal to the best.”**

# What are the implications of that for what matters in ECE?

**Not** the # of children

**Not** the caregiver:children ratio

**Not** having the best materials



**A teacher or caregiver's ability to be present for each child, to develop a close and caring relationship with each child, is probably what is most important.**

**You can do the textbook-perfect thing, but if it doesn't come from the right place, it won't have the desired result. But if it comes from the right place, even if it isn't textbook perfect, it will be all right.**

**“The fundamental problem in education is not an educational problem at all; it is a social one. It consists in establishing new and better relationships between children and adults. This is the crux of the problem.”**

**- Maria Montessori**

**We are not just intellects,  
we have emotions  
we have social needs  
& we have **bodies****

**Our brains work better when our bodies are physically healthy.**

**Bachen, E. A., Cohen, S., & Marsland, A. L. (2007)**

**This is *particularly* true for PFC & EFs.**



**“I never let anyone with a cold do anything important.”**

**-- Martin Seligman**





**You need your sleep.**





**Lack of sleep will produce deficits in EF skills, and cause someone to look as if he or she has an EF impairment, like ADHD.**



# Our brains work better when our bodies are physically fit.

*Nature Reviews Neuroscience* (January 2008)

“Be Smart, Exercise Your Heart:

Exercise Effects on Brain and Cognition”

Charles Hillman, Kirk Erickson & Art Kramer

“There is little doubt that leading a sedentary life is bad for our cognitive health.”

This is *particularly* true for PFC & EFs.



**The brain doesn't recognize the same sharp division between cognitive and motor function that we impose in our thinking.**

**The SAME or substantially overlapping brain systems subserve BOTH cognitive and motor function.**



**For example, the pre-Supplementary Motor Area (SMA) is important for sequential tasks, whether they are sequential motor tasks or sequential numerical, verbal, or spatial cognitive tasks.**

**Hanakawa et al., 2002**

**Motor development and  
cognitive development appear  
to be fundamentally intertwined.**

**Diamond, A. (2000)**



**Close interrelation of  
motor development and cognitive development  
and of the cerebellum and prefrontal cortex.**

***Child Development, 71, 44-56***

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When cognitive development  
is perturbed,  
as in a neurodevelopmental  
disorder,  
motor development is often  
adversely affected as well.



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For example.....

At least half of all children with ADHD have poor motor coordination & fit the diagnosis for developmental coordination disorder.

At least half of all children with developmental coordination disorder have ADHD.

Similarly for dyslexia, autism, and other disorders.



Though many studies have found that aerobic exercise improves prefrontal function and EFs..... all but 3 of those studies have either been with adults and/or examined effects of a single bout of aerobic exercise, where benefits may be transient. In general, the studies with children have not found strong effects.

Exercise alone appears not to be as efficacious in improving EFs as exercise-plus-character-development (traditional martial arts) or exercise-plus-mindfulness (yoga).



Lakes & Hoyt (2004) randomly assigned children in grades K thru 5 (roughly 5-11 years-old) by homeroom class to Tae-Kwon-Do martial arts (N = 105) or standard physical education (N = 102).

Children who had been assigned to Tae-Kwon-Do training showed greater gains than children in standard phys. ed. **on all dimensions of EFs studied** (e.g., cognitive [distractible —focused] and affective [quitting —persevering] and emotion regulation). **This generalized to multiple contexts and was found on multiple measures.** They also improved more on mental math (which requires working memory).

**Traditional martial arts  
emphasize self-control,  
discipline (inhibitory control),  
and character development.**

In a study with adolescent juvenile delinquents (Trulson, 1986), one group was assigned to traditional Tae-Kwon-Do (emphasizing qualities such as respect, humility, responsibility, perseverance, honor as well as physical conditioning). Another group was assigned to modern martial arts (martial arts as a competitive sport).

Those in traditional Tae-Kwon-Do showed less aggression and anxiety and improved in social ability and self-esteem.

Those in modern martial arts showed *more* juvenile delinquency and aggressiveness, and decreased self-esteem and social ability.

Whether EF gains are  
seen depends on the  
**way** an activity is done.

*Science* asked me to write a review of all interventions shown to improve EFs in young children

**Diamond, A. & Lee, K.**

**(2011)**

**Interventions shown to Aid  
Executive Function Development  
in Children 4-12 Years Old**

*Science*, vol. 333

**accompanying online tables**

**Diverse activities including computer training, aerobics, martial arts, yoga, mindfulness, playing a musical instrument, & school curricula have all been shown to improve children's executive functions.**

**Regardless of the  
intervention,  
a few principles hold,  
including:**

EF training appears to transfer,  
but the transfer is **not wide**.

Computerized working memory  
training improves working  
memory but not inhibition or  
speed & probably not  
reasoning in children.

EF gains from training in **task switching** (Karbach & Kray, 2009), **traditional martial arts** (Lakes & Hoyt, 2004) and **school curricula** (Raver et al., 2011; Riggs, Greenberg, Kusché, & Pentz, 2006) **are wider**, perhaps because the programs themselves address EFs more globally, so the transfer may not be wider but the programs address more EF components.

For example, training **task-switching** (which arguably **requires all 3 core EFs**) was found to transfer not only to an un-trained task-switching task, but also to **inhibition (Stroop interference)**, **verbal and non-verbal working memory**, and **reasoning** (Karbach & Kray, 2009).

**EFs need to be  
continually challenged  
to see improvements -  
not just used, but  
challenged**

Consistent with: what Ericsson reports is key for being truly excellent at anything -- need to keep trying to master what is just beyond your current level of competence and comfort

(working in what Vygotsky would call the ‘zone of proximal development’)





# The Importance of ...Action for Learning ...Learn through Doing



The Dalai Lama has said:

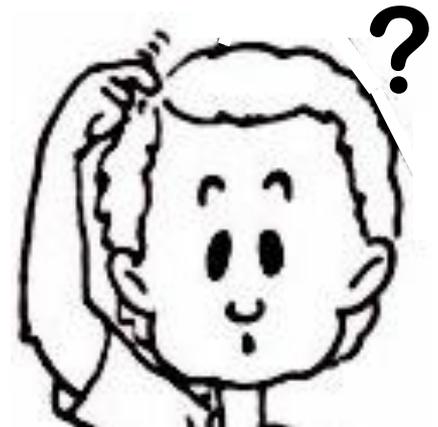
If you want others to be happy,  
practice compassion.

makes perfect sense, even to a child



If you want to be happy,  
practice compassion.

huh?



For children to understand the deep truth of:

“if you want to be happy, practice compassion”

they need to practice compassion and experience for themselves the joy it brings them

**“The act teaches us the  
meaning of the act.”**

**-Rabbi Abraham Heschel**

# Hands-on Learning

We evolved to be able to learn to help us act, to help us do what we needed to do.

If information is not relevant for action, we don't pay attention in the same way (hence the difference in route memory for the driver, versus the passenger, of a car).

You learn something when you **NEED** it for something you want to **DO**.

**(My son teaching me to program  
the VCR)**

**The same is true when we teach  
children in school. They need  
opportunities to concretely  
apply what they are taught.**

If you tell a student a concept that's one thing.

If the student **discovers** the concept that's entirely different.

In the end, students need to own the knowledge themselves. We can try to help, but when all is said and done, it is the students' work; **we are only helpers.**

Parents' & teachers' "work is more like that of a midwife....When the baby is born, there is no question to whom it belongs....Lao Tzu says that when the sage is at work, people will say 'they did it themselves.' This is empowerment."

(Johanson & Kurtz)

**“Help me do it myself”**

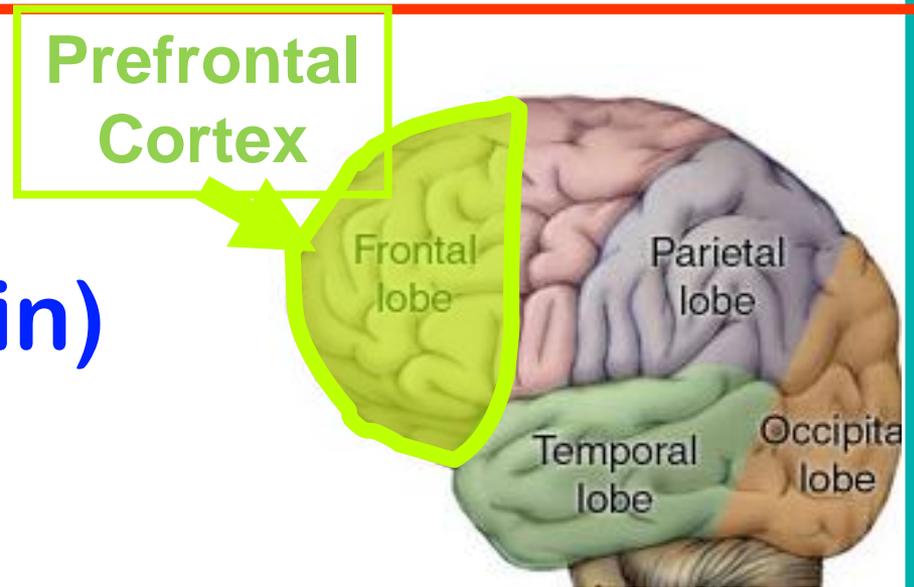
**The pride and self-confidence  
that comes from figuring things  
out for themselves is priceless.**





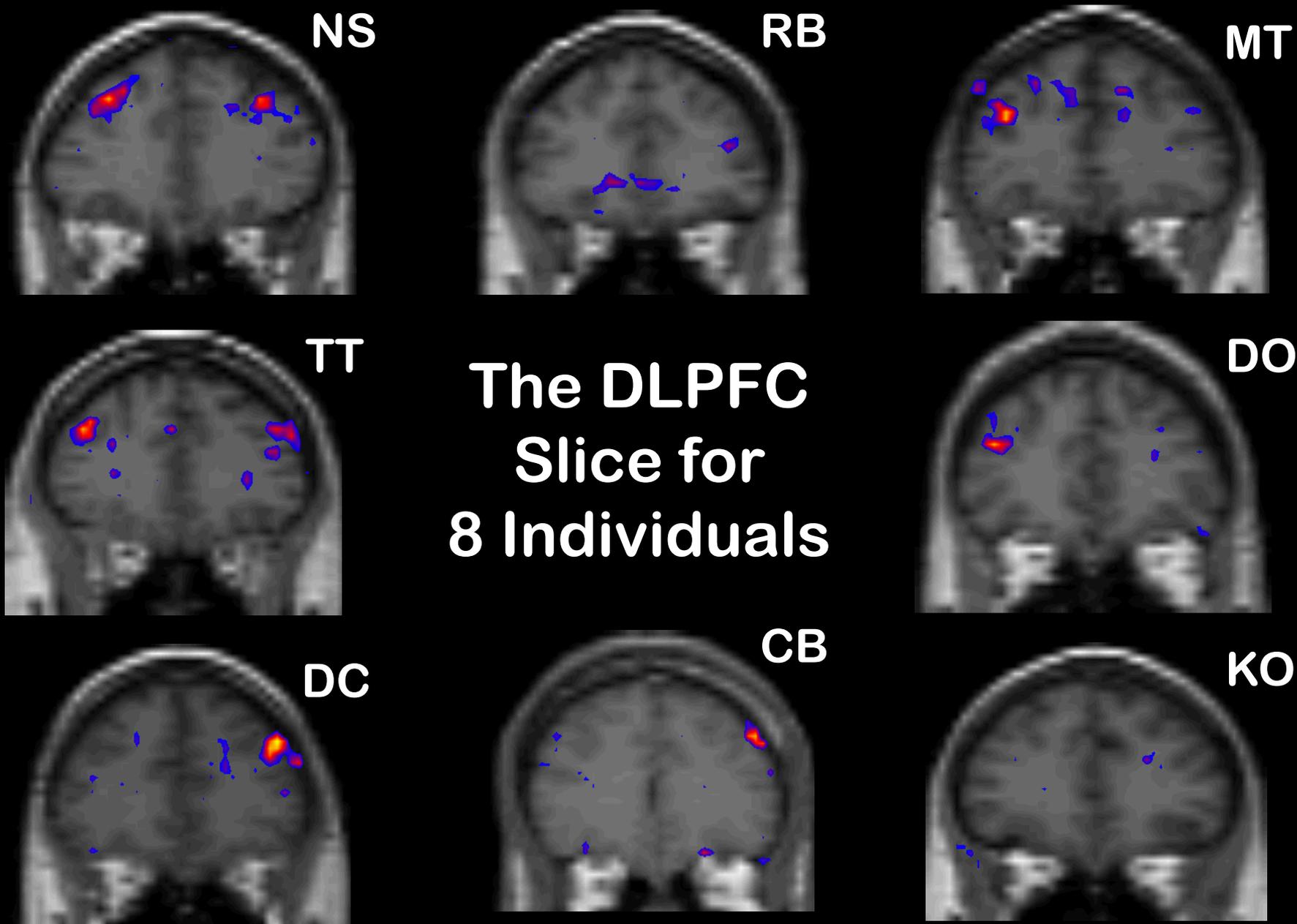
# **The Importance of Repeated Practice**

Prefrontal cortex  
(what I specialize in)  
is over-rated.



To learn something **new**, we need  
prefrontal cortex.

**But after** something is no longer  
new, persons who perform best  
recruit prefrontal cortex ***least***.



To learn something, you need PFC.

**When something is new, those who recruit PFC most, usually perform best.**

But when you are really good at it, you are **NOT** using PFC.

**AFTER** something is no longer new, those who perform best usually recruit PFC least.

Older brain regions have had far longer to perfect their functioning; they can subserve task performance ever so much more efficiently than can prefrontal cortex (PFC).

A child may know intellectually (at the level of PFC) that he should not hit another, but in the heat of the moment if that knowledge has not become automatic (passed on from PFC to subcortical regions) the child will hit another (though if asked, he knows he shouldn't do that).

**knowing what one should do**

**vs.**

**2nd nature (automatic)**

**(i.e., NOT dependent on PFC)**

**The only way something  
becomes automatic  
(becomes passed off from  
PFC) is through action,  
repeated action.  
Nothing else will do.**

**“We are what we repeatedly do.**

**Excellence, then, is not an act, but a habit.**

**We do not act rightly because we have virtue or excellence, but we rather have these because we have acted rightly; 'these virtues are formed in a person by doing the actions';**

**we are what we repeatedly do.”**

**Aristotle, *Ethica Nicomachea*, 4th century BC**

**How can someone practice  
a skill he or she is not yet  
capable of performing?**

**The answer: Scaffolds**

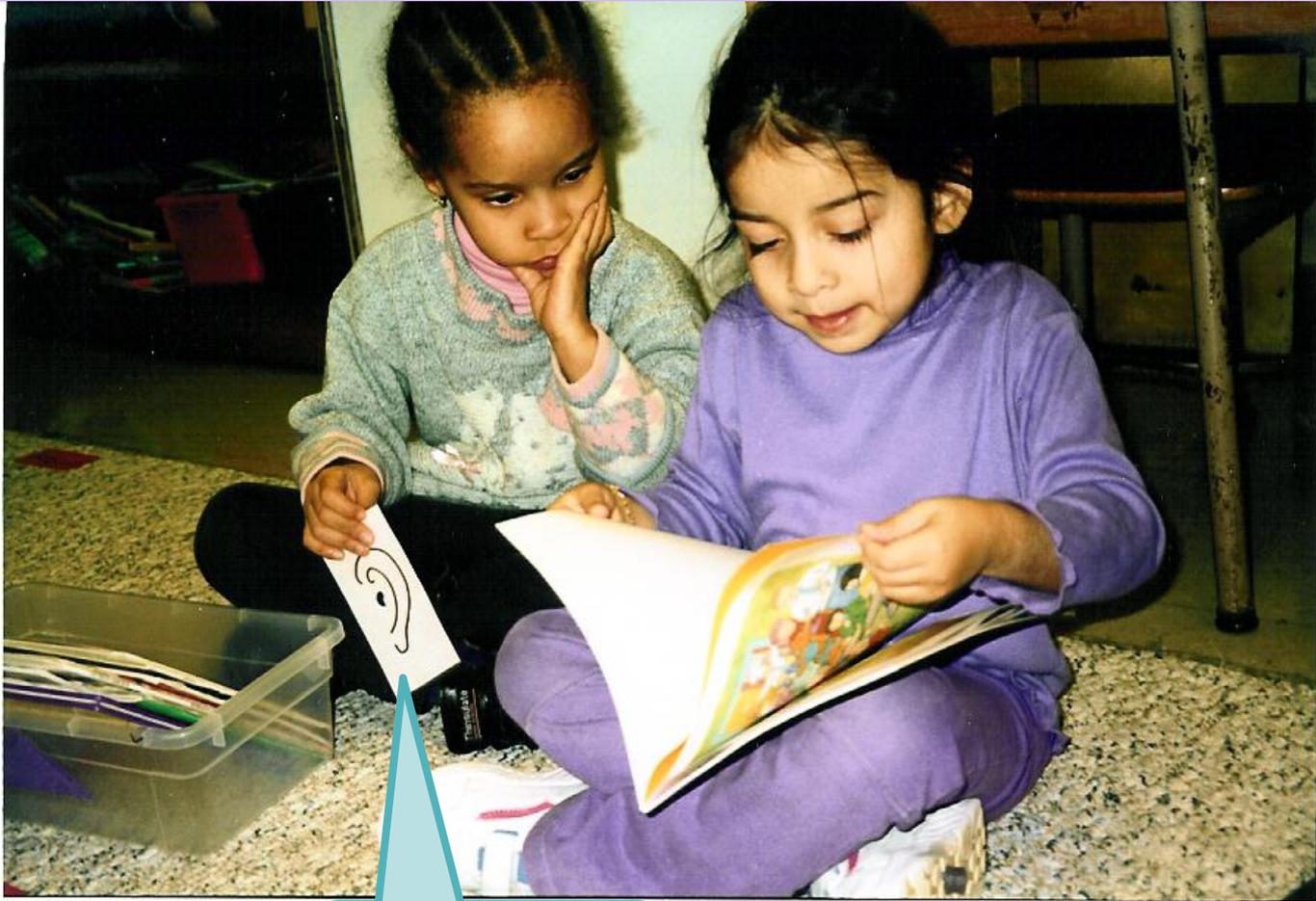


**Scaffolds enable children to practice skills they would not otherwise be able to practice.**





# Buddy Reading



a scaffold

Isolate the one feature you want the children to focus on by having the materials differ **ONLY** along that one dimension.

only vary by diameter



only vary by height



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mirror reversal writing

If we let children try to exercise EFs but **don't provide supports** (scaffolding), children **fail** and **feel embarrassed**, perhaps even **get scolded**.

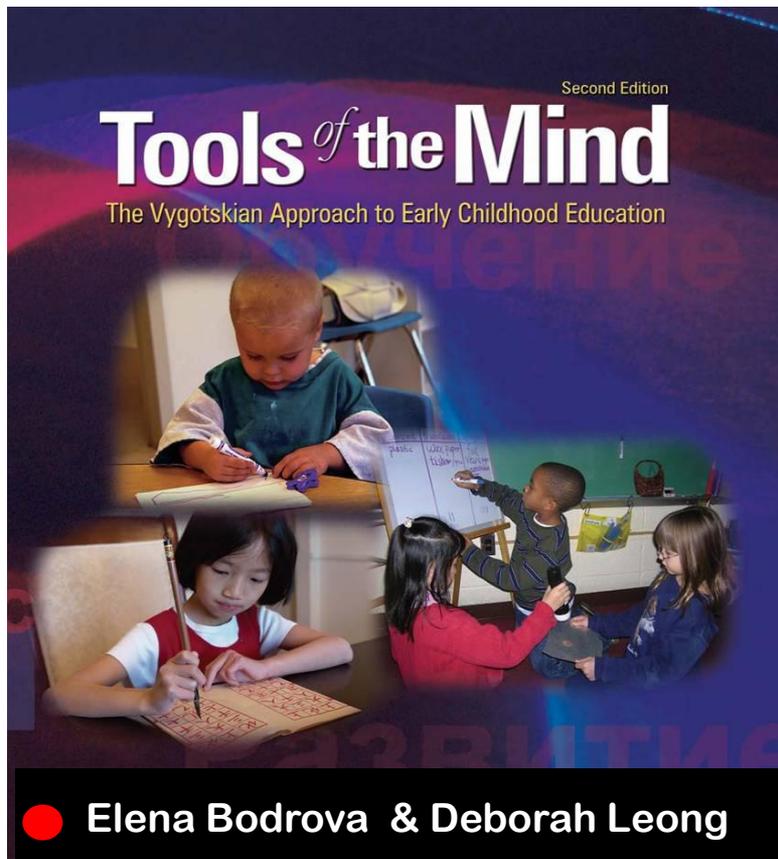


vs. providing scaffolds to help children exercise EFs.

They get the pride of having succeeded (of being a good listener), & increasing confidence that they'll be able to do this.

And, through repeated practice, they improve.

School curricula empirically shown to improve EFs share several features in common.



Montessori

Second Edition

# Tools of the Mind

The Vygotskian Approach to Early Childhood Education



● Elena Bodrova & Deborah Leong

Foreword by Michael Cole

The Tools of the Mind early childhood program, based on theories of Vygotsky and Luria



**Vygotsky: Engaging in social pretend play is critical for developing executive function skills in very young children. It is emphasized in *Tools of the Mind*.**



**Children must plan who they want to be in a pretend scenario, and the teacher holds them accountable for**

- During social pretend play, children must hold their own role and those of others in mind (working memory)
  - inhibit acting out of character (employ inhibitory control), and
  - flexibly adjust to twists and turns in the evolving plot (cognitive flexibility)
- all three of the core executive functions thus get exercise.



**Vygotsky: Engaging in social pretend play is critical for developing executive function skills in very young children. It is emphasized in *Tools of the Mind*.**



**Children must **plan** who they want to be in a pretend scenario, and the teacher holds them accountable for**

What Tools of the Mind calls 'play'  
(e.g., pretending to be a policeman)  
Montessorians call 'work.'

From the youngest ages, Montessori  
children think ahead & plan their day.

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Schools are under pressure to cut back on time allowed for play to provide more time for academic instruction.

**BUT**, children in *Tools of the Mind*, who have more time to play, perform **BETTER** on academic outcome measures than their peers who have more time in direct academic instruction.



**PLAY** doesn't have to take away time from improving academic outcomes; **play** can help improve academic outcomes.

**But not just any play!**



**Montessori** curriculum doesn't mention executive functions but what Montessorians mean by **“normalization”** includes having good EFs.

Normalization is a shift from disorder, impulsivity, and inattention to self-discipline, independence, orderliness, and peacefulness.

Montessori classrooms intentionally have **only one of any material** so children learn to wait until another child is finished.

Several Montessori activities are **essentially walking meditation**, though Montessori never called them that.



**An activity from Montessori schools, that is essentially a type of walking meditation.**

**Everyone (even the grown-ups) gets a bell and walks in a line or circle. The goal is for no one's bell to make a sound.**



**By looking at what *Tools* & Montessori have in common, perhaps we can learn something about what elements might be most important in early education.**



**In both programs, supports for, training in, and challenges to EFs are embedded in all aspects of the school day.**

**not only increases amount of time practicing but also varies the type of practice**

**Because their rudimentary  
EFs are working well and are  
scaffolded, children can work  
in small groups, pairs, or alone  
without constant supervision.**





**In Tools of the Mind & in Montessori..**

**The classroom is not centered  
around the teacher.**

**The teacher is rarely expected to  
teach all children the same thing at  
the same time.**

**Learning is active and hands-on.**





**When children are able to work on their own or in small groups, the teacher can then give each child individual attention.**

**to teach, to observe, & to listen**

**Because other children are productively engaged when the teacher works with any individual child --**

**individualized instruction can readily be provided.**

The teacher can take time to **carefully observe each individual child** -- a hallmark of Montessori.

In **Tools** they call this **dynamic assessment**.

In both cases the **teacher is acting as a scientist, testing out hypotheses about**

- **what kind of assistance might be most helpful to this particular child?**
- **is this child ready for new challenges?**

**This is not easy. It takes training.**

But **anyone** can be trained.

The Director of the International Montessori Assoc. has been working in a **Displaced Persons Camp in Kenya**, training the mothers to be the Montessori teachers for their children.

These women were illiterate.

They had no fancy materials. They were taught to make all the teaching materials from scratch from what they could find in the camp.









**Communicate loud and clear  
the faith and expectation that  
each child will succeed.**



Starting point: “There’s no question you are going to master this.”

When a toddler falls while trying to learn to walk, we don’t say he gets a ‘D’; we say, “Don’t worry; I’m sure you’re going to be able to do this.”



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# Powerful Role of Expectations (by others AND yourself) and Attitude

Pygmalion in the Classroom -- powerful  
role of expectations    Robert Rosenthal

Stereotype threat - female performance on  
math exams    Claude Steele

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- Children need to believe in themselves. They need to have confidence that they will succeed.

Two routes to that:

- They need to feel you believe in them - that you fully expect them to succeed.

&

- They need do-able challenges. We need to give children the opportunity to do things that enable them to see for themselves that they are capable.

**Children need opportunities to do things that enable them to believe in themselves: do-able challenges.**

**Pride and self-confidence (and joy) come from seeing yourself succeed at something that you know is not easy -- even in the youngest infants.**

“[My teachers] demonstrated their respect for our humanity by holding us to standards.... [A] child needs to sense from his teachers that they respect him as a person. The only way he can see that is through his accomplishments and through teachers providing the parameters for accomplishment.... [C]hildren know when they are able to accomplish something and when they are failing.... To give their groups the names of birds or animals doesn't fool them a bit. I don't know a single child who is so unintelligent as not to know when his school has given up on him.”

-- Kenneth Clark

Neither program lets children get away easily; they hold children to high standards.

Children rise to the occasion.

This is NOT free-form, do whatever you want.

The children have a lot of fun but they also work very hard. Those two are not incompatible.

Learning can be wonderful fun.

**In both Tools and Montessori, as a child's EFs improve, supports are gradually removed, gently pushing the child to extend the limits of what he or she can do.**

**Difficulty keeps increasing.**

**Another way to show children  
we believe in them and have  
faith in them is to give them an  
important responsibility.**

**the 'Coca Cola' study**



In both programs **embarrassment is rare.**

They provide **scaffolds** so each child is able to **succeed**, rather than being left to flounder.

The materials themselves let a child know if s/he has made an error -- **without anyone else having to know**, or later the teacher might show the solution, not mentioning the child's error.



# Do not embarrass a child.

“No matter if he does it wrong –  
do not correct him or he will  
retire into his shell.”

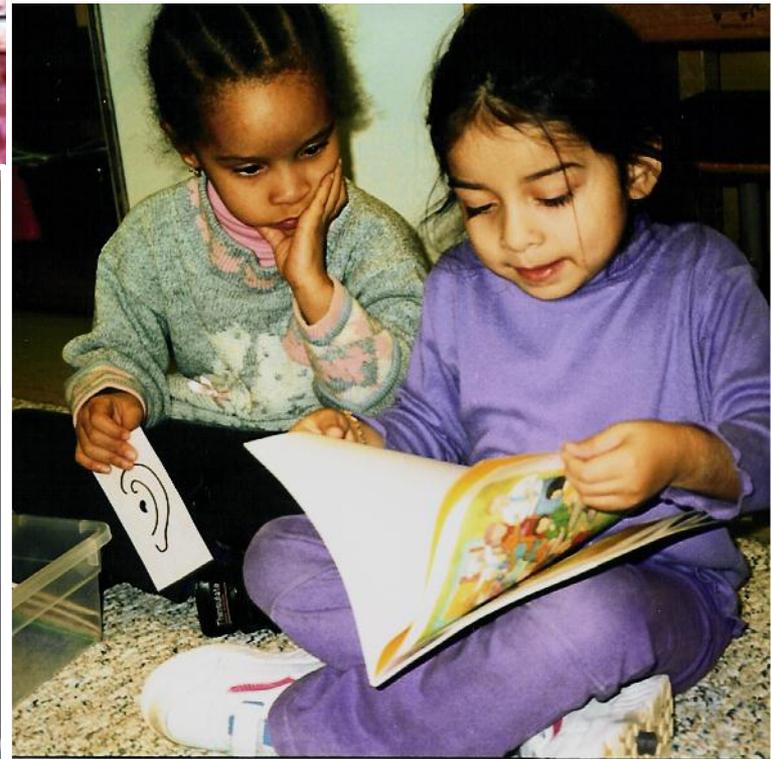
-- Maria Montessori



**There are no external rewards (no stickers, no gold stars) in either programs.**

**It's expected that learning and mastery themselves are sufficient reward. And there is decades of research in psychology that backs that up (e.g., White 1959, 1960).**

# ORAL LANGUAGE



## Both programs:

- challenge children to improve; challenge EFs
- scaffold, never embarrass
- hands on learning makes possible:
  - giving each child individual attention - Listen
  - dynamic assessment - carefully Observe
  - individual pacing; individualized instruction
- make it clear they expect each child will succeed
- foster community & consideration for others
- have children teaching & helping one another
- no external rewards
- joyful - less stress - more relaxed
- strong emphasis on oral language

## Both programs:

- challenge EFs,
- reduce stress in the classroom,
- cultivate joy, pride, and self-confidence, and
- foster social bonding.



Almost any activity can be the way in, can be the means for disciplining the mind and enhancing resilience.

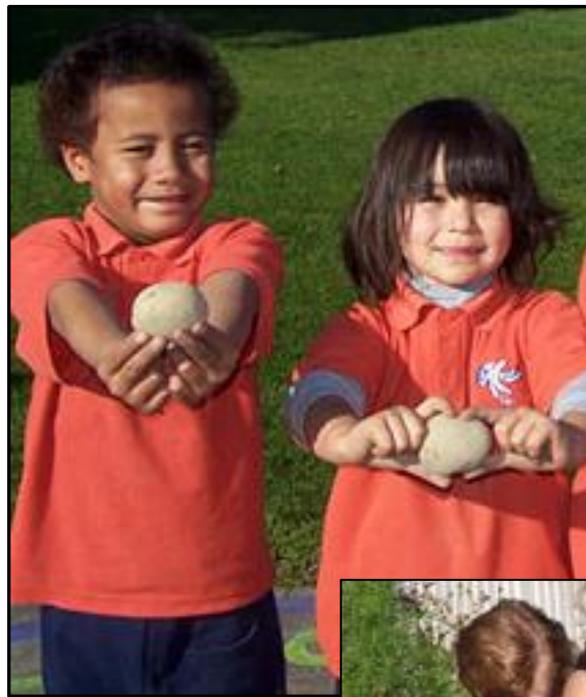
**MANY** activities not yet studied might well improve EFs.



could be caring for an animal....







# SERVICE ACTIVITIES

activities where the children are working to help their community or people elsewhere

a goal larger than oneself --

helping children in Haiti, helping a local family whose home burned down, lobbying to get a new playground for the neighborhood

**These are acts of caring and generosity,**  
**They require forethought , planning, and**  
**perseverance even in the face of setbacks,**  
**creativity and flexibility when unexpected**  
**obstacles or opportunities arise, and**  
**putting into use what they've learned in school.**

**Each is a member of a group working toward**  
**an important shared goal.**





Since almost any activity if done the right way might do, and since a crucial element is the amount of time spent doing the activity...

**The most important element is** probably that the child really want to do it, so that s/he will spend a lot of time at it. It's the discipline, the practice, produces the benefits.

**Might as well have children  
do something they can put  
their heart and soul into.**





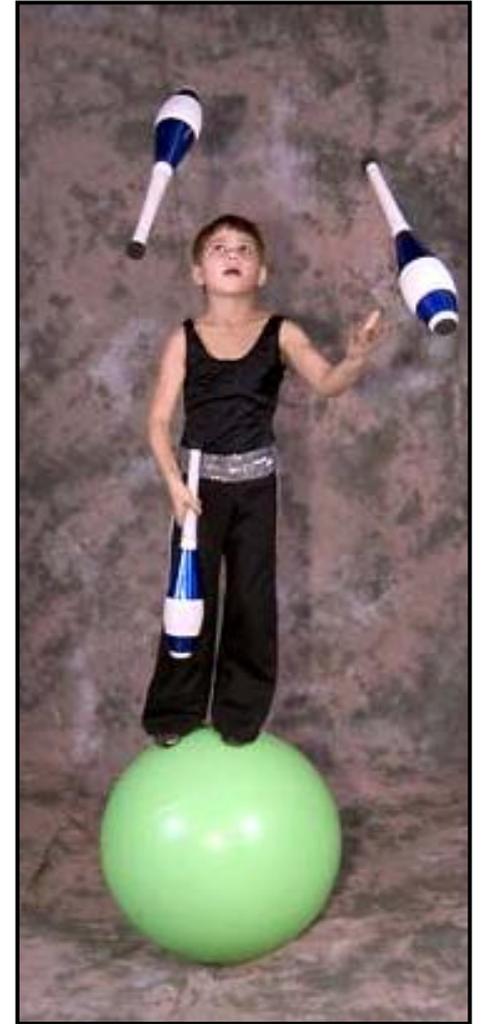
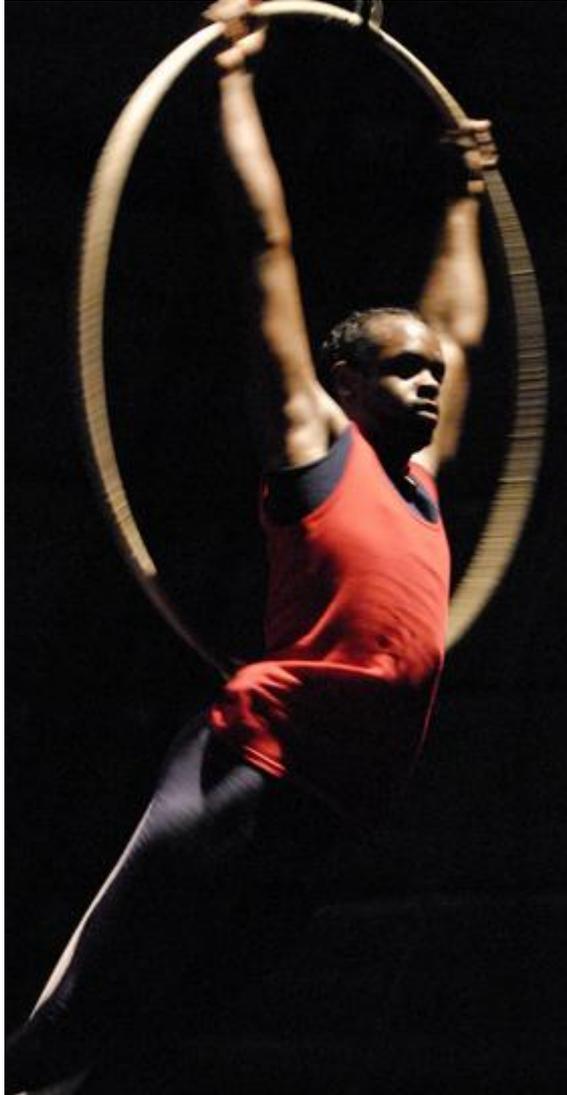






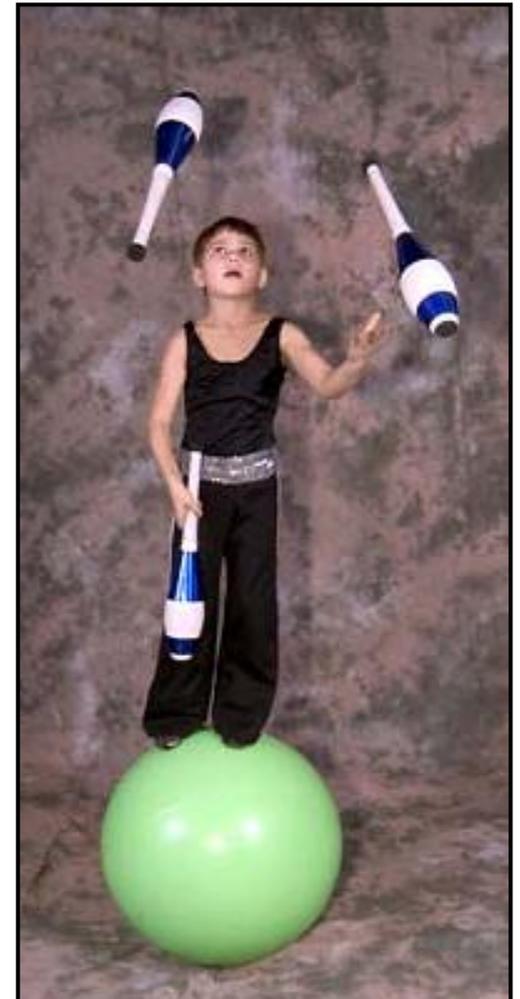
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# Circus Arts



# Circus

challenges one's executive functions;  
have to concentrate & *stay* focused





For 10's of 1,000's of years, across *all* cultures, storytelling, dance, art, & play have been part of the human condition.

People in *all* cultures made music, sang, danced, did sports, and played games. There are good reasons why those activities have lasted so long and been found so ubiquitously.

**Music-making, singing, dance, and play address our physical, cognitive, emotional, and social needs.**

**They**

- **challenge our executive functions,**
- **make us happy & proud,**
- **address our social needs, &**
- **help our bodies develop**

Because they challenge EFs directly,  
and indirectly support EFs by  
increasing joy,  
a sense of belonging, &  
physical exercise,  
I predict they should improve EFs.





**The National Dance Institute (NDI)** was founded by Jacques d'Amboise in 1976 as a way to rescue troubled youth .

Jacques was the best male ballet dancer in the world for 3 decades & received the National Medal of Honor. He was a high school dropout, a poor kid from a poor neighborhood, headed for trouble. **Since dance transformed his life, he figured it might do the same for others.**

Provided free. It takes *all* children (even those in wheelchairs). Has reached over half a million children in some of the poorest areas.



**El Sistema (Venezuela's national system of Youth and Children's Orchestras) was started by José Antonio Abreu in 1975.**

**He envisioned classical music training as a social intervention that could transform the lives of poor kids. El Sistema is intended as a social program with music at its core. Rather than aiming to produce great musicians, it aims to create community.**

**Provided free. It takes *all* children (even deaf). Has reached over half a million children in 25 countries & 3 continents.**

**Life and Learning can be Joyous!**

**Kids can have a great time in school - and you know what - if they do, they'll learn more and perform better!**



## To Recap Some of the Points just Made

1. There is no better way to learn than by **doing**, by experiencing for oneself.
  - We learn something when we **NEED** it for something we want to **DO**.
  - Give students opportunities to discover things for themselves.
2. The importance of repeated **practice**.

The only way something becomes automatic (becomes passed off from PFC) is through action, repeated action. **Nothing else will do.**

  - 2b. **Scaffolds** can help someone practice a skill that he or she could not perform unaided.

**We are not just intellects,  
we also have emotions  
social needs  
& bodies.**



# Our brains work better, and we have better EFs, when

- we're not stressed or sad
- we're not feeling lonely or isolated
- we're physically fit



**The different parts of the human being are fundamentally interrelated.**

**Each part (cognitive, spiritual, social, emotional, & physical) probably develops best when no part is neglected.**

Programs that address the  
**WHOLE CHILD** will probably  
be the most successful at  
improving any aspect.



**What nourishes the human spirit may also be best for Executive Functions.**

**Perhaps we can learn something from the traditional practices of people across many cultures & 1,000's of years.**

**The arts, play, and physical activity may be critical for achieving the outcomes we all want for our children.**

Even if your goal is *only* to improve academic achievement, the best way to achieve that is *not* to focus narrowly on academics alone, but to address children's **emotional and social development** (as do all curricular-based programs that improve EFs) and children's **physical development** (as do aerobics, martial arts, & yoga).

**Counterintuitively, the most efficient and effective strategy for advancing academic achievement is not to focus only on academics but to nurture all aspects of the child.**

**While it may seem logical that if you want to improve academic outcomes you should concentrate on academic outcomes alone, not everything that seems logical is correct.**



*thank you for  
your attention*

My thanks to the NIH (NIMH, NICHD, & NIDA), which has continuously funded our work since 1986, & to the Spencer Fdn, CFI, & IES for recently adding to our funding - and to all the members of my lab.



**Claudia Paige David Cecil Joel Kaye Adele Holly Jeanette Rose**

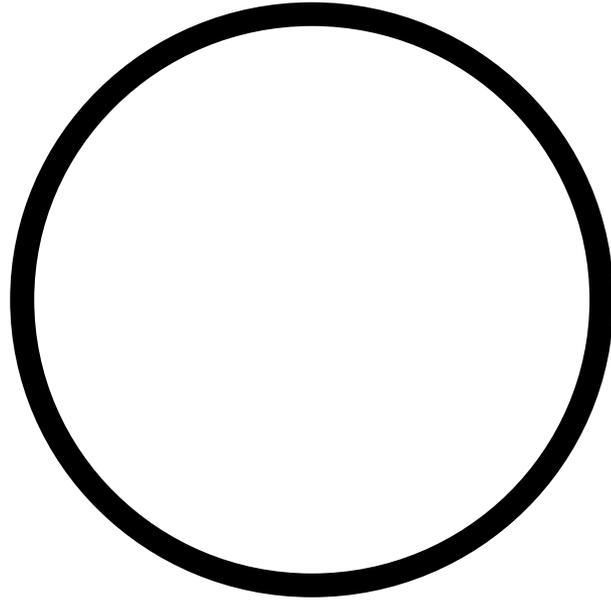


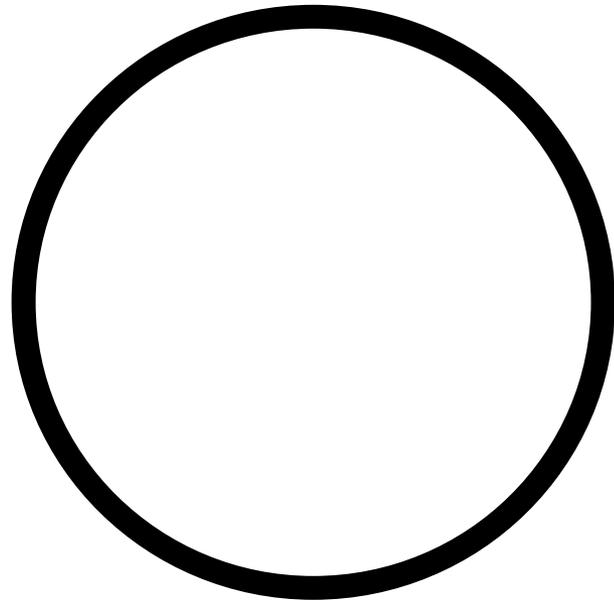
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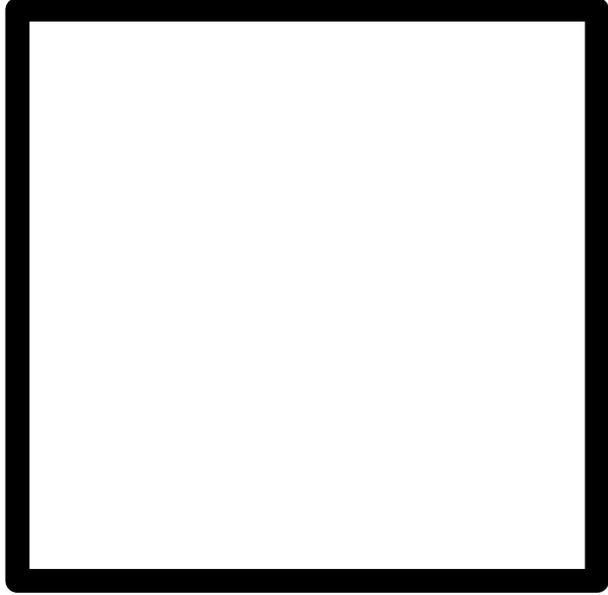
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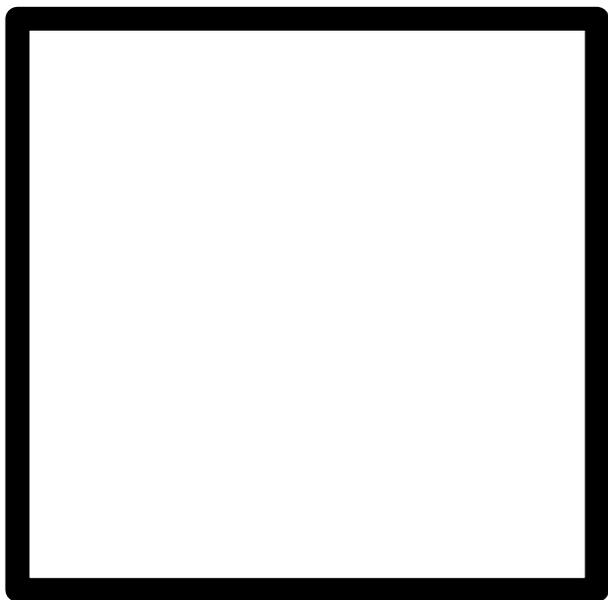
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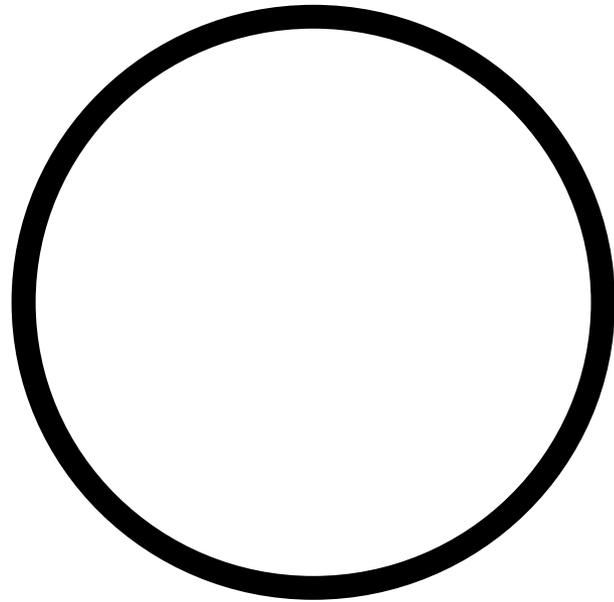
**Sarah Courtney**

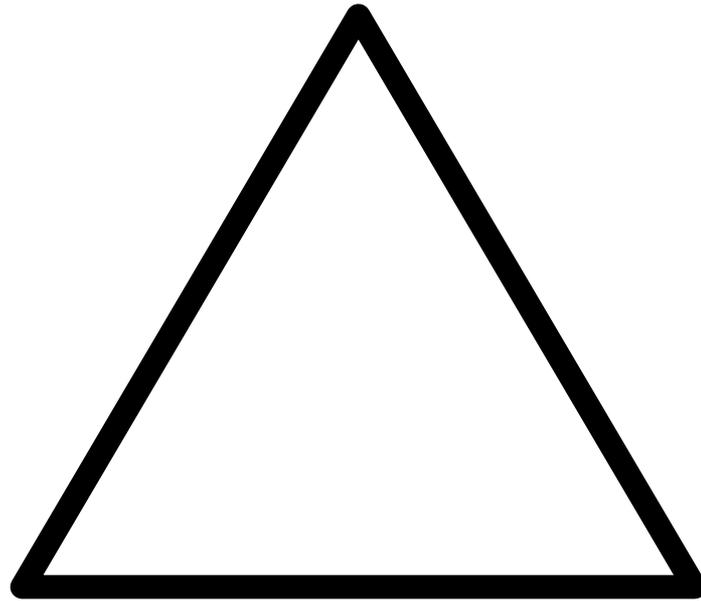


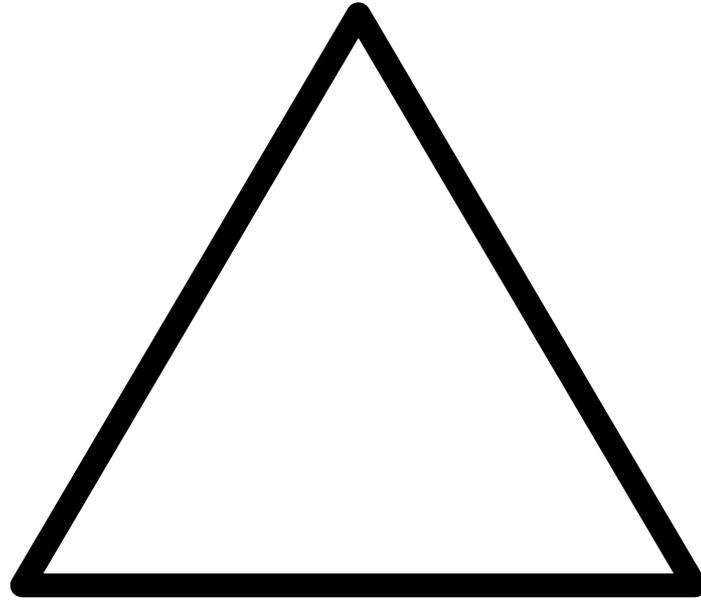


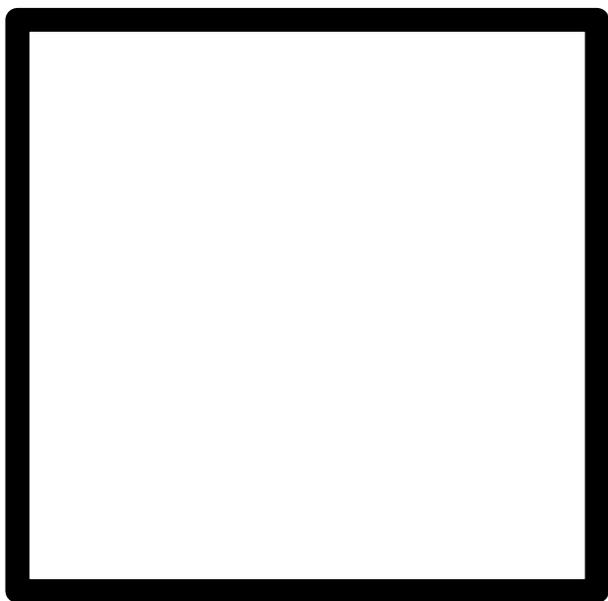


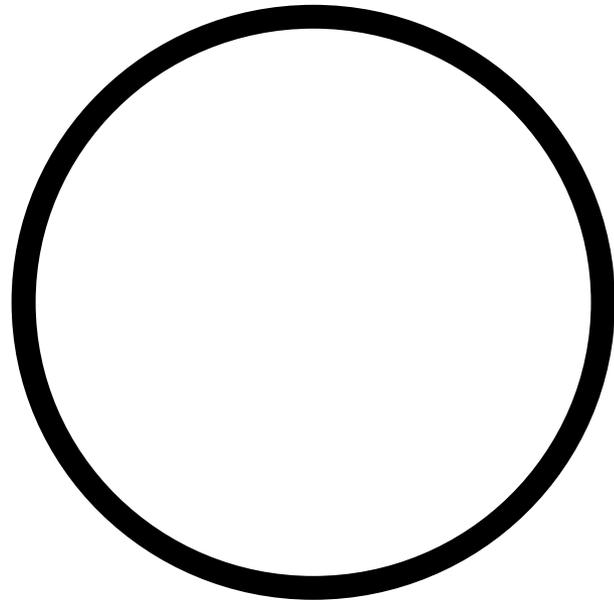


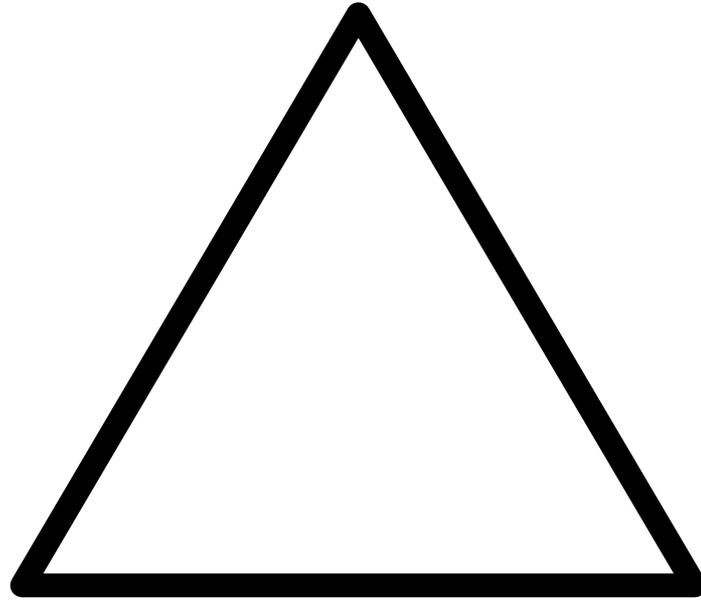


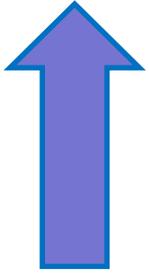
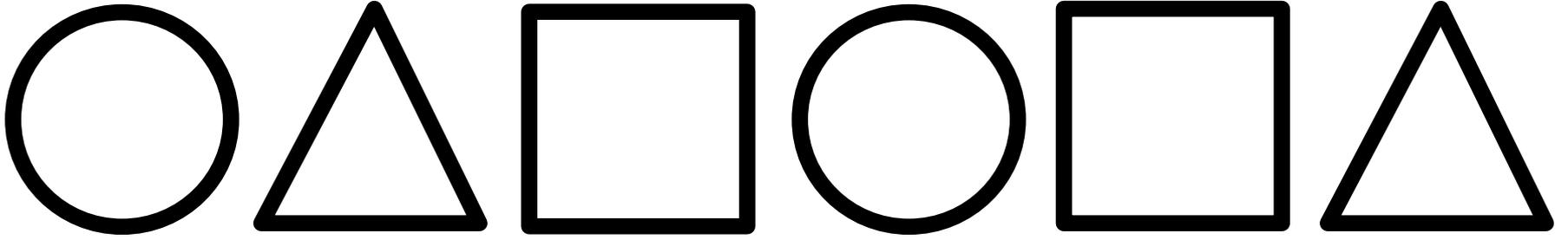


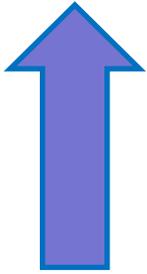
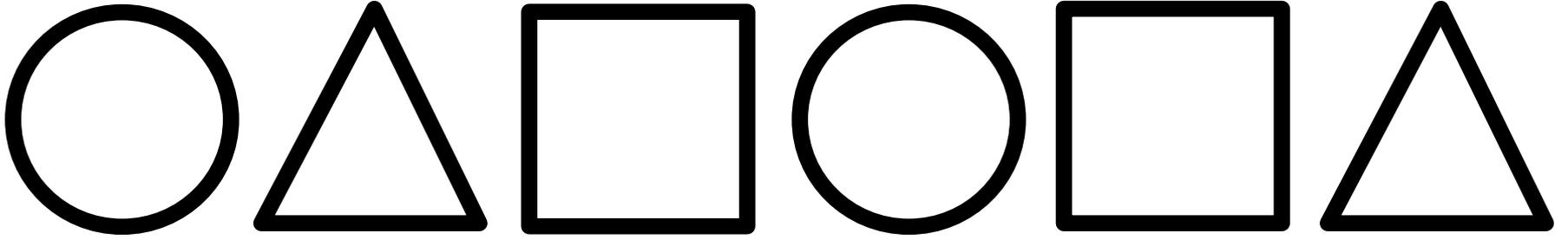


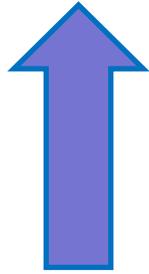
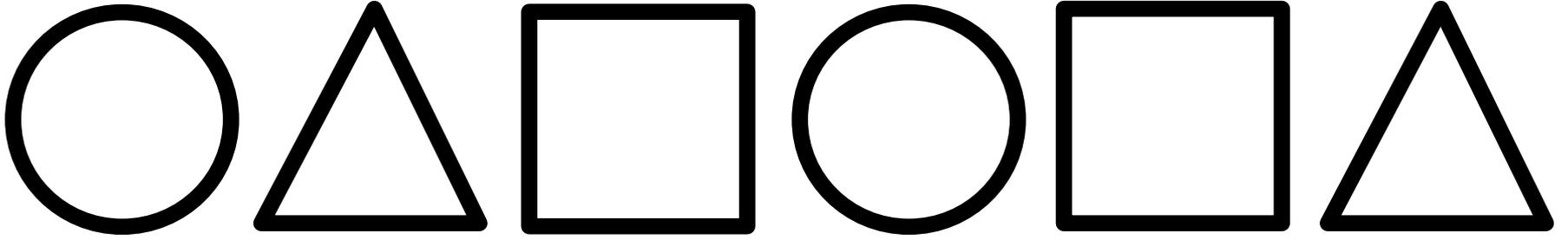


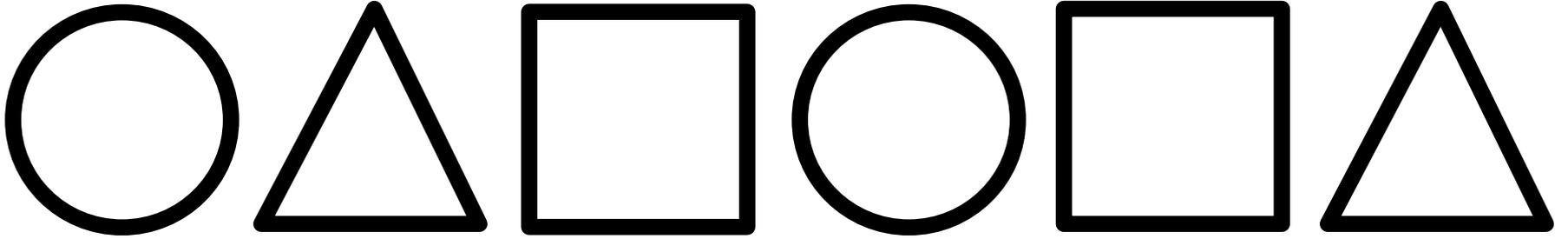


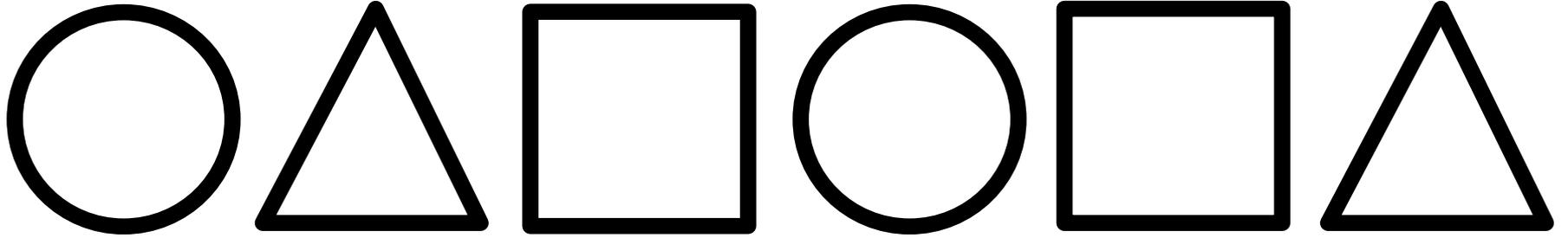


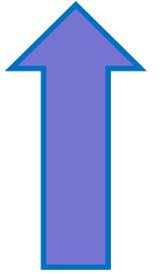
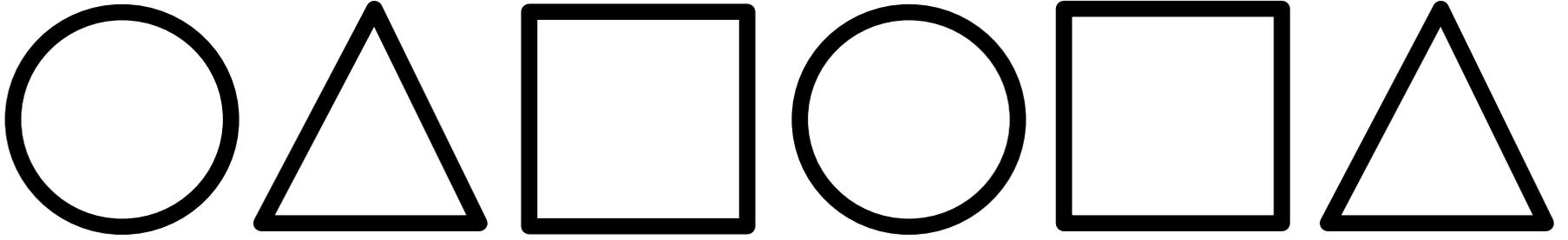




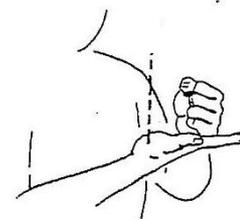
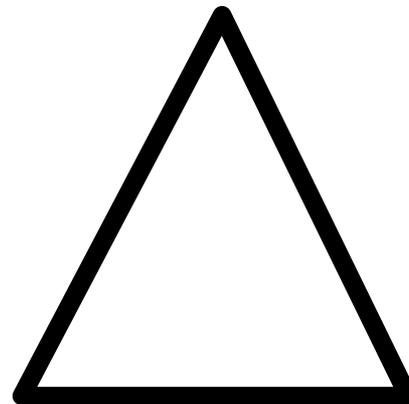
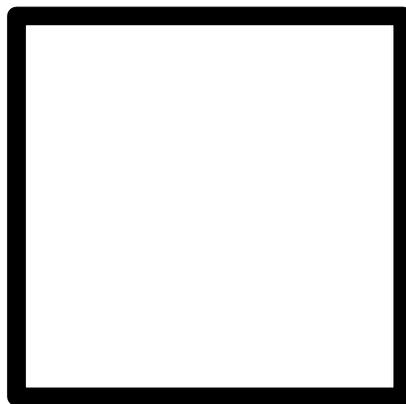
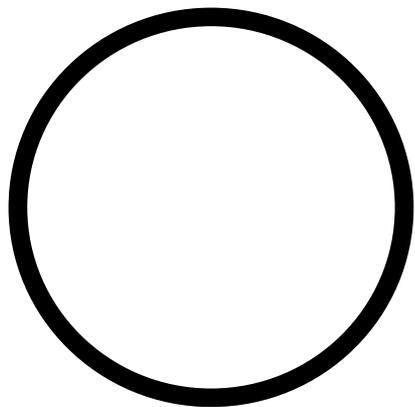


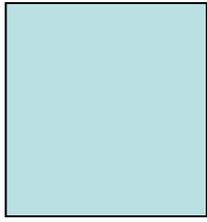




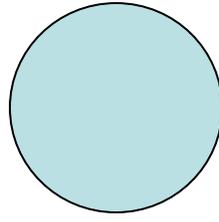


Imagine if the mappings were now changed to these:

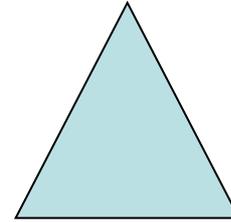




Clap  
your hands

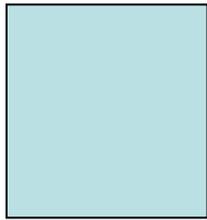


Stamp  
your feet

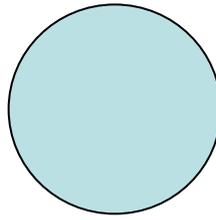


Touch your  
nose

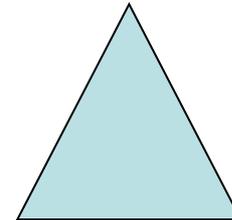
memory



Touch  
your toes



Raise your  
hands up



Jump

memory +  
inhibition  
(conflict is  
present)

Scaffolded: Teacher does it in front of them.  
Whole class does it together; NOT a testing or evaluation  
context