

How & Why Dance, Music, & Storytelling might well support Critical Cognitive Development in Children and Youth



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I would like to I acknowledge that I
am speaking from the ancestral,
unceded territories of the Coast Salish
Nation (x^wməθk^wəy'əm [Musqueam],
skwxwú7mesh [Squamish] &
selíl'witulh [Tsleil-Waututh]).

Opening sequence of images I showed
with what I said now recorded with the
images in the video file:

http://devcogneuro.com/videos/imagine_a_world_41sec_with_sound.wmv

Much of what I'm going to say is written
on my slides.

The text is there to aid understanding
since I speak quickly
& to help deaf attendees.

You don't have to worry about writing
down what's on the slides.

I am happy to give a PDF of my slides to
the conference organizers.



**I worry that activities needed
for children to thrive
are being cut from
school curricula & children's lives.**





JOY
is not
the opposite

of
SERIOUS



Serious business

(like learning) can be

JOYFUL

Research shows
we learn more and get more
done, when we're happy.



For example:

Hirt et al. 2008
J. of Personality
& Social Psych.
vol. 94, 214-230.

Yang, Yang & Isen.
2013
Cognition & Emotion
vol 27, 474-482.

**Creativity requires that you
feel happy and relaxed
enough to be playful.**

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
(specifically better creative problem-solving)
(Ashby et al. 1999; Hirt et al. 2008)**

For ex., when we're happier, we're able to work more flexibly (Murray et al. 1990) & to see potential relatedness among things that wouldn't normally be grouped together (Isen et al. 1985,1987).

Corporations want creativity.

**They are looking for people who
can think outside the box.**

**When we're sad we have worse
working memory and
selective attention.**

Desseilles et al., 2009

von Hecker & Meiser, 2005

Yang, Yang, & Isen, 2013

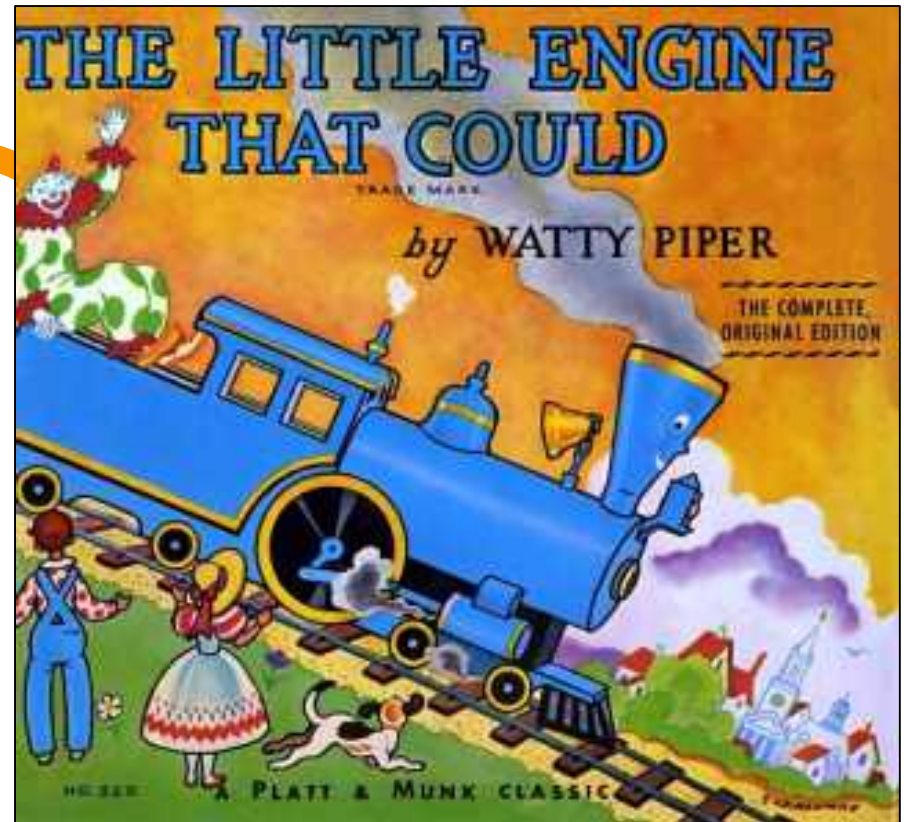
**When we're happy we have
better working memory and
selective attention.**

Gable & Harmon-Jones, 2008

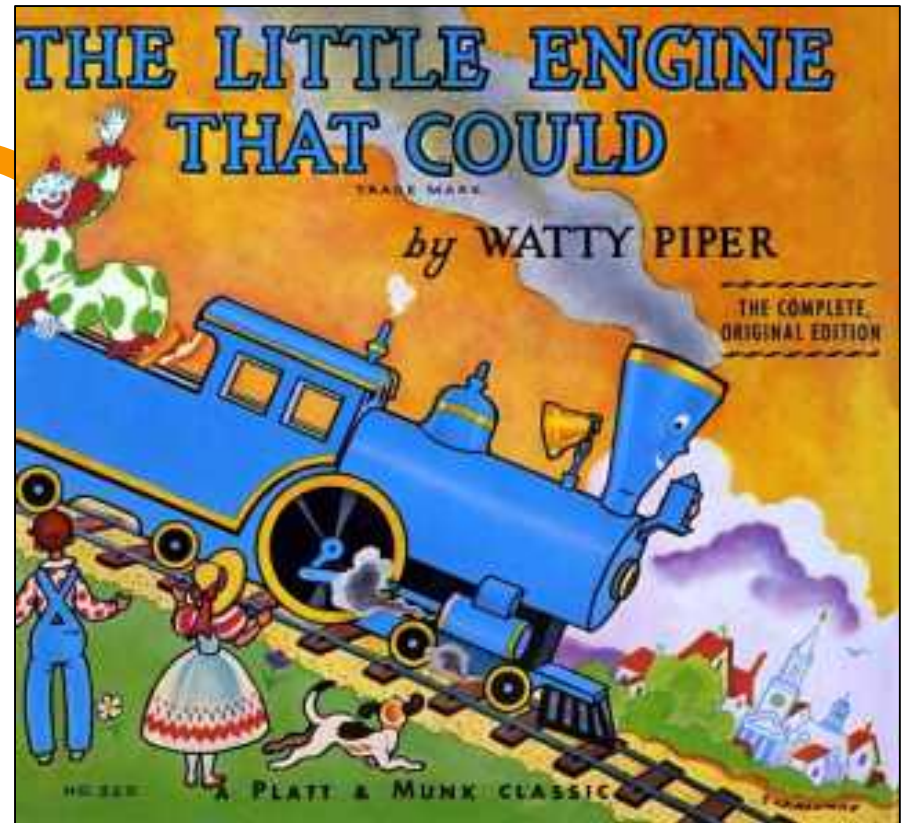
Yang, Yang, & Isen, 2013

**The Arts provide joy because
they are intrinsically fun activities
and
because they build self-confidence,
helping children be proud
of who they are.**

Children
need to
believe in
themselves



They need
to believe
they can &
will succeed.



There are 2 routes to this:

- 1) They need to know that
you believe in them & fully
expect them to succeed.**

**It's important to
communicate loud and clear
the faith and expectation
that every child will succeed,
will find their way.**

**Our expectations for how a
child have a HUGE effect on
the expectations that child
develops for him- or herself**

(the Pygmalion Effect)

**And the expectations
children have for
themselves become self-
fulfilling prophecies.**

Stereotype Threat

Joshua Aronson & Claude Steele

Good, C., Aronson, J., & Harder, J. (2008). Problems in the pipeline: Women's achievement in high-level math courses. *J of Applied Dev Psych*, 29, 17-28

For ex., there's a stereotype in our culture that men are better than women at math.

A group of researchers went to a university & gave a standardized math test,

As a group, the male students scored higher than the female students.

Then they tested another group of entirely comparable university students on exactly the same test

– the ONLY difference: **added** one sentence before the exam. They said,

“This particular test has been designed to be gender-neutral; on this particular test women score as well as men.”

And what happened?

The women scored as well as the men.

It was the **SAME** test as the first group got!

The only difference was whether the women expected themselves to do well or not.

Our expectations for ourselves can often become self-fulfilling prophecies

**Just one person believing in
you (believing in
your potential)
can make all the difference.**

**With HOPE in the
POSSIBILITY of SUCCESS,
can come the COURAGE
NOT TO GIVE UP**

A Gallup poll study of >70,000 students in the US, found that the HOPE children in Grades 5 - 12 had for themselves predicted their college grades and college success better than did their high school grades or standardized test scores.

The 2nd route is:

2) Children need do-able challenges. They need opportunities to do things that enable them to see for themselves that they're capable.

**Pride, self-confidence, and joy
come from seeing yourself
succeed at something that you
know was difficult.**

(Research studies by e.g., Duckworth, 2010;
Lewis & Goldberg, 1969; White, 1960)

In Arts activities

(like music, dance, circus, etc.)

children experience repeatedly that
through effort and repeated practice
what looked impossible becomes
possible, even easy.

**They repeatedly see themselves
conquering challenges.**

That builds Confidence.

Repeated cycles of
“fail, keeping trying, succeed”
also build **GRIT**.

Grit is the courage, resolve, & tenacity to
preserve against all odds & despite
all obstacles, to keep trying when
others might given up.

It is basically an attitude, a personal creed,
that you can conquer anything if you just
put your mind and heart to it.

**Arts programs build feelings of pride
and self-confidence video:**

**[http://devcogneuro.com/videos/new_self_
confidence_10min_17sec.wmv](http://devcogneuro.com/videos/new_self_confidence_10min_17sec.wmv)**

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

El Sistema is intended as a social intervention with music at its core. Abreu envisioned classical music training as a social intervention that could transform the lives of poor kids.





El Sistema is provided FREE.
It takes all children (even those who are deaf).
It's reached over a million children in >30
countries across 5 continents.

Including Scotland
(where it is called "Big Noise")

BIG NOISE



SISTEMA SCOTLAND

"I see music as a way to rescue children. It is a weapon against poverty.

When a child can play an instrument well it builds his self worth. He works hard and succeeds. He can then build on that success. He does well in other areas of his life.

To me, poverty creates a feeling of powerlessness. But music creates happiness. The children succeed in making beautiful sounds. This represents hope for families and communities."

-- words of an *El Sistema* graduate

The National Dance Institute (NDI) **was founded by Jacques d'Amboise in 1976** to transform the lives of 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.





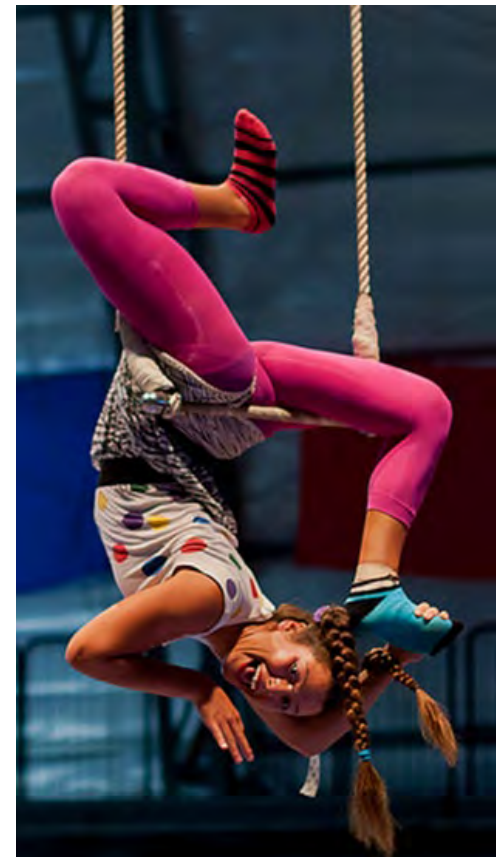
NDI is provided free. It takes *a//* children (even those in wheelchairs). Has reached over half a million children in some of the poorest areas.

Youth Circus / Social Circus



Almost 200 cities throughout the US have **youth circus programs**, as do many in Europe. Youth circus is **circus created and performed by youth**, as opposed to entertainment devised for youth.

Since the 1970s, youth circuses have used circus arts to instill in young people qualities they need to survive and thrive in society, **teaching them the art of life through circus, building character, and inspiring youths, especially those at-risk.**





In 2015, I met this strong, proud African-American man. You would never guess he was born in prison, his father dead before he was born, his mother a couple of years later. At age 15 he was the oldest male in his family still alive and not in prison.

He joined Circus Harmony, St. Louis's youth circus program, at the age of 12 and it transformed his life. Through his circus skills he won international awards and when I met him, he was enrolled in a prestigious circus 'university' in Montreal.

These, like many other Arts programs,
are quite cognitively demanding.

They don't let children get away easily.

They hold children to high standards.

Children rise to the occasion.

The children have a lot of fun

AND

they work very hard.

The two are not incompatible.

There's no reason why learning
can't be joyful.

When it is,
there's no clear distinction
between 'work' and 'play.'

Are these budding musicians working or playing?



How about here? Working or playing?



When you're lucky enough to
work on something that you're
passionate about, that you
thoroughly enjoy,
then there's no clear distinction
between 'work' and 'play.'



Lack of Fear of Failure in El Sistema

A mistake is nothing to be embarrassed about.
“Going wrong is just something you do on the
way to going right.” - Abreu

**El Sistema programs
emphasize the JOY of playing
music – not perfect technique,
but playing together & from
the heart.**

**If you make a mistake, just try
again.**

**Many young people
are so terrified of
making a mistake
they're afraid to try
anything new.**

**We need to let our
youth know it's okay
to make mistakes.**

**Everyone makes mistakes,
even us.**

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

**Making mistakes is part of
learning and improving;
we should **celebrate** when any
child has the courage to try and
challenge him- or herself.**

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

- Albert Einstein

**Students in my lab,
and in most labs,
are always terribly disappointed
when their hypothesis is
disconfirmed.**

I tell them that they should rejoice.

**Now you have the opportunity
to learn something
they didn't know before and
perhaps no one knew before!**

When we find out we were right,
we're not learning anything new.

It is only when we are surprised --
when we were wrong -- that we learn
something we didn't know before.

Take the risk of making a mistake,
of being wrong!

Treating errors and failed attempts as learning opportunities, or just part of improving, **has been demonstrated repeatedly to be important for improving and succeeding** (e.g., Carol Dweck).

**Making a mistake
is NOT a problem.**

Suffering embarrassment
because you made a
mistake
is a problem.

The important thing is
how you react
after you've made a mistake
or fallen short of a goal.

**We need to emphasize to young people
that they haven't failed
until they've tried for the last time,
and they haven't lost until they quit.**



**- to paraphrase
Samuel Proctor Massie**

It's never over 'til it's over

**It's important to try,
and to keep trying.**

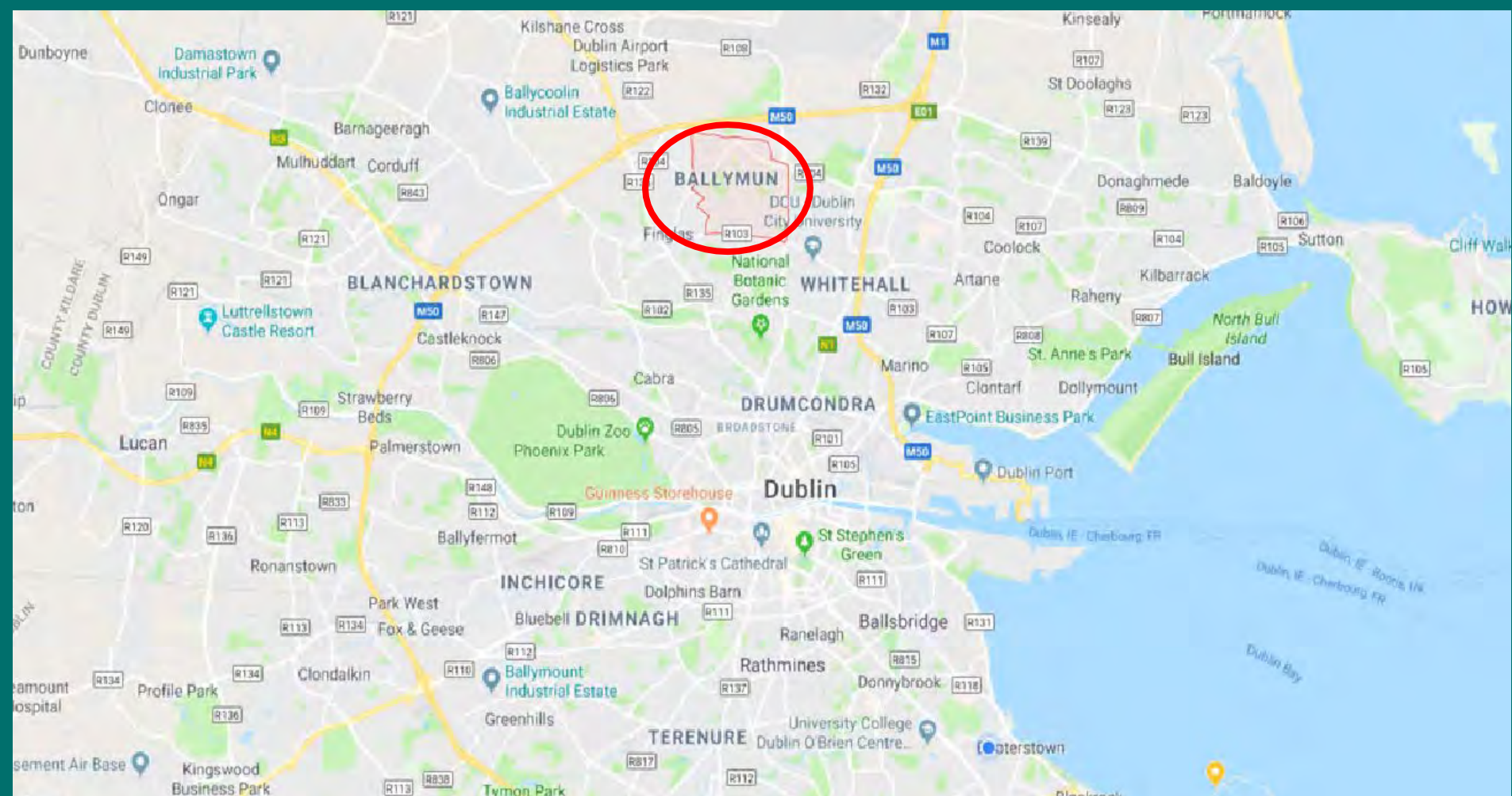
**The Arts teach young people that
it's okay if your first several
attempts don't work out.**

One other example of an Arts project
that built enormous pride:

The Book Project
at Virgin Mary
Boy's National School
in Ballymum



Ballymun's Location



The project was to publish an
anthology of the writings and
illustrations of students in
Grades 2 – 6
with the goal of helping
the children feel proud
of who they are and what they can

Why Publish a Book?

The System fails children – it often tells them they are 'below par'



Our Book! Our Voice!



And on the 25th April 2018...



Not surprisingly teachers commented:

'The children are really enjoying writing stories and poems. They are taking great pride in their work...

It is great to see the children excited to write.'

- a Special Needs Assistant

'I loved the fact that all the stories were brought to life through their imagination, and how the children really enjoyed writing their stories.' - a Teacher

It's good to read books, but it's even better to read a book that you helped write or illustrate.



RTÉ news2day

@news2dayRTE

Irish children's television news programme, broadcast weekdays at 4.25pm on RTÉ Two.

📍 Ireland

🔗 rte.ie/trte/news2day/

📅 Joined March 2011

Tweet to RTÉ news2day

👤 13 Followers you know



🖼️ 539 Photos and videos



Tweets	Following	Followers	Likes	Lists
1,793	315	3,173	565	1

Tweets Tweets & replies Media



RTÉ news2day @news2dayRTE · 8h

It's good to read books but it's even better to read a book that you helped write or illustrate. @zainabboladale spoke to a group of students about their new book called Terrific Tales!



250 views

0:01 / 2:07



RTÉ news2day @news2dayRTE · 8h

Scientists in Norway are becoming worried since they've noticed that the nests on one bird island, are now being made with plastic!

Project Features & Achievements

Educational

- Inclusive
- Generation of ideas
- Literacy development
- Teamwork
- Leadership
- Hidden talents realized

Social

- All-school involvement
- Parents and guardians
- Local library
- Trinity and UCD
- Field trip to see book in development
- Nationwide reach through media organizations

Rights

- Voice
- Citizenship
- Participation
- Social Actors / Agency
- Identity acknowledged

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Questions? Comments?

(5-6 minutes)

**Moving on to other
benefits of the Arts
for success in school
and in life...**

**My specialty is
something called
“Executive Functions”**

Executive Functions
have been described
as the
mental toolkit for success.

Hendry, A., Jones, E. J. H., & Charman, T. (2016). Executive function in the first three years of life: Precursors, predictors and patterns.

Developmental Review, 42, 1–33.

Research has often found EFs
to be **more predictive of**
academic & career success
than SES or IQ.

e.g., Alloway, T. P., & Alloway, R. G. (2010). Investigating the predictive roles of working memory and iq in academic attainment. *Journal of Experimental Child Psychology*, 106(1), 20–29.

**There are
3 core
Executive
Functions**

- 1. Inhibitory
Control**
- 2. Working
Memory**
- 3. Cognitive
Flexibility**

**Inhibitory
control
at the level of
attention:**

**Focused
Attention

or

Selective
Attention**

Attentional Control

- The ability to concentrate,
- Pay attention, &
- Stay focused

despite distractions,
even when the material is boring

FOCUSED ATTENTION

Screening out distractions



**How can the Arts help
improve Focused
Attention?**

To improve any of the EFs,
it is critical to keep
practicing that EF.

It's the discipline,
the practice that
produces the benefits.

Not only that:

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

That's true for being truly excellent
at **anything**.

It's the hours of practice,
pushing yourself
to keep improving,
that drives the benefits.

Ericsson: 10,000 hrs of practice

Ericsson, K.A., Nandagopal, K., & Roring, R.W. (2009).

Toward a science of exceptional achievement: Attaining superior
performance through deliberate practice.

Annals of New York Academy of Sciences, 1172, 199-217

**Well, which Arts provide an
opportunity to practice
focused attention and
concentration?**

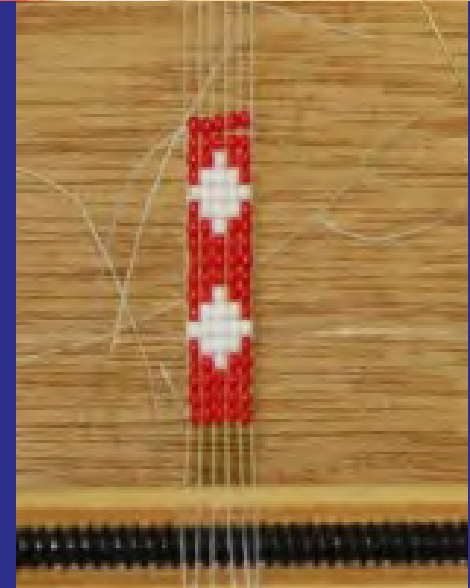
**Just about
all of them!**

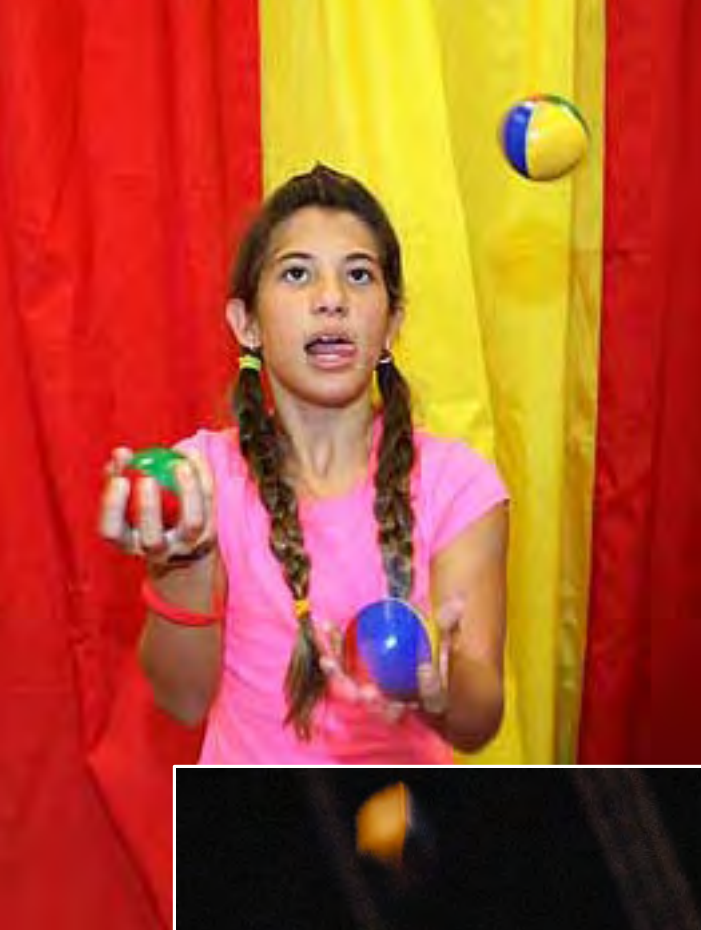
Singing in a Round



Dancing while balancing something on your head





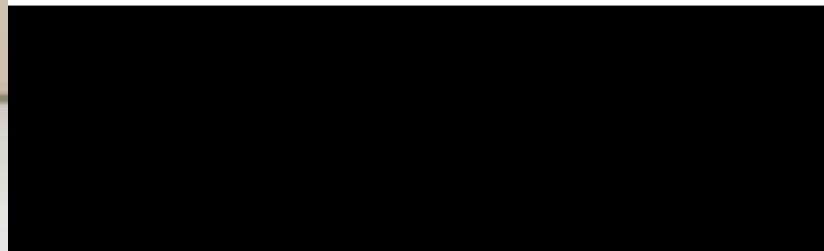
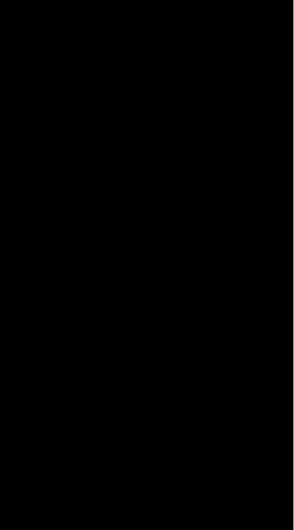












Rueda is a community-style of Salsa from Cuba. **You dance in a “wheel” (the Rueda) as a group.**



Rueda is a community-style of Salsa from Cuba. **You dance in a "wheel" (the Rueda)** as a group. Each person starts with a partner, gets in the circle, and **changes partners** throughout the dance. **The dance is done to calls** often in rapid succession, requiring dancers perform a complex interweave of patterns.

Sam Gill has been teaching it to public sch students for yrs



The dancers exert themselves physically and mentally and stay focused for a much longer period at levels far beyond what would be possible based on external goals and rewards.

The pace and demands of dancing require one's full attention.

The music doesn't stop; the calls keep coming; there's no leeway to space out, to lose attention, even to reflect on how you're doing.

The pace and demands require full presence....

After a few classes, the dancers know many moves, **but they don't know what move will be called.** When a move is called, the entire group must do the move simultaneously and accurately in the prescribed rhythmic structure. **Dancers must listen for the 'call' and react immediately** with the appropriate actions, which are often complex movement patterns.

- Sam Gill www.SalsAmigos.org

**Inhibitory control
at the level of
behavior:**

**Self-Control
or
Response
Inhibition**

SELF-CONTROL

resisting temptations,

not acting impulsively,

thinking before you speak or act

- wait your turn
- don't grab something without asking or paying for it
- don't eat sweets before dinner
- don't cross when the light turns red
- don't blurt out the first thing that comes to mind



Inhibit acting out of character

Wait.. until it's time for you to speak your lines, or when playing music w/ others, wait until it's your turn to play.



**When doing a comic routine:
Try not to laugh at your own jokes**



Discipline & Perseverance

require inhibitory control

to resisting the many temptations to quit
and not finish what you started

to stay on task **despite**

- **being bored with it,**
- **running into unexpected difficulties, setbacks, even failures**
- **more fun things calling**

continuing to work though the reward may be a
long time in coming (**delaying gratification**)

Evidence indicates that
discipline accounts for over
twice as much variation in
final grades as does IQ,
even in university.

Duckworth, A. L. & Seligman, M. E. P. (2005)
Self-discipline outdoes IQ in predicting academic
performance of adolescents.
Psychological Science, 16, 939-944.

**And the Arts
build discipline and
perseverance in spades,
as I've already talked about.**

Music Education, Academic Achievement, and Executive Functions

S. J. Holochwost et al. (2017)

Psychology of Aesthetics, Creativity, and the Arts, 11, 147-166

- **265 children** (Grades 1 through 8; 86% African American) half of whom were **selected by lottery to participate in Philadelphia's El Sistema** program (*Play on Philly*) – i.e., random assignment.

All attended the same parochial school.

The parents of *a//*children wanted them to participate in El Sistema.

None were classified as special ed. Most were lower income.

The program takes place for 2 hrs every school day - 39 weeks / yr.

Drop-out rate over 3 years was only 10%.

They did an intent-to-treat data analysis, which is very conservative.

El Sistema in Philadelphia

Variable	Difference*	Significance	Effect Size
Standardized test scores (TerraNova)	13.5 points higher	$p < .007$	$d = 0.24$
Grades: in English	2.5 points higher	$p < .001$	$d = 0.30$
Grades: in Math	3.9 points higher	$p < .01$	$d = 0.42$
EF measures:			
1) Go/No-go (response inhibition)	3.5% higher	$p < .004$	$d = 0.40$
2) Flanker Test: (focused attention)	6.6% higher	$p < .01$	$d = 0.35$
more efficient (based on RT & %correct)	12.3 better	$p < .001$	$d = 0.50$
smaller Flanker Effect (RT difference on incongruent & congruent trials)		$p < .001$	$d = 0.50$
3) Stroop Test (focused attention)	more efficient (based on RT & %correct)	$p < .001$	$d = 0.50$
faster RT	313 msec faster	$p < .0001$	$d = 0.57$
(for the bottom 25%)	620 msec faster		$d = 1.13$
4) Wisc. Card Sort Task: fewer perseverative errors		$p < .02$	$d = 0.18$
5) Tower of London	NS (too difficult)		
6) Trail-making Test	NS (too insensitive)		

* Those in the program for 3 yrs vs. controls.

Holochwost et al., 2017

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Holochwost et al., 2017

Working Memory

**Holding
information
in mind
and working or
playing with it**

Working Memory enables us to

- mentally play with ideas and relate one idea to another
- reflect on the past or consider an imagined future
- remember multi-step instructions & execute them in the correct order
- remember the question we want to ask as we listen to the ongoing conversation

Working Memory

Working memory is critical for making sense of **anything that unfolds over time**, for that always requires holding in mind what happened earlier and relating that to what is happening now.

Working Memory is essential for

REASONING and for

CREATIVE PROBLEM-SOLVING

for those require holding ideas and
information in mind and playing with
them, relating one to another,
and more

The Arts

**require working memory,
and if the children push
themselves to keep
improving,
the Arts improve WM.**

**I predict that a great way to
improve children's focused
attention & working
memory is simply to tell
them stories.**

Storytelling

should be a terrific way to
challenge and improve
both Working Memory
& Sustained Attention
(both telling *and* listening)



I'm a huge fan of Storytelling





Storytelling requires and invites your rapt attention for extended periods (**sustained, focused attention**), and **working memory** to hold in mind all that's happened so far, different characters' identities, story details & to relate that to the new info being revealed – **without visual aids** (like pictures on the page !



A researcher (Gallets, 2005) randomly assigned children in Kindergarten & Grade 1 to storytelling or story-reading -
- 2x a week for 12 weeks.

Vocabulary and recall improved more in the children assigned to **STORYTELLING** than in children assigned to story-reading.

That's important because
vocabulary assessed at age 3
strongly predicts reading
comprehension at 9-10 years
of age.

Hart and Risley (1995). *Meaningful
Differences*

(see also Hoff, 2002, 2003, 2013; Rowe et al., 2013;
Pancsofar & Vernon-Feagans, 2010)



Maybe one reason for Gallets' results is that when you are reading to, or with, a child you are looking down at the page at least part of the time.

But when you are telling a story you are looking directly at the children & interacting more.



The conversation (the human interaction) that takes place in the context of reading **seems to benefit language development, literacy, & brain maturation even more** than the reading itself.

The critical variable is the # of conversational turns taken. **It is talking *with* the child, listening to & responding, not talking to or at the child**, that drives the effect.



Children who have experienced more
conversational turns
show greater activation in the language
region in prefrontal cortex (**Broca's Area**).

That explains almost **50%** of the relation
**between early language exposure and later
language skills.**

Romeo, Leonard, Robinson, West, Mackey, Rowe, & Gabrieli (**2018**)

Beyond the 30-Million-Word Gap: Children's Conversational Exposure
Is Associated With Language-Related Brain Function.

Psychological Science, 29, 700-710.

That builds on a lot of earlier work showing similar results:

Walsh, B.A., & Blewitt, P. (2006). The effect of questioning style during storybook reading on novel vocabulary acquisition of preschoolers. *Early Childhood Education J.*, 33, 273-278.

Sénéchal, M., Thomas, E., & Monker, J. (1995). Individual differences in 4-year-old children's acquisition of vocabulary during storybook reading. *J. of Ed. Psychology*, 87, 218-229.

Kertoy, M.K. (1994). Adult interactive strategies and the spontaneous comments of preschoolers during joint storybook readings. *Journal of Research in Childhood Education*, 9, 58-67.

The conversation that takes place in the context of reading seems to have more benefit than the reading itself.

**While Story-reading
is wonderful**



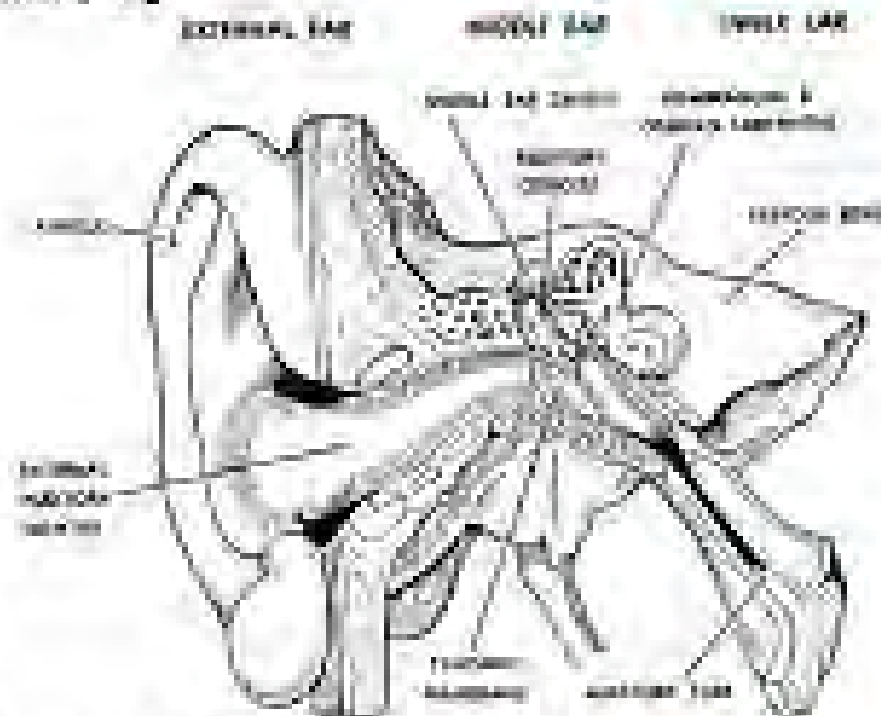
**I predict that
Storytelling
should improve
attention and working memory more
because it taxes them more**

POETRY

drink in
brighton

Featuring
Split! Richard,
Adam Kammerling
and Teel

SLAM



7:30PM MONDAY 4TH JUNE
@ THE QUADRANT
ENTRY £2.50

Places up for grabs so
get there early! Cash
prize for the winner



SPOKEN WORD

PROTEST THROUGH POETRY

Center for American Progress • 1333 H St NW Washington DC
WEDNESDAY, JUNE 25, 2008 • 6:30-8:30PM

Cognitive Flexibility

involves being
able to

- ..see an issue from different perspectives
- ..think about something in a whole new way ("thinking outside the box")
- ..seamlessly adjust to change or unexpected situations

Cognitive Flexibility also includes having the FLEXIBILITY...

- ...to take advantage of a sudden opportunity (serendipity)
- ...to get to your desired goal despite unexpected obstacles seeming to block the way
- ...to admit you were wrong when you get more information

**An example of poor
cognitive flexibility:**

**When one door closes, another door
opens;**

**but we often look so long and so
regretfully upon the closed door,
that we do not see the ones that
open for us.**

- Alexander Graham Bell

Improv, such as...

Improvisational theatre

Improvisational dance

Jazz

**is unsurpassed for encouraging
and nurturing creativity**

All the visual arts...

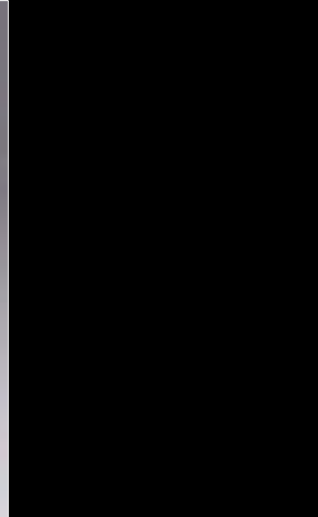
**drawing, painting, sculpture,
weaving, beading, quilting,
ceramics, pottery, mosaics, etc.**

invite and nurture creativity.

















Arts activities require...

- **planning**
- **cognitive flexibility** to respond to unexpected reactions or difficulties
- **perseverance**, even in the face of setbacks or initial failure
- **creative problem-solving**

Indeed, ALL the executive functions!

For EF skills or anything else, people improve on the skills they practice and that transfers to *very* similar contexts where those same skills are needed -- but people *only* improve on what they practice – improvement does not transfer to other skills.

Transfer is narrow.

That means if you want EFs like focused attention, self-control, working memory, cognitive flexibility, or creative problem-solving to generalize from an arts activity to academic activities, you have to help students see that what they did in arts also applies to science, math, English, history, etc.

**You need to draw very explicit analogies
for students.**

**Don't assume that since it's obvious to
you how a skill used in music applies
to science, that it will be obvious
to your students.**

Questions? Comments?

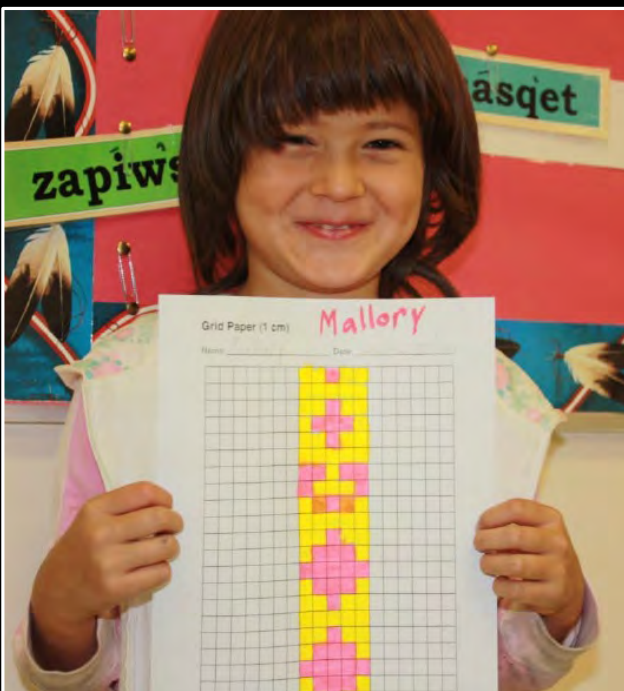
(5-6 minutes)

Besides helping to
develop the self-control &
thinking skills in Executive
Functions, the Arts can
also help develop
Academic Skills.

Ron Eglash brilliantly uses
computing simulations of
tradition crafts like beading,
weaving, quilting, and hair-
braiding to teach Math and
respect for the brilliance in these
traditional cultural practices.

But you can also teach any of these traditional crafts alongside teaching math – as co-equals, equal in importance.

Rosa Andrews uses beadwork
to help teach math to her
students of the Lil'wat
First Nation in BC.



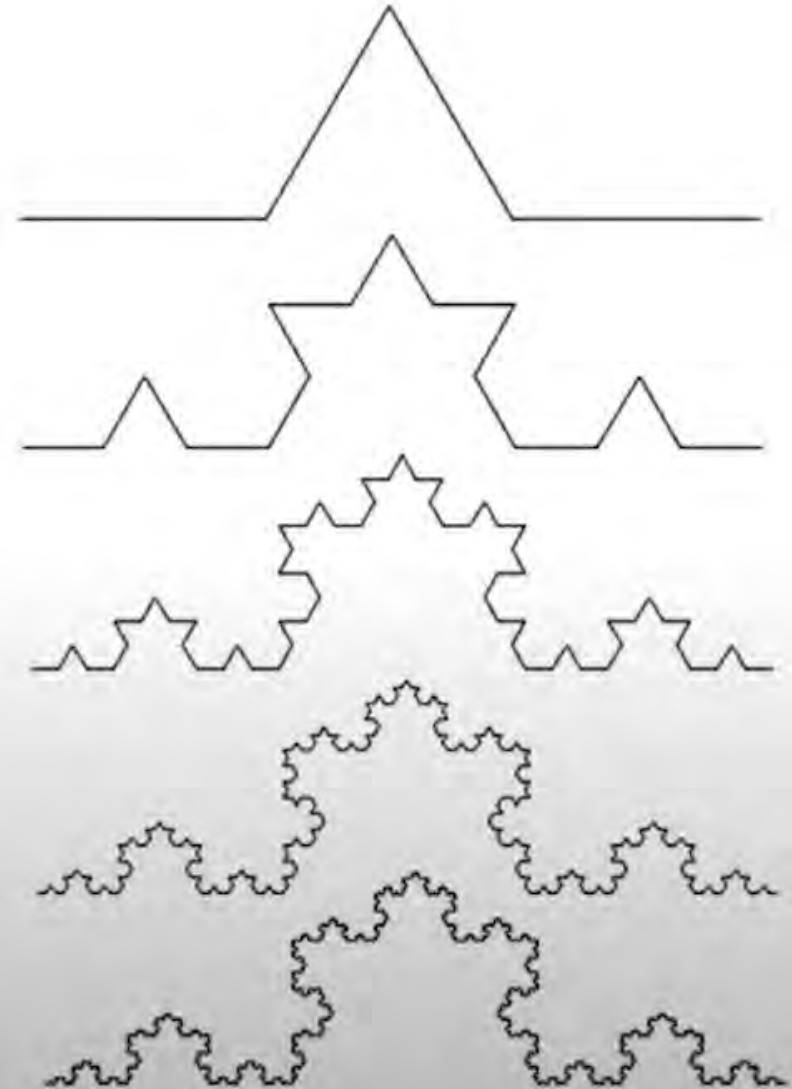
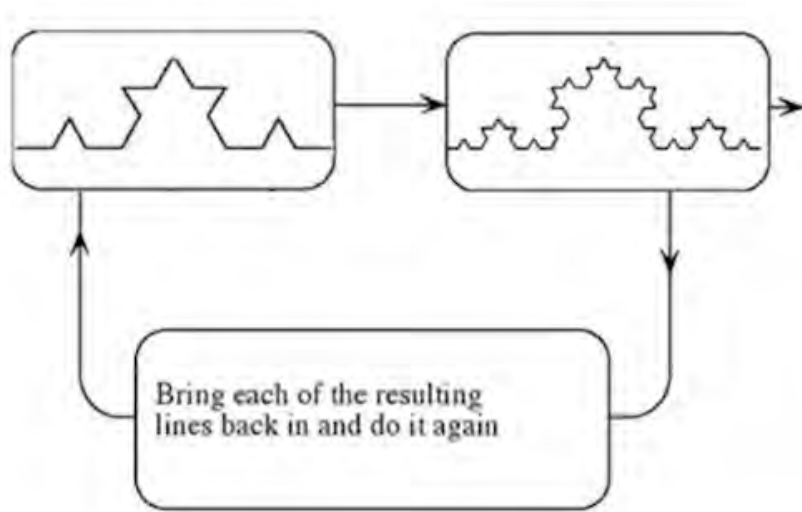
Rosa Andrews video:

[http://devcogneuro.com/videos
/beading clip rosa 2min 35sec.](http://devcogneuro.com/videos/beading_clip_rosa_2min_35sec.wmv)

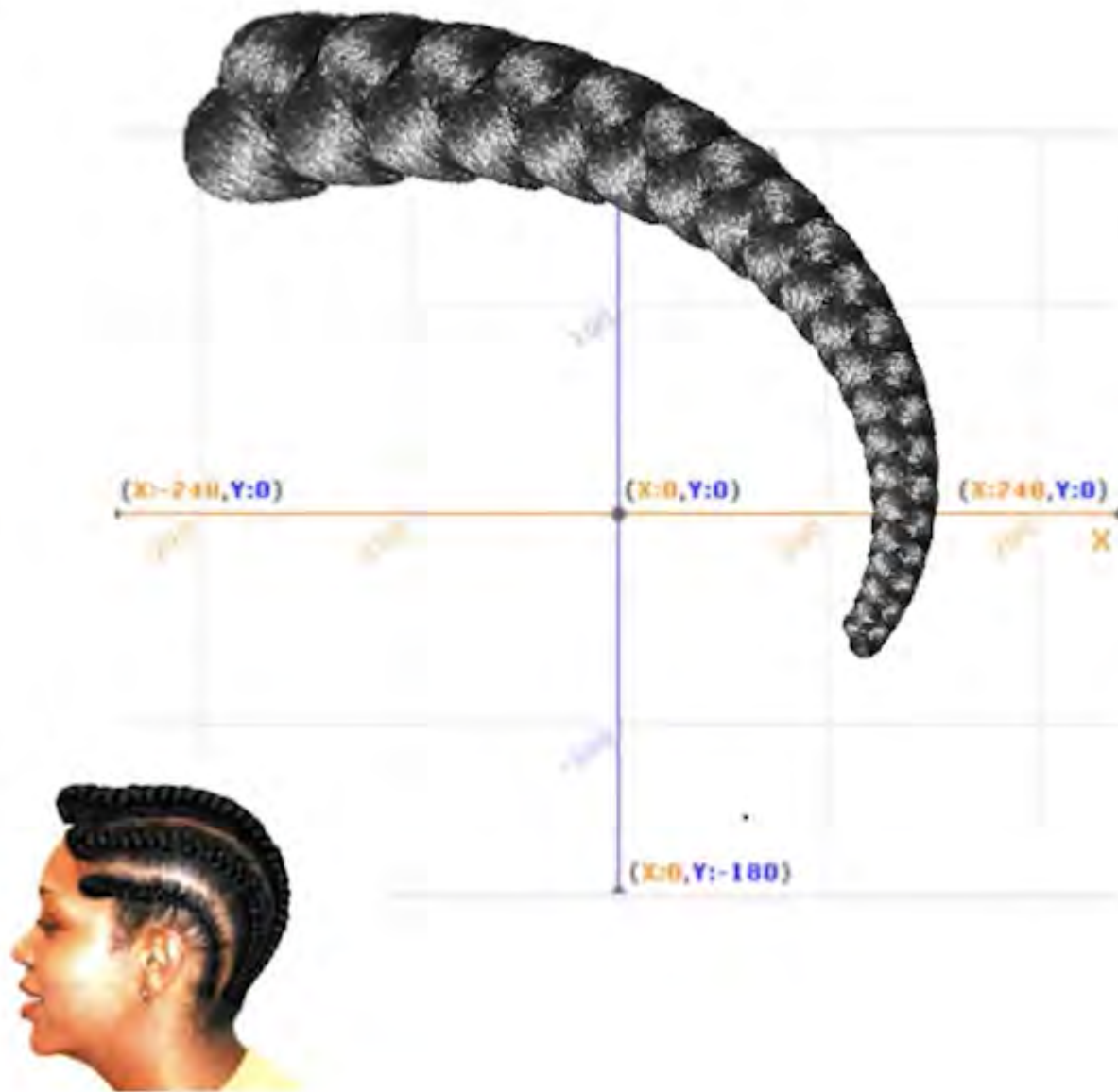
wmv

Ron Eglash

Fractals are patterns that repeat at many scales, typically created by a “bottom-up” cycle





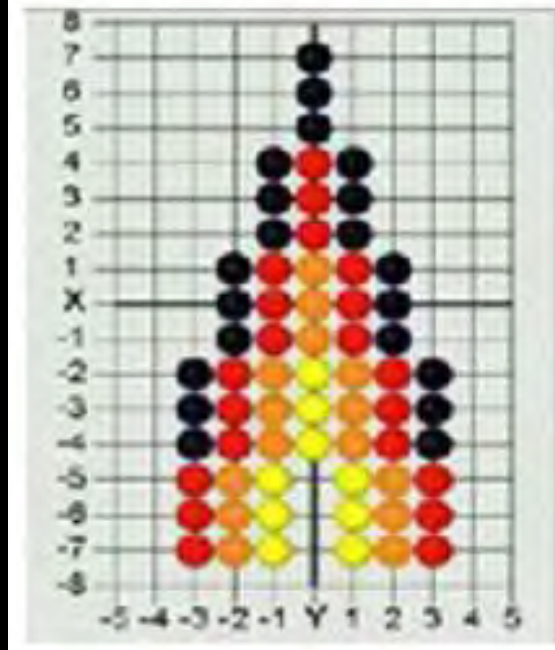


Click to Change

loom designs, and create their own virtual designs.



Virtual Bead Loom



The Virtual Bead Loom software will allow you to simulate traditional loom designs, and create new virtual designs of your own.

Almost all math concepts can be illustrated using beadwork! These materials have been provided to empower educators to use culturally situated design tools to teach.





Northwest Basket Weaving

Ron Eglash's website

Browser address bar: <http://csdt.rpi.edu/na/pnwb/weavework.html> Search: Ron Eglash

Navigation links: Apple, Yahoo!, Google Maps, YouTube, Wikipedia, News (33), Popular

[Home Page](#)

[Cultural Background](#)

- [Baskets Past and Present](#)
- [Symmetry](#)
- [How to Weave a Basket](#)

[Basket Weaver Software](#)

[Teaching Materials](#)

[Acknowledgements](#)

[CSDT Home](#)

Welcome to Pacific Northwest Basket Weaver



Introduction

The indigenous peoples of the Pacific Northwest--such as the Salish, Tlingit, Haida, and Tsimshian--have a rich and long history. Basketweaving is one important aspect of native culture. The product of techniques handed down from generation to generation, native baskets are both practical tools and beautiful pieces of art. This website will explain some of the history of Pacific Northwest basketweaving and the principles of math that are embodied within it. Through our Basket Weaver software, you will be able to create your own basket designs.

(Image courtesy of Teri Rofkar)

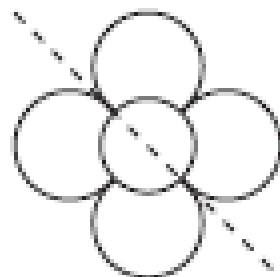
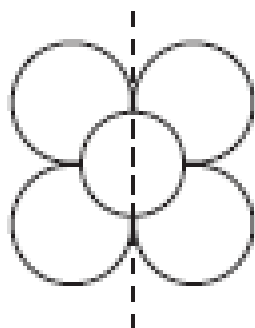
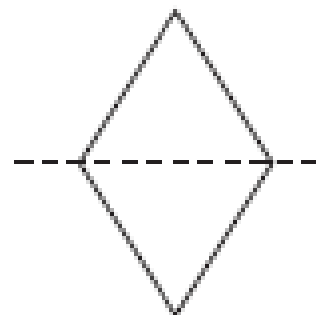
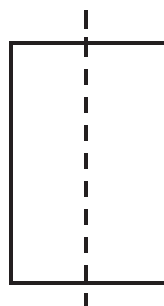
[continue](#)

Rotational Symmetry

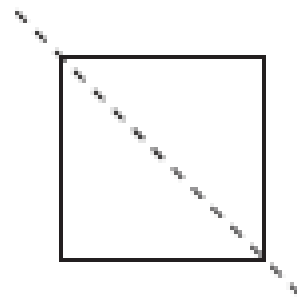




☐ Draw another line of symmetry.



Bonus: Draw
3 more lines
of symmetry.



Ron Eglash videos

The composite video I created:

http://devcogneuro.com/videos/ron_eglash_teaching_math_6min_27sec.wmv

which comes from these two videos:

[Teaching Programming through Hair Braiding, Quilting & Latin Percussion - Dr. Ron Eglash – PreparationTech](#)

&

[Computing for generative justice – Ron Eglash | Computing education research - YouTube](#)

Ron Eglash's

"Culturally Situated Design Tools"

website:

<https://csdt.org/>

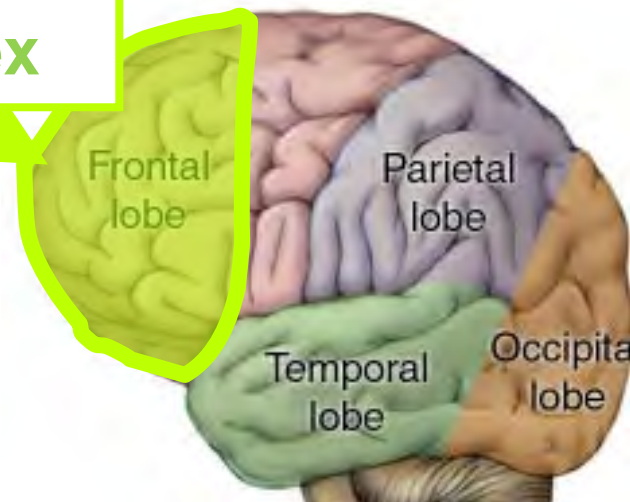


Questions? Comments?

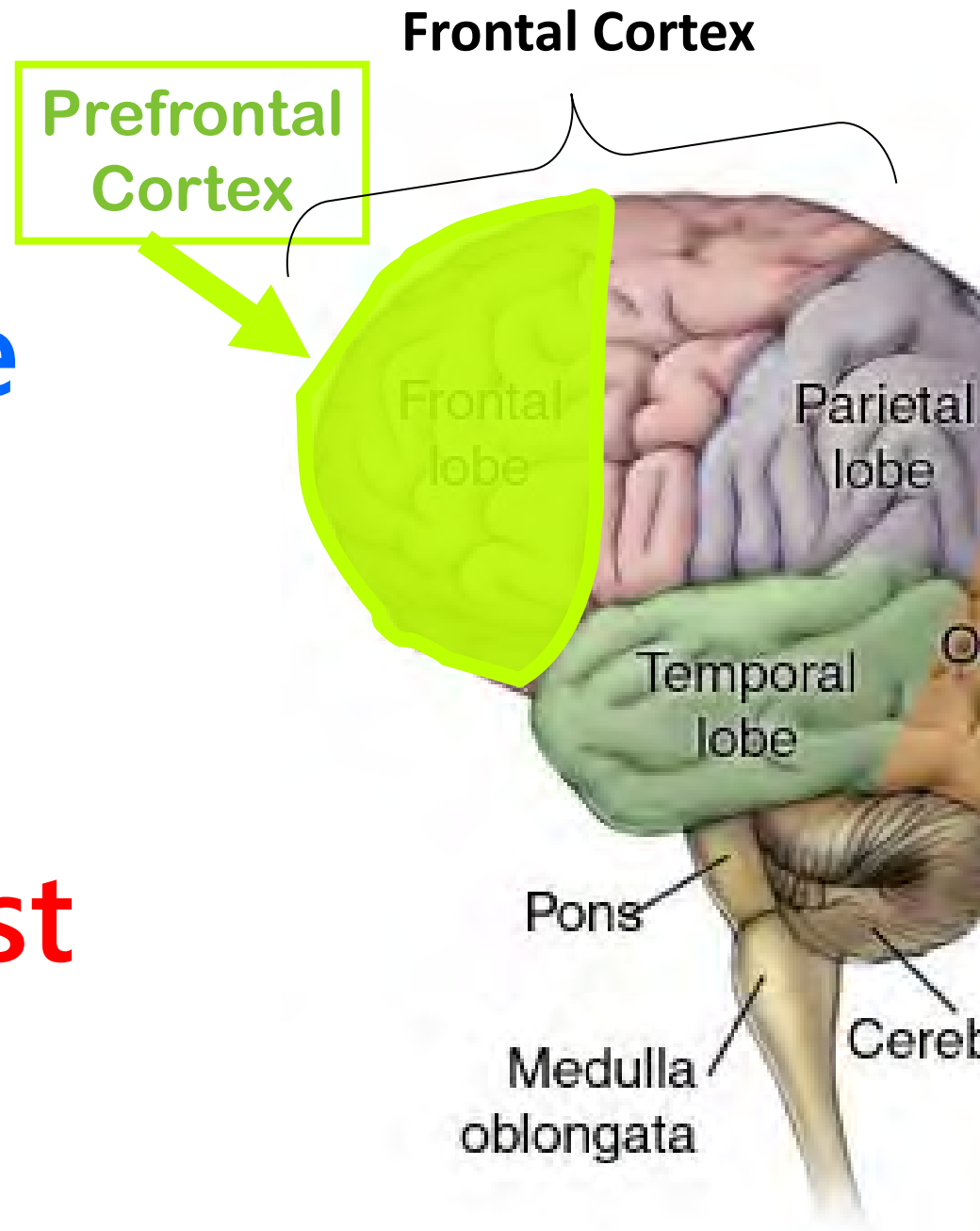
(5-6 minutes)

Executive Functions
depend on **Prefrontal
Cortex** and the other
neural regions with
which it is
interconnected.

Prefrontal
Cortex



**Prefrontal
cortex is the
newest area
of the brain
and the most
vulnerable.**



If you're

- sad or stressed
- lonely or
- not physically fit

Prefrontal Cortex and Executive
Functions are the **first to suffer,**
and **suffer THE MOST.**

Conversely, we show better
Executive Functions when we're

- happy
- feel socially supported, &
- we're healthy & physically fit

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

**That is particularly true
for prefrontal cortex
and executive functions.**

We are **fundamentally social**.

We need to belong.

We need to fit in & be liked.



Dan Siegel talks about
'interpersonal neurobiology'
because social relations shape
and change our neurobiology.

People who feel lonely, or are focusing on anticipating being alone, show worse EFs than people who feel, or anticipate feeling, more socially supported.

Baumeister et al., 2002

Tangney et al. , 2004

Twenge et al., 2002

Campbell et al. (2006) gave subjects
a survey when they came in the lab
that included questions like “Do you feel
socially supported? Do they feel
lonely?”

They found that prefrontal cortex
functioned less efficiently
in those who felt lonely or isolated.

Being socially excluded activates the same brain network as that for physical pain (the dACC & insula) & the more social pain you feel, the more activity the dACC shows pain.

Naomi Eisenberger et al. (2003) *Science*

**Let's return for a moment to the
activities I started with...**

**El Sistema orchestral music
the National Dance Institute
Youth circus / social circus**

They all build
camaraderie & community.

They all provide children &
youth with social support and
a sense of social belonging.

In these activities, children are part of an ensemble of dancers, musicians, or circus artists.

They learn to help one another, listen to one another, and respect one another.

Each is an important part of the whole, of a community. All are working toward a common, shared goal.

They learn to trust & rely on one another.

These activities address social needs, providing feelings of belonging & social support video:

http://devcogneuro.com/videos/social_4min_32sec.wmv



The primary skill you learn in El Sistema is not your instrument; the primary skill is working together. It's using the orchestra as a metaphor for how we work together as a society – to become fantastic at working together.

**El Sistema, emphasizes
playing together
from the outset**

**(vs. training alone on one's
individual instrument first)**

Joint music-making involves coordinating one's efforts with those of others.

A convincing musical performance by multiple individuals is only possible if it involves cooperation among those playing.





When we try to synch with others musically
(such as keeping the beat or harmonizing)
research shows we tend to have warm,
positive feelings towards those we are
synchronizing with.

Koelsch, S. (2013). From Social Contact to Social Cohesion -
The 7 Cs. *Music and Medicine*, 5(4), 204-209.

Kirschner and Tomasello (2010)

had pairs of 4-year-olds interact with one another and an adult

either

in the context of traditional music activities (dancing, singing, & playing percussion instruments to a novel, easy-to-learn children's song)

- or --

doing similar activities but without singing, dancing or playing instruments.

Immediately afterward each pair participated in 2 social interactions to test their willingness to

(1) help their partner and

(2) cooperate on a problem-solving task

They found that joint music-making increased their warm feelings toward one another and their subsequent spontaneous cooperative and helping behavior.

Kirschner, S., & Tomasello, M. (2010). Joint music making promotes prosocial behavior in 4-year-old children. *Evolution and Human Behavior*, 31(5), 354-364. doi:<https://doi.org/10.1016/j.evolhumbehav.2010.04.004>



Children teaching one another:

Abreu: "The person who knows 3 notes is the teacher to the person who knows 2 notes."

Child-to-child teaching has been found *repeatedly* to produce better (often dramatically better) outcomes than teacher-led instruction.

(review by Hall & Stegila, 2003;
Miller et al., 2010; Dangwal & Kapur, 2009;
Miller, 2005)

**In Circus you learn to trust others
not to let you get hurt**





You learn to
cooperate
closely
with others





In social circus, your age, gender, race, SES, weight or body type, background, experience, skill or talent, typically developing or developmental different **do not matter** – ALL are accepted. All are united by a common interest in circus, & by commitments to try their best and to help and support one another – all are part of one team, one community.





Cirque Bijou in the UK features both differently-abled and able-bodied artists, and one of their projects, Extraordinary Bodies, invites the audience to think about different kinds of bodies and how they look.





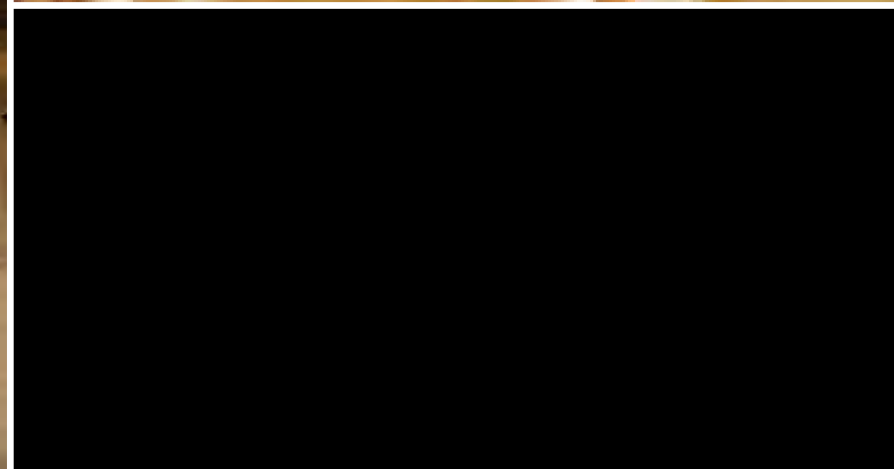
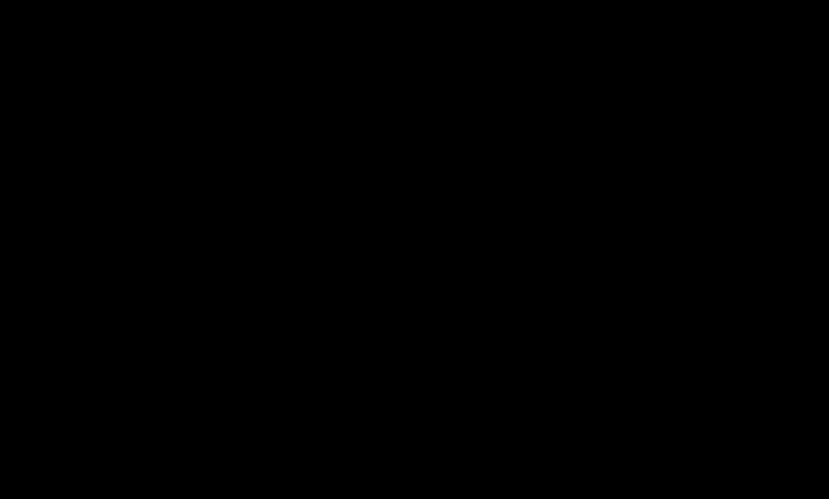














Rueda style of Salsa



Rueda is similar to contradancing or square dancing in that:

- (a) although each person has a partner, you keep changing partners and dance with everyone in the group, and**
- (b) each move is called.**

In Sam Gill's Rueda classes, all dancers dance both lead and follower roles.

Sam Gill again:

“Students recognize that every dancer is different; there is literally a different feel and physical interconnection, with every single person. All these differences are accepted and subordinate to the community or group.

In Rueda dancing, differences that, outside the dance that would usually isolate and separate, are, during the dancing, overcome. While dancing, individuals touch those they would never even look at otherwise.”

“Rueda **creates community** based on such values as **cooperation, inclusiveness, tolerance** and **joy** and all this is accomplished among the most diverse and motley collection of teens... I’m stunned by how eager the kids are to **help one another learn....**

The dancers become a community, with a clear understanding that **everyone’s participation is equally important.....**Without ever mentioning ‘community,’ dancing rueda provides an experience that is most fun and satisfying as a successfully working community.

There's a tacit understanding that **everyone dances with everyone else**. This is an important bodily experienced understanding of community....

Dancers experience the importance of cooperation and mutual assistance. When a dancer doesn't do his or her part, there is a natural inclination and incentive for others to assist....This often requires no more than a gentle guiding with the hand on the back or arm. Sooner or later all dancers find themselves lost or going in the wrong direction & appreciate that softly spoken word or little push or pull."

While training and challenging EFs
is needed for them to improve
but that *alone* is not enough
to achieve the best results.

The **VERY BEST** activities for
improving Executive Functions
not only work on *directly*
improving Executive Functions by
training and challenging them,
but

indirectly support executive functions

by lessening things that

impair them (like stress or sadness)

and

enhancing things that support them

(like joy or feelings of belonging).

**What activities directly
train and challenge
executive functions and
indirectly support them by
also addressing social,
emotional, and physical
needs?**

What activities touch the
hearts and minds of young
people, inspiring them,
challenging them to reach for
the stars, building their self-
confidence and pride?



Traditional
Activities
that have been
around for millennia.



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

People in all cultures made music, sang, danced, told stories, and created beautiful works of art. There are good reasons why those activities have lasted so long and arose everywhere.

They

...challenge our intellect (EFs),

...make us happy & proud,

...address our social needs, and

...help our bodies develop

FEATURES OF MUSIC, DANCE, CIRCUS

HARD WORK, PERSISTENCE, DISCIPLINE

practice, practice, practice

HIGH STANDARDS – challenge the children

COGNITIVELY DEMANDING – challenge concentration,
quick-ly adjusting to the unexpected, sustained
attention, working memory (remember complicated
sequences)

COGNITIVE

SELF-CONFIDENCE, PRIDE

EMOTIONAL

JOY – engage & motivate the children

EMOTIONAL

SOCIAL SUPPORT, SOCIAL BELONGING – part of a group,
an ensemble – help & respect one another. Each is a
critical part of the whole.

SOCIAL

PHYSICAL ACTIVITY - intensive movement, visuomotor
training, increase lung capacity

PHYSICAL

Indirect routes

Increase feelings of
Social Belonging &
that we'll all help
one another.

Bring JOY

Direct route

Increase Pride,
Confidence, & Sense
of Self-efficacy

Improve physical
fitness & motor skills.

Builds EFs -
requires
concentration,
focus, discipline,
holding complex
sequences in
mind, quickly
adapting to
changed
circumstances

The Arts

```
graph LR; Arts[The Arts] --> IB[Increase feelings of Social Belonging & that we'll all help one another.]; Arts --> JOY[Bring JOY]; Arts --> IPC[Increase Pride, Confidence, & Sense of Self-efficacy]; Arts --> IPFS[Improve physical fitness & motor skills.]; IB --> EF[Builds EFs - requires concentration, focus, discipline, holding complex sequences in mind, quickly adapting to changed circumstances]; JOY --> EF; IPC --> EF; IPFS --> EF;
```

The distinction between
'academic' & 'enrichment'
activities is arbitrary

Critical executive functions,
like reasoning, problem-solving,
self-control, working memory,
& cognitive flexibility, can all be
taught thru music-making,
dance, theatre, etc.

Why not have children do
activities they love?

If those activities challenge
problem-solving, reasoning, etc.,
they should improve those skills
more than a class children
find boring.

If companies want to hire people
who can creatively problem solve,
work together with others, and have
discipline and a strong work ethic...
they should insist that schools have
strong programs in the
arts.

It may not be enough to have programs where students get to enjoy the arts (e.g., have fun making music together), **it may be necessary that they be working toward group performances,** where everyone is pulling together, no one wants to let the group down, and there's a concrete goal to be working toward.

The different parts of the human
being are fundamentally
interrelated.

Each part (cognitive, spiritual,
social, emotional, & physical)
is affected by, and affects,
the others.

Diamond, 2007

The best and most
efficient way to foster
any one of those,
is probably to foster all.

Supporting all the aspects of
a child

(emotional, social, and physical)

that support optimal EFs

may be key to seeing EF benefits
and seeing them last.

The ARTS do exactly that.

**Besides directly
training & challenging
executive functions,
they also nourish us
socially, emotionally, and
physically.**

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

The arts may be critical for
achieving the outcomes we all want
for our children in school & in life.

If a child is emotionally, socially,
and physically nourished
that child is more likely to show
the full cognitive ability of which
he or she is capable and
do better in school.

On the other hand,
if a child is stressed,
sad, lonely,
or not physically fit,

the very academic performance a school
is trying to improve will take a hit.

The abilities to

- problem-solve
- screen out environmental distraction
- exercise the self-control to

not act impulsively

resist temptations

delay gratification

are compromised if a child is sad, stressed,
lonely, or not physically fit

**We have to care about children's
emotional
social &
physical well-being,**

**if we want them to be able to problem-solve,
exercise self-control, or creatively solve
problems and meet life's challenges**

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

I fear that
mainstream education
has it all wrong.

Focusing exclusively on
academic instruction
may not be the best,
or most efficient, way
to improve cognition
or academic outcomes.

Addressing children's social,
emotional, spiritual,
and physical needs
may be key to whether
they do well in school and in life.

**Activities that most successfully
improve Executive Functions
include each of these elements:**

(1) They tax EFs, continually
challenging them in new
and different ways,

(2) They're personally meaningful
and relevant, inspiring a deep
commitment and emotional invest-
ment in the activity and to the
others doing that activity with you

**(3) The mentor firmly believes in
the ability of that activity to make
a difference and is supportive
(sincerely cares about and
believes steadfastly in child),**

(4) The activity provides joy,
reduces feelings of stress and
loneliness, and inspires self-
confidence and pride.



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



*thank you so much for
your attention*



adele.diamond@ubc.ca

The Arts for Raising Children up out of Poverty

El Sistema, esp. Big Noise in Scotland, Youth Circus
including among the Inuit, etc.

http://devcogneuro.com/videos/social_change_16min_2sec.wmv

Landfill Harmonic in Paraguay

http://devcogneuro.com/videos/landfill_harmonic_6min_46sec_b.wmv

The Arts & Children with Disabilities

Deaf Children in El Sistema

www.devcogneuro.com/videos/DEAF-el_sistema-2_min.wmv

Children w/ Autism in Theatre, Dance, & Circus

www.devcogneuro.com/videos/Autism_theatre/Making_sense.wmv

Questions? Comments?

(5-6 minutes)