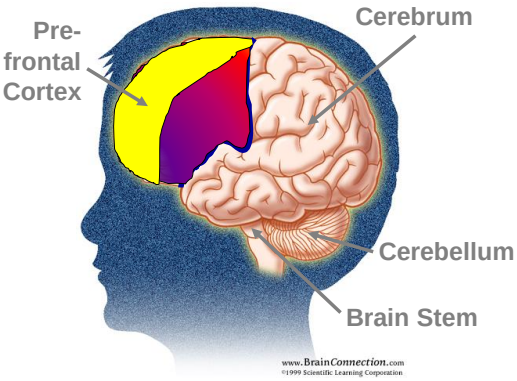
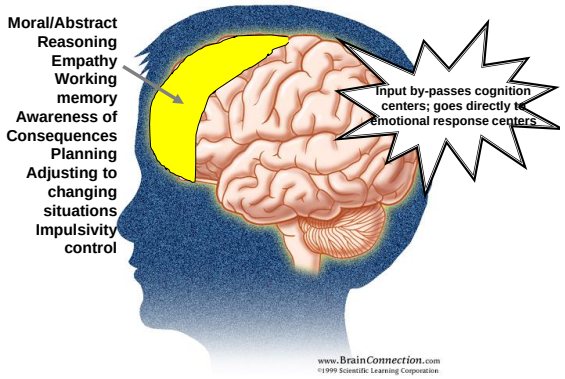
Show Me Conference 2017

Practical Cognitive Science Principles and Tips

For further conversation about any of these topics:

Rick Wormeli
rwormeli@cox.net
703-620-2447
Herndon, Virginia, USA
(Eastern Standard Time Zone)
@RickWormeli2 (Twitter)





"Emotion drives attention, attention drives learning."

-- Robert Sylwester, 1995, p. 119, Wolfe

Oxygen/Nutrient-Filled Bloodflow
When the Body is in Survival Mode

Vital Organs

Areas associated with growth

Areas associated with social activity

Cognition

Neurotransmitters

- Dopamine – activates pleasure centers, controls conscious motor activity, facilitates mental acuity
- Serotonin – calming, mood enhancer, helps with memory, sleep, appetite control, and regulation of body temperature

Healthy diet, exercise, and sleep help production of both!

Dopamine: POWERFUL Neurotransmitter

Dopamine increases our general level of inquisitiveness and goal-directed behavior as we seek to fill those needs.

We feel good while we are doing the task (not just upon completion).

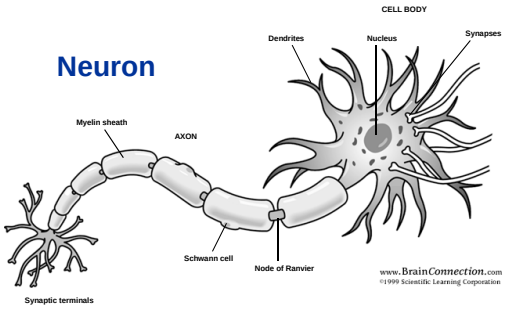
Released in great amounts when goals are accomplished.

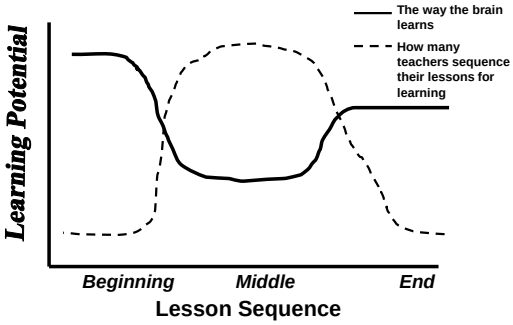
We Can Alter Dopamine Release

1. The brain can be trained to feed off bursts of dopamine sparked by accomplishment (rewarding experiences)
- Little incremental goals
- Accomplishing task is reward
- Positive Feedback
- Progress through series of goals to accomplish the BIG one!

2. Other Dopamine-Releasing Triggers:
- Successful problem solving
- Positive, deeper-learning, group experiences
- Eating protein
- Laughter, fun, anticipation
- Movement, exercise

Neuron





The Primacy-Recency Effect

Remember Who's Doing the Learning:

- **Whoever responds to students/classmates is doing the learning. Make sure the majority of the time it's the students responding and summarizing, not the teacher.**
- **Teachers ask 80 questions each hour on average, while students ask only two during that same hour. (Hollas) Students learn more when they ask the questions. Find ways to make question-asking so <u>compelling</u> and <u>habitual</u> they can't escape it.**

We file by similarities,
and we retrieve by differences.

What does this mean for instruction?

Avoid Confabulation/Refabricatoin

The brain seeks wholeness. It will fill in the holes in partial learning with made-up learning and experiences, and it will convince itself that this was the original learning all along. To prevent this:

Deal with Misconceptions!

Students should summarize material they already understand, not material they are coming to know.

Practice

- **Repeated, but not the same thing over and over**
- **Spaced Out**
- **Interleavened**
- **Increase Complexity**

Sleep

- Melatonin production in young adolescents shifts by 3 to 5 hours, but runs for the same length of time.
- Sleep deprivation often invokes the starvation response in the body.
- Sleep helps us encode memories for long-term memory; lack of sleep lowers the brain's capacity to learn new things, Dye, 2000, as cited in Sprenger
- Adolescents need 9.25 hours of sleep or more, Wolfe, others, 2010
- Young children, ten hours. Ages 5 to 10, 12 hours, Adults, eight hours.
- REM sleep important to memory and consolidation of learning.

- There are periods during sleep in which the brain is as active as it is at your brightest, conscious moment awake.
- New information is not fixed the moment it is perceived. It takes time to consolidate. Sleep and time are critical.

  Famous study: Individuals typed sequence of letters on a keyboard. They trained in the morning, tested 12 hours later but no improvement. When tested after a good night's sleep, all performances were up 20%.

Nocturnal "Aha!" moments

- Brain makes connections while it sleeps, replays the day.
- Missing even one hour has detrimental effect. …a slightly sleepy 6th grader will perform in class just like a 4th grader (Sadah, Gruber, & Rav, 2003), p. 98, Wolfe
- Nutritious breakfast also matters: complex carbohydrates, proteins, water, fruit, breakfast cereal rich in omega-3 fatty acids, multi/whole grains – not glucose, saturated fats

Vividness

- **"a lot" – Running to each wall to shout, "a" and "lot," noting space between**
- **Comparing Constitutions – Former Soviet Union and the U.S. – names removed**
- **Real skeletons, not diagrams**
- **Simulations**
- **Writing Process described while sculpting with clay**

***Creativity* is Powerful, but *Meaning* also Matters!**

An English professor wrote the words, "A woman without her man is nothing," on the blackboard and directed the students to punctuate it correctly. The men wrote: "A woman, without her man, is nothing," while the women wrote, "A woman: without her, man is nothing."

"Let's eat, Dad!"

"Let's eat Dad."

Punctuate this one:

That that is is that
that is not is not
is that it it is

-- Daniel Keyes, *Flowers for Algernon*

"To a person uninstructed in natural history, his country or seaside stroll is a walk through a gallery filled with wonderful works of art, nine-tenths of which have their faces turned to the wall."

-- Thomas Huxley, 1854

Important for all ages when moving content into long-term memory:

Students have to do both,

Access ⇒ Sense-Making

Process ⇒ Meaning-Making

Yes, teach students to memorize content.

Journalistic vs. Encyclopedic Writing

"**The breathing of Benbow's pit is deafening, like up-close jet engines mixed with a cosmic belch. Each new breath from the volcano heaves the air so violently my ears pop in the changing pressure – then the temperature momentarily soars. Somewhere not too far below, red-hot, pumpkin size globs of ejected lava are flying through the air.**"

-- ***National Geographic*, November 2000, p. 54**

"A volcano is a vent in the Earth from which molten rock (magma) and gas erupt. The molten rock that erupts from the volcano (lava) forms a hill or mountain around the vent. Lava may flowout as viscous liquid, or it may explode from the vent as solid or liquid particles…"

-- *Global Encyclopedia*, Vol. 19 T-U-V, p. 627

Which one leads to more learning of how microscopes work?

1. Kellen plays with the microscope, trying out all of its parts, then reads an article about how microscopes work and answers eight comprehension questions about its content.
2. Kellen reads the article about how microscopes work, answers eight comprehension questions about its content, then plays with the microscope, trying out all of its parts.

Perception

Perception is when we bring meaning to the information we receive, and it depends on prior knowledge and what we expect to see. (Wolfe, 2001)

Are we teaching so that students perceive, or just to present curriculum and leave it up to the student to perceive it?

Exposure to a wide array of experiences creates the connections needed for long-retention and creativity. Insulation embalms the sentiment that the world we know is the only one that matters.

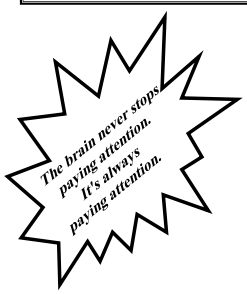
Read complex text aloud with proper vocal inflection and pacing. Students can understand text in readabilities above their own independent, silent reading proficiency when the complex text is read aloud by someone who understands the material.

And students who understand text are more inclined to stick with it when reading it silently later.

With hocked gems financing him,
Our hero bravely defied all scornful laughter
That tried to prevent his scheme.
Your eyes deceive, he had said;
An egg, not a table
Correctly typifies this unexplored planet.
Now three sturdy sisters sought proof,
Forging along sometimes through calm vastness
Yet more often over turbulent peaks and valleys.
Days became weeks,
As many doubters spread
Fearful rumors about the edge.
At last from nowhere
Welcome winged creatures appeared
Signifying momentous success.

-- Dooling and Lachman (1971) pp. 216-222

The Brain's Dilemna:
What Input to Keep, and What Input to Discard?



- **Survival**
- **Familiarity/Context**
- **Priming**
- **Intensity**
- **Emotional Content**
- **Movement**
- **Novelty**

-- Summarized from Pat Wolfe's *Brain Matters*, 2001

Prime the brain prior to asking students to do any learning experience.

Priming means we show students:

1) **What they will get out of the experience (the objectives)**
2) **What they will encounter as they go through the experience (itinerary, structure)**

Creating Background Where There is None

- Tell the story of the Code of Hammurabi before discussing the Magna Charta.
- Before studying the detailed rules of baseball, play baseball.
- Before reading about how microscopes work, play with micros copes.
- Before reading the Gettysburg Address, inform students that Lincoln was dedicating a cemetery.

Creating Background Where There is None

- Before reading a book about a military campaign or a murder mystery with references to chess, play Chess with a student in front of the class, or teach them the basic rules, get enough boards, and ask the class to play.
- In math, we might remind students of previous patterns as they learn new ones. Before teaching students factorization, we ask them to review what they know about prime numbers.
- In English class, ask students, "*How is this story's protagonist moving in a different direction than the last story's protagonist?"*
- In science, ask students, "*We've seen how photosynthesis reduces carbon dioxide to sugars and oxidizes water into oxygen, so what do you think the reverse of this process called, 'respiration,' does?"*

- Chess masters can store over 100,000 different patterns of pieces in long term memory. Chess players get good by playing thousands of games!
- Experts think in relationships, patterns, chunks, novices keep things individual pieces.
- Physics experiment in categorization…
- Solid learning comes from when students make the connections, not when we tell them about them.

The Gettysburg Address

Four score and seven years ago our fathers brought forth on this continent, a new nation, conceived in Liberty, and dedicated to the proposition that all men are created equal. Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battle-field of that war. We have come to dedicate a portion of that field, as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this. But in a larger sense, we can not dedicate -- we can not consecrate -- we can not hallow -- this ground. The brave men, living and dead, who struggled here, have consecrated it, far above our poor power to add or detract…

Chronological Order

Definition and Key words: This involves putting facts, events, a concepts into sequence using time references to order them. Signal words include on (date), now, before, since, when, not long after, and gradually.

"Astronomy came a long way in the 1500s and 1600s. In 1531, Halley's Comet appeared and caused great panic. Just twelve years later, however, Copernicus realized that the sun was the center of the solar system, not the Earth, and astronomy became a way to understand the natural world, not something to fear. In the early part of the next century, Galileo made the first observations with a new instrument – the telescope. A generation later, Sir Issac Newton invented the reflecting telescope, a close cousin to what we use today. Halley's Comet returned in 1682 and it was treated as a scientific wonder, studied by Edmund Halley."

Compare and Contrast

Defintion and Key words: Explains similarities and differences. Signal words include however, as well as, not only, but, while, unless, yet, on the other hand, either/or, although, similarly, and unlike.

"Middle school gives students more autonomy than elementary school. While students are asked to be responsible for their learning in both levels, middle school students have more pressure to follow through on assignments on their own, rather than rely on adults. In addition, narrative forms are used to teach most literacy skills in elementary school. On the other hand, expository writing is the way most information is given in middle school."

Cause and Effect

Definition and Key words: Shows how something happens through the impact of something else. Signal words include because, therefore, as a result, so that, accordingly, thus, consequently, this led to, and nevertheless.

"Drug abusers often start in upper elementary school. They experiment with a parent's beer and hard liquor and they enjoy the buzz they receive. They keep doing this and it starts taking more and more of the alcohol to get the same level of buzz. As a result, the child turns to other forms of stimulation including marijuana. Since these are the initial steps that usually lead to more hardcore drugs such as Angel Dust (PCP), heroin, and crack cocaine, marijuana and alcohol are known as "gateway drugs." Because of their addictive nature, these gateway drugs lead many youngsters who use them to the world of hardcore drugs."

Problem and Solution

Definition and Key words: Explains how a difficult situation, puzzle, or conflict develops, then what was done to solve it. Signal words are the same as Cause and Effect above.

"The carrying capacity of a habitat refers to the amount of plant and animal life its resources can hold. For example, if there are only 80 pounds of food available and there are animals that together need more than 80 pounds of food to survive, one or more animals will die – the habitat can't "carry" them. Humans have reduced many habitats' carrying capacity by imposing limiting factors that reduce its carrying capacity such as housing developments, road construction, dams, pollution, fires, and acid rain. So that they can maintain full carrying capacity in forest habitats, Congress has enacted legislation that protects endangered habitats from human development or impact. As a result, these areas have high carrying capacities and an abundance of plant and animal life."

Proposition and Support

Defintion and Key words: **The author makes a general statement followed by two or more supporting details. Key words include: In addition, also, as well as, first, second, finally, in sum, in support of, therefore, in conclusion.**

"There are several reasons that teachers should create prior knowledge in students before teaching important concepts. First, very little goes into long-term memory unless it's attached to something already in storage. Second, new learning doesn't have the meaning necessary for long-term retention unless the student can see the context in which it fits. Finally, the brain likes familiarity. It finds concepts with which it is familiar compelling. In sum, students learn better when the teacher helps students to create personal backgrounds with new topics prior to learning about them.

Enumeration

Definition and Key words: **Focuses on listing facts, characteristics, or features. Signal words include to begin with, secondly, then, most important, in fact, for example, several, numerous, first, next finally, also, for instance, and in addition.**

"The moon is our closest neighbor. It's 250,000 miles away. It's gravity is only 1/6 that of Earth. This means a boy weighing 120 pounds in Virginia would weigh only 20 pounds on the moon. In addition, there is no atmosphere on the moon. The footprints left by astronauts back in 1969 are still there, as crisply formed as they were on the day they were made. The lack of atmosphere also means there is no water on the moon, an important problem when traveling there."

Components of Blood Content Matrix

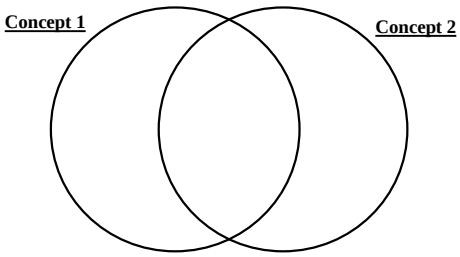
	Red Cells	White Cells	Plasma	Platelets
Purpose				
Amount				
Size & Shape				
Nucleus ?				
Where formed				

The student's rough draft:

Red blood cells carry oxygen and nutrients around the body. They are small and indented in the middle, like little Cheerios. There are 5 million per cc of blood. There is no nucleus in mature red blood cells. They are formed in the bone marrow and spleen.

Text Structures

[Taking Notes with Compare/Contrast]



T-List or T-Chart: Wilson's 14 Points

Main Ideas	Details/Examples
Reasons President Wilson Designed the Plan for Peace	1. 2. 3.
Three Immediate Effects on U.S. Allies	1. 2. 3.
Three Structures/Protocols created by the Plans	1. 2. 3

Cornell Note-Taking Format

Reduce	**Record**
[Summarize in short phrases or essential questions next to each block of notes.]	*[Write your notes on this side.]*

Review -- ***Summarize (paragraph-style) your points or responses to the questions. Reflect and comment on what you learned.***

Somebody Wanted But So

[Fiction]

Somebody ***(characters)…***

wanted ***(plot-motivation)…,***

but ***(conflict)…,***

so ***(resolution)… .***

Something Happened And Then

[Non-fiction]

Something ***(independent variable)…***

happened ***(change in that independent variable)…,***

and ***(effect on the dependent variable)…,***

then ***(conclusion)… .***

Executive Function could be key!

- He swears he can wake up and be ready to go to school 10 minutes before the bus arrives, and he does – but he forgets to bring three assignments and one permission slip due today, so after he arrives, he calls Mom to see if she can bring those items to school on her way to work, and oh, could she bring some lunch money, too?

- He blurts highly inappropriate comments only to have maturity catch up with the front of his brain seconds later and the blood drains from his face in embarrassment.
- "It's not cheating to copy others' homework when I already understand the stuff."
- "Jumping off a one-story building will work just fine if I have an opened umbrella to slow me down."

- She makes unsupported claims in an information essay and says she was never told to she had to support them with facts even though the requirement was underlined in her printed directions and you emphasized it with her orally three times.
- She reasons well through tricky word problems last week, but can't figure out similar ones this week using the same processes.
- When doing a Web search on the speed of light, she gives up when she inputs, "light" in the search box and gets 2,220,000,000 possible websites.

- He Tweets a line in poor taste from a movie, but doesn't put quotes around it and cite the movie, so friends and family think he said it himself and he is confused when they are upset with him.
- He demonstrates "learned helplessness," citing very fixable problems for why he can't start the assignment, such as he doesn't have a pen, his desk is askew, he doesn't know which page to use, and he can't find his folder on the computer.

Executive Function skills:

(Guare, Dawson, Guare, 2013, p. 15-17)

- Response inhibition
- working memory
- emotional control
- flexibility
- sustained attention
- task initiation
- planning/prioritizing
- organization
- time management
- goal-directed persistence
- metacognition

And How Do We Build These Skills in Students?

There's no one strategy that works.

And even more interesting:

The strategies will need to change as the students mature

Exercise daily.

"Aerobic exercise can grease the wheels of executive brain function." "….[R]ecent research indicates that exercising students…can expand their working memory...as well as improve their selective attention and their ability to inhibit disruptive impulses. Regular exercise and overall physical fitness have been linked to academic achievement, as well as to success on specific tasks like safely crossing a busy street while talking on a cell phone."

And later, "…[E]xercising young adults…post quicker reaction times, give more accurate responses, and are more effective at detecting errors when they engage in fast-paced tasks in the lab."

-- "The Science of Smart: A Surprising Way To Improve Executive Function," Annie Murphy Paul, author of *Brilliant: The New Science of Smart* posted on her PBS on-line article, March

Video Students.

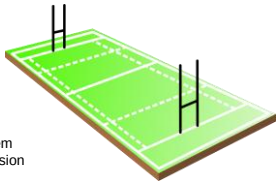
Video students struggling with EF skills, and in a quiet moment away from other students, sit with them and watch it, asking questions so the student can see and articulate the reality of what he is doing and its impact on his own learning and the learning of those around him.

Provide a compelling visual aide for pretty much everything students have to learn.

Provide students with time-keeping tools with alarms such as watches and timers.

Make Every Goal Transparent.

Provide lots of examples of the final product for every standard, and include almost-examples so they can see the difference. Also, provide students with ample experience critiquing others' products and attempts at the learning goals. Create their internal editor!



And just as importantly, develop a system to visibly see growth over time, progression toward goals.

Demonstrate how EF skill success leverages students for what they desire in life.

Examples: Help them make a plan for making enough money to purchase something of value, Help them identify what they need to do in order to be a successful group member of group they are seeking.

Help students find a way to improve their sleep patterns.

Sleep deprivation exacerbates executive function issues, and it degrades memory formation and learning, changes personalities, suppresses immune systems, and thwarts resilience.

Record Due Dates at Tops of Assignments (Or Opening Page of File)
Remove clutter and distractions from immediate visual area of student while he works.

Regular Bag Dumps and Clean-outs!
Do a book bag dump and clean out once a week and on the same day of the week. If everything is on an I-Pad, do a folder and file clean-out and confirm the current organization is helping not hindering the student's success.

Create a successful emotional atmosphere.

- Let students know that they are accepted as fully valued class members.
- Operate as an advocate, not an adversarial "gotcha" taskmaster.
- Know that humiliation for EF shortcomings kills motivation and enflames resentment.
- Let students know EF issues are normal.
- Accept that most everything that enters students' minds goes to emotional response centers first, cognitive centers later. Don't take it personally when they laugh at the unlaughable.

Help students experience growing autonomy.

Provide a modified democracy, choice, and control from time to time.

Give students with EF challenges increasing responsibility for lessons and classroom management and the leads in the school play or afterschool clubs.

Announce Upcoming Events and Changes to the regular schedule well in advance, and do it repeatedly. 'No surprises. If we are actually going to do a surprise visitor to the classroom, we may need to tell students struggling with EF skills about it ahead of time.

Establish more than one reminder system. Don't keep it to Post-it notes and alarms on cell phones alone.

Confirm, Reconfirm, and Reconfirm Again.

Do this with directions and evaluative criteria for assignments and assessments, and calendars. Making it ritualistic helps, but the occasional asynchronous confirmation is wise, too.

Cue from Afar.

"Communicate indirectly (Example: note, text message) The idea is to create distance between you and your teen so that the cue can work without the two of you being in the same space at the same time."

-- P. 144, Guare, Dawson, Guare, 2013

Analyze, Break Down Tasks.

Break larger tasks down into smaller chunks and as Atul Gawande wisely taught us (*The Checklist Manifesto: How to Get Things Right*, 2011); it's particularly effective to put these task analyses in a checklist.

Practice breaking down tasks: preparing a bibliography, doing an Internet search, washing a P.E. uniform, getting himself ready for musical, athletic, or theatrical performance.

Analyze, Break Down Tasks - Example: Homework

- ❑Ten minutes before the end of class, confirm assignment with the teacher.
- ❑Write it in Daily Planner.
- ❑List everything I need to bring home in order to do the assignment.
- ❑Get every item on that list, cross off each one as I do.
- ❑Re-explain the assignment's directions to someone in my family and confirm that I have it right. If confused, check with the class Website.
- ❑Do assignment in room at home without distractions.
- ❑Half way through the assignment, check with someone that I'm doing it correctly.
- ❑Finish the assignment.
- ❑Put it in my book bag.
- ❑Put book bag on table near the front door.

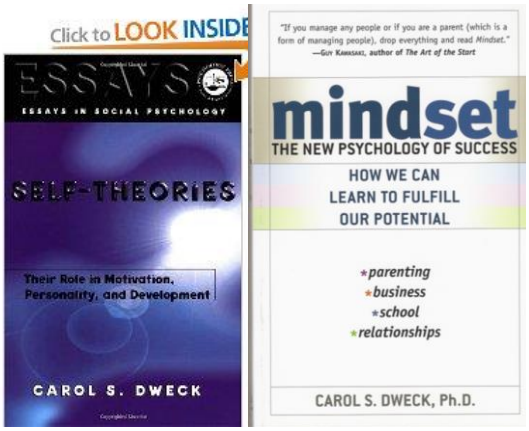
Recommended Resources:

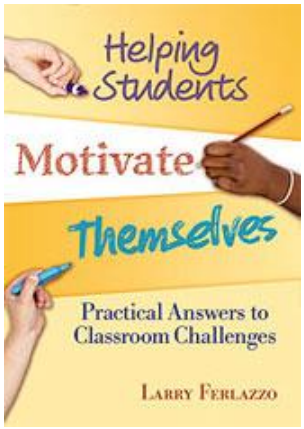
- *Smart but Scattered: The Revolutionary "Executive Skills" Approach to Helping Kids Reach Their Potential* by Peg Dawson and Richard Guare
- *Smart but Scattered Teens: The "Executive Skills" Program for Helping Teens Reach Their Potential* by Richard Guare, Peg Dawson, and Colin Guare
- *Late, Lost, and Unprepared: A Parents' Guide to Helping Children with Executive Functioning* by Joyce Cooper-Kahn and Laurie Dietzel
- *Promoting Executive Function in the Classroom (What Works for Special-Needs Learners)* by Lynn Meltzer
- The National Center for Learning Disabilities (www.ncld.org)
- http://developingchild.harvard.edu/resources/multimedia/videos/inbrief_series/inbrief_executive_function/
- "Worth a Closer Look: Executive Function," Rick Wormeli, *Middle Ground* magazine (Now, *AMLE Magazine*), August 2013, Association for Middle Level Education

Recommended Resources for ADHD information:

- *The Attention Deficit Disorder Assocation (www.add.org)*
- *http://www.helpguide.org/mental/adhd_add_signs_symptoms.htm*
- *National Resource Center on ADHD (http://www.help4adhd.org/), which includes resources for the organization, CHADD (Children and Adults with Attention-Deficit/Hyperactivity Disorder*

Processing Activity:
"I used to think…, but now I think…"

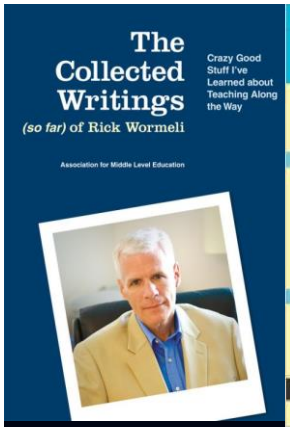


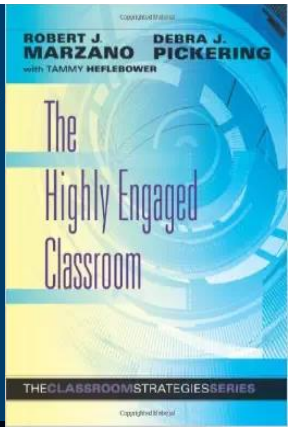


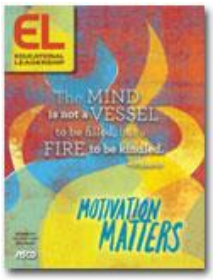
Larry Ferlazzo

Helping Students Motivate Themselves: Practical Answers to Classroom Challenges

Practical, Creative, Real….







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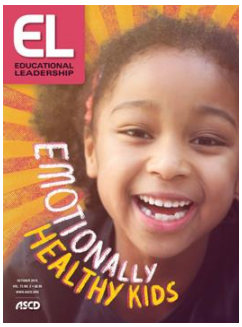

ASCD's *Education Leadership*
"Emotionally Healthy Kids"

October 2015| Volume 73 | Number 2

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Relationships First
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