Executive Functions, LD, and ADHD

Who’s the Boss?
Non-profit Organization and Registered Charity

- Founded in 1979
- Fundraise 1 million+ dollars/year to support needs of families & community
- Extensive bursary program reduces cost barrier to access our services (both school and community services)

School for students with Learning Disabilities

- LD school program (275-300 students from grades 3 – 12)
- Small class sizes (1:14 max)
- Extensive supports and strategies
- Consistent graduation rate of close to 100% annually

Community Services

- Psych-Ed assessments & counselling
- Year round recreation programs & camps for students with LD/ADHD
- Read/Write/Math: 1:1 remedial tutoring
- Parent & Educator Workshops (in-person & online)
Teacher
BEd (U of A)
Minor: Special Ed
Students with: ODD, CD, FASD, ASD, ELL, gifted, LD and ADHD

Manager
Professional Development & Parent Education

Registered Provisional Psychologist
MEd (U of C)
Child & School Psychology

Mom
10 year old: ADHD, Reading and Math LD
Part A: Meet the Executive Functions (EF)

Part B: Executive Function Development

Part C: Executive MALfunction

Part D: Executive Function Brain Research in the Classroom

Part E: Engaging Students From the Start

Part F: Best Practice Accommodations and Supports
Meet the Executive Functions

What are they and why do I need to know about them?
What are Executive Functions?

Processes that work together to guide thoughts, behaviors, and feelings to reach goals

- Activation
- Focus
- Effort
- Emotion
- Memory
- Action

Behaviour Management System of the Brain

Processes that work together to guide thoughts, behaviors, and feelings to reach goals.
ACTIVATION

Organizing information and materials

Prioritizing tasks

Managing time

Getting started on tasks

Attention to details

CHALLENGES

• Sorting & prioritizing information and materials to get started

• Losing items

• Procrastination, last minute panic

• Not completing tasks

• Time-blindness
EFFORT

Being alert

Processing speed

Staying alert

CHALLENGES

• Takes longer to think of responses, responses may be disconnected or disjointed.

• Appears to not be engaged or know the answer, may still be processing the question

• Often has many ideas, but has difficulty thinking through them all and committing to one

• Extreme drowsiness when not interested in task
FOCUS

Shifting focus from one thing to another

Focusing on one thing at a time

Ignoring distractions

CHALLENGES

• Focusing on teacher’s voice
• Difficulty screening out distractions
• HYPER-focus
EMOTION

Awareness of emotions

Immediacy of emotions

Controlling emotion

Managing frustration

Self regulation

CHALLENGES

• Short fuse
• Over-reactions to situations
• Overly sensitive to criticism & sarcasm
• Misreads social situations
CHALLENGES

• Difficulty following directions

• Chronic working memory issues

• Reading, writing and math deficits

• Receptive & expressive communication
Primary challenge with ADHD: inhibiting action

This EF influences other EFs the most

Thinking before acting or speaking

Reading social situations correctly

Awareness of how others see you

Acting in an expected manner

Awareness of own thought processes

**CHALLENGES**

- Restless
- Hyperactive/impulsive
- Difficulty compromising
- Incorrectly reading social situations
- Under/hyper aware of how others see them
Executive Function Development

When, where and how?
EF Development

- From early childhood into adulthood
- Develops at different rates
- Develops in a sequence
- Some people may always have challenges in certain areas
Typical EF Development

Age 5: Inhibition of impulses

Age 7: Increase in working memory, attention, flexibility

Age 10: Decrease in inattention, impulsivity and distractibility

Age 12: Development spurt in goal setting skills

Age 14: Developmental spurt in working memory

Ages 12-15: Ongoing increase in planning skills

Age 15: Working memory, shifting attention, inhibitory control stabilizes

Age 15 & BEYOND: Spurt in attention capacity, goal setting behavior, planning
Individuals with EF Deficits have a developmental lag of 30%.

**What Does This Mean?**

- **Age 11 x 30%**
  - Emotional age: 7.7
  - Puberty

- **Age 16 x 30%**
  - Emotional age: 11.2
  - Driving

- **Age 18 x 30%**
  - Emotional age: 12.6
  - Alcohol Post-Secondary

They have an emotional age 30% below their actual age. Readiness for milestones can be greatly affected by such a lag.

Dr. Russell Barkley

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*EF Development*

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WHAT DOES THIS MEAN?
EF Development

Prefrontal Cortex (PFC)
“Rational Brain”
  Thinking
  Logic
  Slow

Limbic System
“Emotional Brain”
  Irrational
  Illogical
  Quick
Teen VS Adult Brain
Incorrectly reading facial expressions = inappropriate reactions

Teen VS Adult Brain

Teen Brain
- Emotional Brain
  - Limbic System

Adult Brain
- Thinking Brain
  - Prefrontal Cortex
Executive MALfunction

What happens when individuals have significant and/or multiple executive function deficits?
Multiple and/or Significant Weaknesses

Executive MAL-function (Significant AND Chronic)

ADHD (Multiple/cluster of EF Deficits)
- Inattentive
- Hyperactive/Impulsive
- Combined

Learning Disability/Disorder (Significant EF Deficit)
- Reading
- Writing
- Math

NOTE: other cognitive factors can also contribute to LD (e.g., visual spatial abilities, language processing, and phonological processing)
The State of Learning Disabilities: Executive Summary Understanding the 1 in 5.

www.ncld.org/StateofLD

1 in 5 children in the U.S. have learning and attention issues.

Only a **small subset** receive specialized instruction or accommodations...

1 in 16 public school students have Individualized Education Programs (IEPs) for specific learning disabilities (SLD) such as dyslexia and for other health impairments (OHI) such as ADHD and dyspraxia.

1 in 50 public school students receive accommodations for disabilities through a civil rights statute called Section 504.

...while millions of children with learning and attention issues are **not formally identified**.
EF Deficits: Quick Facts

Everyone experiences EF deficits intermittently – a variation on “normal”.

Those with ADHD and/or LD simply are higher in intensity, longer in duration, higher in frequency, and have significant impact on academic and behavioural functioning.

EF deficits have nothing to do with intelligence as they are found in people across the full range of intellectual abilities.

Imaging research demonstrates significant differences in brain development and connectivity in children with ADHD.

Medication doesn’t cure EF deficits, but for 8 out of 10 individuals, carefully managed medications significantly improve symptoms.

EF deficits are often a result of dynamics of the chemistry of the brain, and symptoms can be situation specific (influenced by interest).
Math Computation & Problem Solving
- Difficulty analyzing and organizing math word problems
- Difficulty differentiating essential and non-essential information
- Difficulty completing multi-step problems

Reading Comprehension
- Cannot remember what is read, has to reread text
- Makes errors when reading silently, may skip words or phrases
- Loses place while reading
- Difficulty identifying and remembering key facts

Fine-Motor Coordination
- Handwriting is poor and difficult to read
- May write slowly
- May prefer printing to cursive
- May produce less written work
**Oral expression**
- Difficulty responding to questions while processing information at the same time
- May talk less or give rambling answers

**Written Language**
- Takes longer to complete work
- Produces less written work
- Difficulty organizing and sequencing ideas
- Difficulty expressing ideas in writing

**Listening Comprehension**
- Difficulty following directions
- Becomes confused with lengthy verbal directions
- May not “hear” or recognize important points made by teacher
Social Impact of EF Difficulties

- Social cues are missed or misread
- Hyperactive and impulsive behaviors contribute to generally unrestrained and overbearing social behavior that is aversive to peers
- Experience higher rates of peer rejection

“...Most of these kids’ interactions with other people are negative. They’re not the ones invited to birthday parties or over to another kid’s house to play.”

—William Pelham, Ph.D., Director of the Center for Children and Families at Florida International University
A Note on Labels

I was told...
I'm lazy.
I'm not good enough.
I need to work harder.
And I thought it was true.
<table>
<thead>
<tr>
<th>Behaviour</th>
<th>Description</th>
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</table>
| Lazy Unmotivated   | • Tired of failing  
                      | • Feeling helpless  
                      | • Doesn’t know where or how to begin |
| Unwilling          | • Unable  
                      | • Still processing instructions and their ideas |
| Attention seeking  | • Need for contact/connection  
                      | • Need for support  
                      | • Need for reassurance |
| Inappropriate      | • Poor judgement or unaware of how to act  
                      | • Unaware of how their behaviour affects others  
                      | • Overcompensating |
| Showing off        |                                                                 |
| Resisting          | • Doesn’t understand  
                      | • Frustrated  
                      | • Embarrassed |
| Does not try       | • Can’t get started  
                      | • Can’t sustain attention  
                      | • Easily confused  
                      | • Still processing instructions & ideas |
Executive Function
Brain Research
In the Classroom

What is neuroplasticity?
What does brain research have to do with how I teach?
Education + Neuroscience

- Exciting times in education!
- We know more about HOW the brain learns than ever before
- Bottleneck effect in getting information from the lab to the classroom
- New information is challenging NEUROMYTHS

MYTH
Right VS Left Brain Learners

MYTH
Students only have one dominant learning style

MYTH
Multiple-Intelligences Theory
Brain Research + Teaching

Understand how the brain processes information into learning

Maximize brain response to input

WHY & HOW successful teaching strategies work

Guides teaching methods to increase learning

Educators are “brain changers”
Neuroplasticity Research

All parts of the brain are malleable throughout our lives

Repeated brain stimulation thru practice & use

Increases the number & durability of the connections between neurons in that memory circuit

If used consistently, these strengthened connections become useful, long-term memories
As teachers, we must understand that a neural pathway is like a new path in the woods. The more frequently that a neural pathway is traveled, the fewer the obstacles, the greater its capacity, and the smoother and faster it becomes.
<table>
<thead>
<tr>
<th>Research</th>
<th>Implications for Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of neuron synapses increases memory storage</td>
<td>Increase frequency of synapses firing through practice, and maintain fluency through frequent use</td>
</tr>
<tr>
<td>Emotions strengthen memory</td>
<td>Appeal to and engage emotions while learning</td>
</tr>
<tr>
<td>Learning causes changes to the physical structure of the brain</td>
<td>Engaging in learning increases our ability to learn throughout our lives</td>
</tr>
<tr>
<td>Memories are stored in multiple parts of the brain</td>
<td>Engage all senses when learning whenever possible</td>
</tr>
<tr>
<td>Our brains are programmed to focus on new and unusual inputs</td>
<td>Learning should tap into the brain’s natural curiosity through novelty</td>
</tr>
</tbody>
</table>
“To become a teacher without understanding the implications of brain-changing neuroplasticity is a great loss to teachers and their future students.”
Engaging Students From the Start

What evidence-based general strategies can we implement to support our students with EF deficits?
Meet Judy Willis

Neurologist
15 years

Teacher
10 years

Author
7 books
50+ articles

Speaker
Brain Learning Research

Educators who understand WHY their most effective teaching strategies work have the creativity, drive & positive expectations to teach in a way that maximizes student success.
Teaching students that they are the "conductors of their own brains" conveys the need to master a wide range of thinking and learning tools for use across core academic subjects, in their personal lives, and later in their college years and careers.

(www.edutopia.org)
Teachers build their own knowledge of how the brain learns at the level of neural circuits, and share that knowledge with students.

Informed teachers can then help students understand their ability to change their own brains (neuroplasticity).

This empowers students to play a part in learning in order to “change their brain.”

Can change student self-perception.

Learning is no longer an abstract or unreachable goal.
Teach students how their brains learn

Students thrive in classrooms where teachers have taught students about how their brains learn

Increased engagement, motivation and confidence

Increased student morale and grades

Students become active participants in their learning

Increased student retention & graduation.

Growth mindset
“If I use my prefrontal cortex to mentally manipulate what I learn, my dendrites and synapses grow, and I will own that learning for a long, long time. I won't have to learn fractions all over again each year.”

“I imagine neurons making connections in my brain when I study. I feel like I'm changing my brain when I learn something, understand it, and review it.”

“I learned about growing dendrites when I study and get a good night's sleep. Now when I'm deciding whether to watch TV or review my notes, I tell myself that I have the power to grow brain cells if I review. I'd still rather watch TV, but I do the review because I want my brain to grow smarter. It's already working and feels really good.”
For example, students’ engagement and learning suffer when they believe they are “not smart” and success is out of their control.”

(J. Willis)

Never underestimate the brain’s potential to impact learning and educational performance.

If you think you can’t, you’re right!

Teach students how their brains learn
STRATEGY

Pre-Frontal Cortex (PFC)
Executive Functions

Neocortex
Higher-order thinking

Brain stem
Survival

Amygdala
Emotional Response

Limitic brain
Emotions

Reduce Student Stress
Information Pathway for Learning

2: Reduce Student Stress

PFC
"Thinking Brain" (Conscious thought, logic, judgement)

Stress

Learning & Memory

Brain Stem

Lower Brain
"Reactive Brain" (Fight/Flight/Freeze: instinctual)

Zone out, act out, no learning
What are the causes of student stress at school?

Frustration
- Sustained Confusion
- Previous and/or repeated failures

No personal relevance
- No interest in a topic
- Unaware how it relates to personal interests or prior knowledge

Boredom
- Inadequate challenge
- Previously learned information

Fear
- Answering questions
- Being wrong in front of peers
- Oral presentations
just breathe
Reduce Student Stress

Promote relaxed and alert state
- Sends information to Thinking Brain
- Increases learning and memory

Awareness of stress
- Boredom
- Frustration
- Lack of relevance
- Fear

Strategies to relax & refocus
- Monitor & control emotions
- Reflect before acting
- Mindfulness, self calming

Promote relaxed and alert state

Awareness of stress

Strategies to relax & refocus
What does dopamine do?

- Pleasure
- Memory
- Motivation
- Curiosity
- Focus
- Creativity
- Perseverance

Low dopamine levels can significantly impact performance.

Increase dopamine production.
Cognitive neuroscience examines how the brain responds to highly motivating activities (e.g., videogames).

This knowledge can be used to increase motivation and engagement in the classroom.

<table>
<thead>
<tr>
<th>Goal buy-in</th>
<th>Individual &amp; achievable challenges</th>
<th>Chances to start over without judgement or penalty</th>
<th>Frequent &amp; ongoing feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase dopamine production</td>
<td></td>
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</tbody>
</table>
What increases dopamine production?

- Choice
- Music
- Being read to
- Novelty
- + Peer interactions
- Expressing gratitude
- Humour
- Optimism
- Acting Kind
- Movement
- Achievement

Increase dopamine production
Neurotransmitters (ex: dopamine) are depleted after as little as 10 minutes. Take syn"naps".

Change the learning activity to allow brain chemicals to replenish. After just a few minutes, brains will be ready for new memory storage and new learning. AKA: Body breaks, brain breaks, etc.
Can be used anytime students are feeling restless, struggling to pay attention, etc.

Increases student engagement, motivation, and readiness to learn

Take syn”naps”
Take the guess work out of success. Clearly define goals of the task, success criteria, & how they will be assessed (rubrics, samples, etc.)

Eliminate timed-tasks wherever possible

Use pre-assessments to determine where further support is needed

Provide more think-time to come up with responses

Remove the writing barrier for those who need it (speech-to-text, typing, scribe, etc.)

Remove barriers to reading comprehension (www.newsela.com, text-to-speech)
Don’t set up situations that are impossible for impulsive children

“Impulsive children do not do well in china stores.

Don’t take them there. It’s unfair for them.

Evaluate your expectations and set these students up to be successful

Dr. Russell Barkley

Remove barriers to success
Students with EF deficits require significantly more assistance with managing transitions.

Provide incremental cues for upcoming transitions.

In advance, plan for start-of-class transitions (dim lights, calming music) with cues for get-to-work times.

Conduct transition periods the same way, every day, using the same language.
In effect, we are the surrogate frontal lobe that operates for the child as a set of supplementary executive skills.

However, we are not there indefinitely to provide these skills. Rather, we are there to prompt and teach them, and then to step back as the child's own executive skills unfold.”

(SCAFFOLDING EF DEVELOPMENT)
Best Practice Accommodations & Supports

What specific strategies can we implement to support our students with EF deficits?
Best Practice Accommodations & Supports

- Model and scaffold strategic and organized To Do lists, prioritizing, etc.
- Use a timer
- Cues for starting tasks, transitions, etc.
- "Get to Work" visual check lists
- Visual calendars and reminders
- Class procedures that are highly structured and consistent
- Reinforcement systems
- Prioritization strategies (highlighters, redacted notes, etc.)

Managing time

Organizing information and materials

Deciding what is most important

Getting started on tasks

Completing tasks

Attention to details

Managing time

Organizing information and materials

Deciding what is most important

Getting started on tasks

Completing tasks

Attention to details

Activation
Best Practice Accommodations & Supports

- Noise cancellation headphones, music, white noise, etc
- Cue in advance to allow for switching focus
- Address the student by name to cue his or her attention
- Be in the student’s immediate vicinity
- Cue student to stop, look, and listen when instructions are given
- Ask the student to look at you while you give oral instructions
- Have the student repeat instructions
- Gain and hold eye contact with the student
- Use novelty to help to capture the student’s attention
- Use a variety of presentation formats and materials to elicit attention
- Manage the student’s time on task and provide frequent breaks
- Model and teach organizational skills
- Allow student to demonstrate understanding of the material in a variety of ways
<table>
<thead>
<tr>
<th>Best Practice Accommodations &amp; Supports</th>
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</thead>
<tbody>
<tr>
<td>Syn-NAPs &amp; body breaks</td>
</tr>
<tr>
<td>Frequent change in instruction format</td>
</tr>
<tr>
<td>Increase dopamine production</td>
</tr>
<tr>
<td>Provide advance warning for student to</td>
</tr>
<tr>
<td>generate response</td>
</tr>
<tr>
<td>Allow for “think time”</td>
</tr>
<tr>
<td>Shorten assignments to be accomplished</td>
</tr>
<tr>
<td>within the time allotted</td>
</tr>
<tr>
<td>Give notes ahead of time (with “cloze”/</td>
</tr>
<tr>
<td>fill in the blank)</td>
</tr>
<tr>
<td>Remove timed tests/activities wherever</td>
</tr>
<tr>
<td>possible</td>
</tr>
<tr>
<td>Focus on quality of work, rather than</td>
</tr>
<tr>
<td>quantity</td>
</tr>
<tr>
<td>Use drill tasks to increase fluency of</td>
</tr>
<tr>
<td>math skills, high frequency words etc.</td>
</tr>
<tr>
<td>Allow extra time for tests</td>
</tr>
<tr>
<td>Reduce the amount of work the student</td>
</tr>
<tr>
<td>is required to do</td>
</tr>
<tr>
<td>Emphasize accuracy rather than speed in</td>
</tr>
<tr>
<td>evaluating the student</td>
</tr>
<tr>
<td>Use test formats with reduced written</td>
</tr>
<tr>
<td>output multiple choice, True False,</td>
</tr>
<tr>
<td>fill in the blank)</td>
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</tbody>
</table>
**Best Practice Accommodations & Supports**

- **Use mindfulness activities in the classroom**
- **Implement emotion awareness program (Zones of Regulation, etc.)**
- **Discuss expected VS unexpected behaviours (scaffold in real-time experiences whenever possible)**
- **Build strong relationships with students**
- **Counselling (student and family)**
- **Discuss concerns with doctor**
<table>
<thead>
<tr>
<th>Best Practice Accommodations &amp; Supports</th>
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</thead>
<tbody>
<tr>
<td><strong>Give a few instructions at a time, and repeat instructions as needed</strong></td>
</tr>
<tr>
<td><strong>Give notes ahead of time (with “cloze”/fill in the blank)</strong></td>
</tr>
<tr>
<td><strong>Link new concepts and information to information and ideas that student already knows</strong></td>
</tr>
<tr>
<td><strong>Encourage student to use lists, advance organizers, personal planners as aids to memory</strong></td>
</tr>
<tr>
<td><strong>Allow use of a calculator for math when computation skill is not the focus of evaluation</strong></td>
</tr>
<tr>
<td><strong>Communicate frequently with parents about the student’s work, schedule, and progress</strong></td>
</tr>
<tr>
<td><strong>Teach mnemonic strategies</strong></td>
</tr>
<tr>
<td><strong>Use open-ended questions with more than one correct answer to allow for marks for anything the student remembers</strong></td>
</tr>
<tr>
<td><strong>Reduce the demands on working memory on tests by providing a structure and outline for responding</strong></td>
</tr>
<tr>
<td><strong>Have student include their brainstorming work, essay outlines, all steps to their solutions of math questions. Give partial marks, where possible</strong></td>
</tr>
</tbody>
</table>
Best Practice Accommodations & Supports

Teach planning as breaking assignments into clearly-defined sub-tasks

Provide a proof-reading checklist as part of each assignment

Teach the student to estimate the time needed and to check it against the time taken for each part of the task

Monitor and teach students the skill of monitoring their performance on task

Teach the student “think aloud” strategies, by providing them with the language and vocabulary of thinking

Teach students to explain what was hard about an assignment, and what was easy

Provide scoring rubrics that inform the student what an answer will include

Discuss expected and unexpected behaviours for various situations (in “real time” whenever possible)

Thinking before acting or speaking

Read social situations accurately

Acting in an expected manner

Awareness of how others see you

Metacognition
Thank you!

QUESTIONS?

tketo@foothillsacademy.org

Created by the National Center for Learning Disabilities
**Emotion Regulation & Positive Behaviour APPs**

**Mood Meter: Building Emotional Intelligence ($0.99, Grades 6-12)**
- Explore a grid of emotions to describe current mood and briefly describe the situation that led to the mood;
- Choose strategies to help users shift their mood;
- Track past moods and get detailed reports to help note reoccurring antecedents.
- www.commonsense.org/education/app/mood-meter-building-your-emotional-intelligence

**Stop, Breathe, and Think (Free, Grades 5-12):**
- Users report their current mental and physical states;
- Get a list of meditations that address current state of mind and track progress;
- Access extensive scientific information about meditation, written in age-appropriate language;
- https://www.commonsense.org/education/app/stop-breathe-think

**Ireward (Free, age K-Grade 6)**
- Allows parents to give positive reinforcement for good behavior;
- Set rewards in exchange for a predetermined number of stars;
- Useful for incentivizing everyday chores and obligations;
- Especially helpful for children with behavioral problems.
Memory, Time Management & Organization APPs

**Finish. The procrastinator's to-do list (Free, Grade 4 – Adult).**
- Unique, fully automated, timeframes-based task management;
- Tasks automatically slide up as time passes through customizable timeframes;
- Notifications for both when a task slides or becomes due;
- Stay focused on each individual task, while also maintaining a broader sense of how long you have to do everything.

**SimpleMind Mind Mapping** (Free, Grades 4 - Adult):
- Mind mapping helps organize thoughts, remember things, generate new ideas;
- Intuitive and easy to use app so you can mind map wherever, whenever

**Ireward** (Free, Grade 4 - Adult)
- Gives a audio/visual representation of daily, weekly, monthly events;
- Events that require more support can be linked to an “activity schedule” or “video clip” to help model the task even further.
- Designed for individuals who may benefit from visual support to ease transitions, anxiety, or who need a way to visually represent their day.
Online Resources

- Learning Disability and ADHD resources and education on the internet:
  - www.ldac-acta.ca
  - www.frostig.org
  - www.ldonline.org
  - www.understood.org/en
  - www.ADDvance.com
  - www.ADHDandYou.ca
  - www.chaddcanada.com
  - www.ADDitudemag.com
  - www.ADHDfamilies.ca
  - www.insideADHD.org

- Video: 30 ADHD Essentials for ADHD by Russell A. Barkley:
  https://www.youtube.com/watch?v=SCAGc-rkIfo
Online Resources

• Dr. Judy Willis: www.radteach.com
• Dr. David Sousa
• Neuroscience concepts and activities organized by grade level: www.brainfacts.org/about-neuroscience/core-concepts
• Neuroscience for kids: http://faculty.washington.edu/chudler/introb.html#bb
• Brain Breaks: http://curriculum.austinisd.org/pe_health/resources/BrainBreaks/
Online Resources

• Current event articles in 5 different reading levels: www.newsela.com
• Graphic organizers: www.eduplace.com/graphicorganizer/
• Rubric generators: www.teachervision.fen.com, rubistar4teachers.org