Differentiated Instruction and Neurological Construct Improvement

Please Note: This bonus section is a more in-depth look at memory, attention and other neurological, brain-based factors that can affect how a student functions in the classroom. This is helpful background information for teachers in trying to tease out underlying problems a student may be having, as well as their learning style. As a result, these lists are not as reflective of the books published in the print edition of The Differentiated Instruction Book of Lists

Lists in this Bonus Section:

16.1 Definitions of Eight Neurological Constructs
16.2 Attention: First Understand, Then Apply These Recommendations
16.3 Understanding Memory
16.4 Tips and Strategies to Differentiate Using Memory Techniques
16.5 Advice on Increasing Executive Functions
16.6 Ten Strategies for Spatial Ordering
16.7 Ten Strategies for Developing Higher Order Thinking

Differentiated Instruction and Neurological Construct Improvement

Dr. Mel Levine, in his groundbreaking book, A Mind at a Time, (Simon and Schuster, 2003) describes learning as falling into several neurological constructs and advocates that teachers can help all students succeed by providing simple teaching accommodations that correlate to the constructs. Every child will learn differently and thus have varying degrees of aptitude in each of the following constructs. Teachers who pay attention to these simple tips will provide a fair and inclusive learning environment for a wide range of learners.

In essence, learning can be looked on as a whole, or as a series of separate, neurological functions that have to be coordinated in order to process and make meaning of information. Dr. Levine and colleagues helped develop a list of the fundamental neurodevelopmental constructs involved in learning. These constructs break learning down into component parts, to help better understand where learning develops for students. In this section, the lists provide definitions and important points for understanding the constructs followed by tips on how to differentiate instruction to maximize learning in the construct.

List 16.1. Definitions of Eight Neurological Constructs

Learning can be looked on as a whole, or as a coordinated series of skills. By understanding more about these fundamental neurological constructs, teachers will better understand the building blocks of learning. There are eight basic learning building blocks, or "neurological constructs" which include Attention, Temporal-Sequential Ordering, Spatial Ordering, Memory, Language, Neuromotor Functions, Social Cognition, and Higher Order Cognition. This list defines these neuro-developmental constructs and subsequent lists in this section will provide tips for differentiation instruction in regards to each of these building blocks of learning.

Attention
Attention is more complicated than most people think, and teachers need to understand the various functions of attention and how it develops in complexity as students progress through school.

Attention consists of the following three subparts:

- **Mental energy controls:** This includes alertness, mental effort, sleep/arousal balance and performance consistency.

- **Processing controls:** Attention also involves processing, and includes saliency determination, depth and detail processing, cognitive activation, focal maintenance, and satisfaction level.

- **Production controls**: Include previewing, facilitation and inhibition, pacing, self-monitoring and reinforcability.

Temporal-Sequential Ordering
Temporal and sequential ordering involves the ability to make order and logic of different inputs. This includes the following subset of skills:

- **Sequential awareness:** Being able to sense a sequence of skill demands or information is going to be required, such as singing the ABC song and knowing what comes next;

- **Sequential perception**: understanding that there is a proper order to things; in order for students to be understood, they need to have a sense of the proper sequence and order of words in a sentence, i.e. subject/verb, although most grasp this order long before they are ever taught grammar formally;

- **Sequential memory:** Remembering and recalling sequences of information, ranging from numbers, the alphabet to timelines and beyond.

- **Sequential output** – Being able to take information and arrange it in sequence

- **Time management**: Understanding the flow and passage of time, and how to manage behavior to match outside expectations;

- **Higher sequential thinking**: this includes being able to see logic, the flow of an argument and its basis on prior statements; proofs in math; sequential ordering of steps for executing computer programs and more.

Spatial Ordering

Spatial ordering involves abilities to manage the body and the space it occupies and interact with the environment. This construct includes the following subset of skills:

- **Spatial Awareness**: Understanding where the body is in space and time and relationship to other objects, so people don't crash into objects;

- **Spatial Perception:** understanding the motion, depth, distance, movement, and other aspects of an object at motion or at rest, which aids in catching a ball or kicking it at the right time;

- **Spatial Memory:** Remembering where objects are in space, including trying to find the library book, remembering car keys, or where the homework is placed.

- **Spatial Output**: Spatial output along with other skills allows people to place things in an order, such as designing a poster to communicate ideas, or putting things in their logical place.

- **Material Management**: Material management is knowing where resources are located, such as pens, pencils, etc. and placing them in retrievable places. This is one of the many problems that plague kids with ADHD- they frequently lose and misplace items.

- **Higher Order Spatial Thinking**: This is the ability to mentally visualize strategies; work through complex sequences of steps required to play the piano, move the furniture to the right place in the home, or parallel park with ease.

Memory

Memory has several different models involved that we'll discuss in detail in a later list, for now, understand that memory has three main components including:

- **Short term memory**: Like the RAM in a computer, this is the part of memory used to take in information and hold onto it while other portions of the brain decide what to do with it and where it goes. Short –term memory includes two basic subparts- a language-based portion, which is called the Phonological Loop, and a visual-spatial component, referred to as the Visual-spatial sketchpad.

- **Working Memory:** Working memory involves taking different components of input from short-term and long-term memory and allows a person to work on these things together, like a lab bench, to solve problems or plan actions. The regulation of working memory is part of a person's processing speed, and how much information they can take in a deal with at one time is called the Episodic buffer.

- **Long Term Memory**: Like its name, long term memory involves the ability to recall information from the past, hopefully with ease and accuracy. In order to get things into long term memory, they need to be properly "encoded" – in essence, filed away properly so they can be found later on when needed. Much like the internet, the more "tags" are attached to an experience or information, the more likely it is to be retained and be easily accessed when needed.

Language

Language involves the ability to communicate effectively with others, whether that's understanding what is said or communicated, or what a person desires to communicate. It has two basic subparts:

- **Receptive language**: This involves the ability to take in and process language, including complex and multistep directions, figurative versus literal language, complex sentences, and the like.

- **Expressive Language:** Expressive language involves the ability to generate language output, orally and in written form, to make needs and wants known and understood by others.

Neuromotor Functions

Neuromotor functions involve coordinating movements including:

- **Gross motor function**- includes everything from body position, outer spatial processing, gross motor memory required to walk, eat, or dance.

- **Fine motor functions:** include more detailed coordination such as hand-eye coordination, fine motor procedural memory, required to do tasks ranging from buttoning a coat, tying shoes or knitting.

- **Graphomotor Function**s: involving the ability to pre-visualize a task, remember how to write (or type) letters, produce legible output, and receive feedback so the brain knows how hard to press on a pencil, or how different implements move across a surface.

Social Cognition

Social cognition involves having a sense of the social affect one has on others, especially in a group setting. This includes the following subskills:

- **Verbal Pragmatics:** This is being able to both communicate and interpret the feelings of another by both the words they use and the tone of their voice. It involves a person's skill

with selecting appropriate topics, maintaining discussions, appropriate use of humor, and using the "right" words or language in the right environment.

- **Social Behaviors**: This includes being able to process information about relationships between others, how to initiate interaction, how to feel welcomed into a group, understanding the timing or staging of relationships, understanding the social environment or the "feel" of a room, and how to resolve conflict.

- **Political Acumen:** This involves being able to understand things like social dominance, social order, when it's appropriate (or not) to challenge authority, and other social skills regarding what is or is not socially acceptable given the totality of the environment.

Higher Order Cognition

Higher Order cognition is the set of deeper processing and thinking skills that develop at different rates in different people. These include:

- **Concept formation:** The ability to generate ideas using verbal, non-verbal and process skills, such as how to turn an assignment into a completed project;

- **Critical Thinking:** Being able to take in information and make decisions about its benefits, burdens and ability to weigh factors in making decisions;

- **Creativity and brainstorming:** The ability to generate ideas, often by taking information from disparate sources and recombining them into something new;

- **Problem Solving:** The ability to take a challenge or situation and make decisions on how to best resolve the issue at hand, whether it's a social, environmental or academic problem;

- **Rule Use**: The ability to take a set of rules or constraints and apply it to a situation (or decide when NOT to apply the rules in a given circumstance);

- **Reasoning and Logical Thinking:** The ability to think through a problem and break it down into steps, chunks or smaller pieces as needed; and

- **Mental Representation:** The ability to take a problem and consider it from many angles to come up with solutions.

List 16.2. Attention: First Understand, Then Apply These Recommendations

"Pay Attention!" is something all students hear and all teachers say at some point, but what does it really mean? How does attention and its variability- not only across the developmental course, but in a given day or class period- affect learning in the classroom? How can teachers help students "pay attention" when they need to, and work with the variability of attention to help enhance learning? In this list, we'll help you better understand attention and how to manage attention in the classroom to meet student needs. When teachers understand how something works, they are more likely to employ the necessary helpful strategies.

Mental Energy Controls

Each person has a limited amount of mental energy available to use on any given task. This energy needs to be allocated to help students execute all the tasks and process information coming in efficiently. If any particular task begins to use up all the mental energy available, performance will start to fall off.

Example: In a lecture, students need to be able to listen to the teacher, take in the information, and while monitoring this verbal stream, take the information and transform it into salient points to write down as notes and memory prompts for later use. If a student is presented with something that is confusing, their mental energy becomes divided between trying to comprehend, writing and monitoring the stream for additional information. Students talking next to them may also disrupt their ability to concentrate on the information and take good notes at the same time. Every time an additional task or distraction is added in, the student's attention may be increasingly divided and the ability to perform will decrease.

To increase mental energy control for all students:

- **Keep things novel and interesting:** The brain is hardwired to pay attention to new things in the environment and things that are surprising. Help keep students keep alert by maintaining an appropriate and consistent switching of activities. Don't have them read or listen too long before changing the activity to assist with alertness.

- **Move around:** Change seating throughout a lesson, allowing students to get up and move around as you switch from on activity to the next. Move between paired activities to small group and individual. Even walking rather than standing still will help students focus, as long as you aren't moving so frequently as to cause distraction.

- **Use vocal adjustments to ensure high mental energy.** Use your voice, tone, inflection and volume to call attention to important information. Increase the volume when making important points, tell students when they should pay special attention, provide vocal cues as to when a student will be called on or asked to participate in an activity.

- **Add some surprise:** An occasional non-sequitor, joke , hyperbole, or simply the unexpected will help create an awakening of attention in the classroom. This also has the effect of making a point "sticky" for memory.

- **Allow students to self-distract.** Allowing students to doodle in class or to squeeze clay or a squishy ball can help them maintain a base level of arousal. These are often called focus objects and help kinesthetic students pay attention when involved in less active assignments. This works well for some students, but can be a non-helpful distraction for others, so use them carefully and selectively.

- **Help students regulate time and attention.** Let students know how long they will be required to pay attention or stay on task beforehand so they will be able to begin to gauge their own attention energy. For students with time management issues, this will also help them become more aware of passage of time.

- **Remember attention fades in the best of us after 10-15 minutes.** If class lasts longer than fifty minutes, allow for short stretches or breaks and let students know in advance when these are coming so they will anticipate recharging.

- **Put attention to good use and Let brains breathe.** Every ten minutes or so, it's important to have a moment where you help students reset their attention meters. You can do this by breaking the pattern of instruction, adding an emotionally relevant story, or otherwise bring the point home to roost. Without this, much of the information you are trying to convey will be lost and the brain will not have time to consolidate the information and get ready for the next chunk. Think of these ten minute change ups as moments for the student's brain to breathe.

- **Prepare students for what's ahead.** Use scaffolding techniques (See List 4.2 in the printed book) to cue students to complexity of task and how much mental energy they will have to exhaust to master the concepts or participate in the learning.

- **Help manage sleep and daytime alertness.** Recommend an earlier bedtime or cutting down on the high stimulus activities such as video games before going to bed. There are even simple, free programs like Flux [http://www.stereopsis.com/flux/] that can automatically adjust computer screen brightness to help you sleep better at night.

- **Manage multi-tasking:** Be aware that the brain processes best sequentially rather than in parallel, which means we do better when focused on one task rather than many. Make sure that you are asking students to primarily focus on a single task at a time- when required to listen and take notes, the speed of the lecture will need to be adequate to allow both tasks to occur. Likewise, if using slides, keep words to a minimum. Students won't be able to read your slides and listen to what you're saying effectively simultaneously.

- **Have age-appropriate expectations.** Many of the attention and executive function issues students have may be related to their development overall. For example, the frontal lobes of the brain, home to attention and executive functions, undergo their

greatest period of development beginning roughly at age 13 and lasting through young adulthood- age 25 or so. Students below this age may have more difficulty with time management, focus, abstraction, judgment and more.

Clues to the student who struggles with mental energy control:
- Often complains of feeling tired or bored.
- May seem sleepy or 'zoned out".
- General sloppiness or careless work.
- Fidgety, nervous tapping.
- May seem to be unable to complete work in a given time period.

Processing controls

Attention also involves processing, and includes saliency determination, depth and detail processing, cognitive activation, focal maintenance, and satisfaction level.

Example:
In our lecture example from above, a student has to be able to listen to the instructor while trying to figure out what's important and what's not, make meaning and relate what's being said to what they've learned so far, or bring their background information and experiences into play to make the information relevant and meaningful. Processing controls help students take the information and transform it, "tag it" by relating it to other experiences, and set it up for storage in memory for later recall and use. If too much information is presented all at once, or if attention is otherwise divided, processing will decline. External factors, including sleep, health, worries and other concerns will also affect processing as these other bits of information will prevent deeper connections from being made.

To assist in attention needed for processing in all students:

- **Help with saliency determination:** Help students identify what is important in the information and what is not by using scaffolding techniques. (See List 2.6 in the printed version) No one should have to guess where the important information is- make it clear.

- **Increase depth of processing- make it relevant.** Link information to student's prior knowledge to provide relevance. Use as many personal linkages as possible. For example, even reminding students about prior lessons, labs, or past experiences in school will help students better remember information presented.

- **Variety and Choices = Engagement.** Offer as many options for assignments, keeping in mind the variety of interests in the classroom. When students perform in interest areas, they are more likely to sustain attention.

- **Don't make them guess.** Be clear about what is the most important and where it will appear again. When introducing concepts, tell students if it will appear on a test and how it will be use in the testing situation. After all, the goal is for students to learn and master

material, so avoid hiding the important things in the name of separating those paying attention from those who had an off day.

- **Help out when possible**. Provide students with outlines or notes from any sustained lectures or presentations. Some teachers will give students partial notes, with spaces for them to fill in key facts to help ensure engagement as well. Review these notes before the actual lecture to make sure they are reflective. Post the outline or notes online before the class, allowing students to better prepare for in-class time.

- **Make sure students are following you.** Check for understanding by asking students to summarize what was taught, said or viewed. Beyond a simple "thumbs up/down", this helps gauge what students heard and understood.

- **Give students visual prompts**. Organize information using colors codes, icons like stars or other visual methods to garner attention. For example, the series of "Dummies" books uses icons to indicate "example" "rule" "warning" and "Remember" to help people find the important information easily. Do the same in written material or even in lecture by using similar visual clues.

Clues to the student who struggles with processing:
- Has trouble shifting from activity to the next.
- Has trouble connecting things or putting information in order.
- Has inappropriate focus to the task—either too much or not enough.
- Has trouble determining what is and what is not important.
- May have problems seeing the relevance of tasks or see the big picture.

Production controls

This attention governor includes previewing, facilitation and inhibition, pacing, self-monitoring and reinforcability. It's the aspect of attention that effects how students respond and act in situations that require output. It effects how a student decides to act (or refrain from acting) in social situations as well as academic environments. Sometimes students appear recalcitrant when they are actually not able to sustain attention to their own behaviors and those around them, to make sure they are appropriate to the situation at hand. These students may appear impulsive, lost, unable to meet deadlines, unable to initiate projects, or struggle with understanding how their actions (or inactions) affect others, leading to poor choices. Here are some ways to help students stay attentive about they are to act:

- **Review expectations**. Before going into a situation with clear behavior protocols, review with students of all expected behaviors and protocols. For example "When we get off the bus at the museum, make sure you meet up with your chaperone and your group before going inside."

- **Preview tasks and requirements**. Let students know how long something will last. If they are going to give a presentation, be clear about how long it should be explaining

both maximum and minimum time limits. Likewise, let them know what a finished project should look like with examples.

- **Help students define strategies and pathways**. Ask questions like: "What are the different ways we might do this? What do you think is probably the best way? What would be the worst way to go about this?" This sort of reviewing of alternative strategies can occur before preparing a report or project.

- **Social autopsies**   Help students preview and/or review social situations. By asking students to preview challenging situations like: "What are you going to do in gym when you see the girl who was mean to you yesterday? What are some other things you could consider doing? What would work best?" they are better prepared for what's likely to happen. In the event of a negative behavioral choice, replay the "decision tree" with the student to help them find where things went pear-shaped and how they can avoid a similar situation in the future.

- **Avoid the rush to reward.** To help children with improper pacing, teachers should discourage frenetic work patterns by avoiding rewards for finished work. "As soon as you are finished you may chat with your friends." Offers of this kind may inadvertently encourage children to work as quickly and carelessly as possible. A better strategy is to help students maintain time during a task, by external prompts ("Five minutes, 10 minutes left…" "Two minutes until the bell") or provide a watch or timer to help them better gauge time.

Clues to the student who struggles with production:
- Has poor sense of how to manage time.
- Inability to pace oneself wither socially or academically. Too slow or too fast.
- Difficulty understating cause and effect of actions. Will repeat behaviors that led to negative outcomes in the past.
- Frustrated with deadlines.
- May seem impulsive or have poor self-control.
- Problems initiating tasks, or can't seem to produce work when required.

Sources and Resources:

Ford, N. (1985). Styles and strategies of processing information. Education for Information, 3, 115-132.

Medina, John. Brain Rules: 12 Principals for Surviving and Thriving at Work, Home and School. Pear Press (2008) See Also: http://www.brainrules.net/

Levine, Mel. *A Mind at a Time.* Simon & Schuster (2002).

List 16.3. Understanding Memory

Memory is taken for frequently taken for granted, but it's one of the more complex skills in use every day. Students who are struggling in school may have deficits in one of the many components of memory, or perhaps simply don't know enough about how memory works to study effectively for tests. When looking to differentiate instruction in the classroom, teachers should have a good grasp on all aspects of memory, especially working memory and how the curriculum and lessons may require or task its capacities. This can be a great starting point for teachers as they think about how to begin differentiating instruction, and where students may differ in their abilities in the classroom. This section first defines the categories that make up the collective term memory, followed by specific tips and strategies on how to differentiate instruction with this knowledge.

What is Short Term Memory?

- **Short-term memory is the front door of the mind**, where information firsts comes in before it is sorted and one decides what its needed for.

- **Short-term memory is transient and temporary.** The brain cannot store all the millions of bits of information coming in through the five senses throughout the day. Unless there is conscious repetition, important need, or strong association, the mind will forget the information it doesn't think it needs.

- **Short-term memory has limited capacity**. George Miller, in his article "The Magical Number 7 plus or minus two: some limits on our capacity for Processing Information" proposed that we can only hold a small number of "items" in our short-term memory at one time. We can "hack" our inability to remember longer strings of data or information by "chunking" the information into different sized conglomerates or pieces.

 Example: Telephone numbers are 10 digits long, and social security numbers are nine digits long.   By adding dashes (i.e. (615-555-1212 or 555-55-5555), we process this information as three larger numbers rather than 9 or 10 individual digits, making them easier to remember.

- **Short term memory has a u-shaped recall curve.** We remember best that which is presented first (Primacy effect) and the material presented last, also called the Recency effect. (Cowen 1994).

- **Processing time affects memory recall.** For example, if it takes an elementary student a long time to process and decode words in a sentence, it's much more difficult for them to glean information or context from the same sentence. They have spent all their working memory capacity on the decoding, and don't have enough "space" left over to process content and meaning.

Processing Information: Working Memory

Working Memory has different components. Baddeley (2000) proposed a model for memory that suggests that working memory has several different parts, including the Visual Spatial Sketchpad, Episodic Buffer and Phonological Loop. Along with long term memory, these components of working memory help explain how we combine short term information with long term memory information to solve problems and challenges.

1. **The Visual spatial sketchpad** is where the brain processes visual and spatial information. This is where one takes in and process information as simple as "Where I left my keys" to being able to look at something and see part to whole relationships.

2. **The Phonological loop** is where we process auditory and language information. Because the same subsection of working memory processes language and sound, most people have difficulty processing two different types of information at the same time. This is why some people can't concentrate both on typing an email and talking on the phone at the same time, or why when two people talk at the same time, it can be difficult to follow both conversations.

3. **The Episodic buffer** is a third component of working memory that combines information from the phonological loop, visual spatial sketchpad and long term memory to perform tasks and solve problems. It also can help "borrow" processing power from one form of short-term memory to another, up until a point.

Example: In a car when it starts to rain hard or the traffic gets intense, it's often necessary to diminish any input that takes away from concentration such as talking or listening to the radio. This instinct is a response of the episodic buffer. It borrows processing energy from the Phonological loop and channels it to the visual spatial processor, as a safety requirement.

Long Term or Storage Memory

• **Long-term memory requires encoding.** In order to transfer information from short term into long-term memory, information needs to be repeated or have strong associations. Information will be most easy to recall when it is repeated often and powerfully associated.

• **Long-term memory is multi-modal.** Long-term memory is enhanced by transforming information using as many of the senses as possible. When students read, then transcode the same information into writing, say it out loud, relate it to other information, use Venn diagrams, outlines and other visual organizational strategies- each of these tools helps students more deeply encode the information and enhances its transfer into long term memory.

• **Long-term memory becomes more organized and hierarchical as people get older**. For example, when younger students are asked to recall all the animals they can name in one minute, they will name a random list of animals. A child around age 10, will start

naming animals in broader categories, as if they are going down a list or through folders in their minds: farm animals, zoo animals, birds, African animals, etc.

- **Long-term memory is enhanced by making deep connections.** Barring physiological reasons for memory failure, people are capable of transferring information into their long-term memories. The ease of recall of information on demand varies, but the following factors help make deeper connections with information:

  - **Expertise** The more details one has about a subject, the easier it will be to recall.
  - **Autobiographical** The more the information is related to a person himself or she, the more likely they are to remember it.
  - **Pleasantness of experience** We remember more accurately and more quickly pleasant experiences better than negative ones unpleasant memories fade faster.
  - **Information in context** It's easier to recall information within context than out.

- **Long Term Memory Efficiency Depends on Forming Short-cuts.** Students who have not yet fully developed or incorporated schemas or procedural memories, such as the order of operations in math, the general pace and pattern of the day, or the individual steps required to perform a task will have more difficulty recalling the sequencing and order of things to be done.

List 16.4. Tips and Strategies to Differentiate Using Memory Techniques

Differentiating instruction requires giving students tools to help them improve their individual learning. This list, used in conjunction with the Understanding Memory list (Bonus List 16.3) provides tips and strategies to help enhance student memory, studying and classroom performance.

Tips to Enhance Memory

- Provide notes to students in advance of instruction or lecture.

- Allow students to use Livescribe pens that record audio and lecture notes simultaneously or other tools to record and review lectures at a later date. If students have access to an iPad or iPod, applications like AudioNote will allow students to type notes and record audio at the same time, and allow playback of audio in sync with the written word.

- Post lists of common classroom procedures and rules.

- Post directions on the board in the same place all the time.

- Adjust talking speed to meet student processing speed.

- Check for understanding frequently during class.

- Allow students to take extra time on task as needed.

- Keep things simple. The more concise and simple something is, the easier to remember and implement.

- Make use of the unexpected (surprise). We tend to remember things more that are shocking, surprising or otherwise catch us off guard.

- Be Concrete. The more tangible or demonstrative a lesson, the more likely students will remember it.

- Make it credible. Authoritative sources, statistics and the like make more credible and therefore people pay closer attention to it and in return recall it better.

- Appeal to the emotions. Emotional involvement equals greater attention and better memory imprint. Ask students how they feel about things. Use examples that have a known emotional response.

- Share Stories. The human brain lights up when people share stories, and stories are the major way people have learned and shared information throughout time.

- Use Repetition and Multi-modal Learning to Enhance Retention.
  Repetition and multi-modal learning help information to be more deeply encoded, "tagged" or filed away in different locations in our brains, enhancing the ease of recall on demand.

- Use Memory techniques like mneumonics to compact complex information into smaller packages. For example, PEDMAS, or "please excuse my dear aunt sally" can stand for the order of operations in math: Paretheses, Exponents, Multiplication, Division, Addition and Subtraction.

- Try Visualizing and Verbalizing: this strategy helps students "see" information in a broader context. By teaching students to draw information, use pictures as knowledge anchors, talk about the lesson- all of these tasks help enhance encoding.

- Chunk Information into smaller units. Breaking down and chunking information helps students develop a knowledge hierarchy a well as a coding technique to help them more efficiently remember complex information.

- Use Music to Help Prompt Memory. Many teachers have used rap or song "parody" to help students remember everything from multiplication facts to the steps of cell divisions.

Sources and Resources

Dehn, M. *Working Memory and Academic Learning, Assessment and Intervention* Wiley & Sons (2008). p. 94.

Heath, C. and Heath, D. *Made to Stick: Why Some Ideas Survive and Others Die.* Random House Publishing Group (2007).

List 16.5. Advice on Increasing Executive Functions

In order to differentiate instruction, it's important to understand students present level of functioning, as well as what portions of that functioning may be developmental in nature. One of the most important areas that can frustrate students and teachers alike involves the gradual development of the Executive functions in the brain.

Executive functions include the ability to organize and prioritize information, as well as use past experience to make better and more accurate predictions of outcomes. Time management, sequencing and other difficulties we lump under "disorganized" "messy" or "chaotic" often have an underlying executive function weakness.

This list provides advice to help students develop their executive functions skills.

What do students with executive function problems look like?

- Frequently forgets homework, although they may have it done, they do not hand it in.
- Frequently loses things, both important and unimportant, including assignments, permission slips, books, clothing, pencils, personal belongings and more
- Desk and personal areas including backpack are disorganized and chaotic.
- Student may not realize the passing of time, and plan poorly for completion of timed assignments in and out of the classroom.
- Despite understanding the consequences, may continue to miss deadlines.
- Parents and teachers will be mystified why this bright child cannot seem to handle the "book keeping" portion of school, frequently forgetting homework, assignments and materials at both home and school.
- Child may have a fluid relationship with time, and not realize that time is passing, spending lots of time on small details of one assignment while losing track of larger and more important aspects that require attention.
- Children with ADHD tend to lag in developing executive function skills. (R. Barkley) They are frequently as much as 20 -30% behind their non-ADHD peers in developing these skills.

Tips to Help Low Executive Functioning

- **Advise parents to create a "homework box"** with paper, pencils, pens, tape, rulers, glue, colored pencils, scissors, glue, stapler, etc. so that any and all supplies needed to complete an assignment are available in one place at all times.

- **Enlist parents to keep a home calendar as well as school assignment book**. An inexpensive wall calendar will help students and families keep track of assignments together. Teachers can even create calendars with assignments and due dates in Google Calendars. Google calendars allows for easy sharing and subscribing of calendars, which could help both parents and students stay on track with what's happening at school and in the classroom.

- **Encourage parents to help students plan ahead for tests**, long-term assignments, etc. by setting up a day-by-day suggested schedule. For children that continue to struggle, a suggested timeline will continue to provide guidance until they effectively incorporate this skill into their study habits over time.

- **Be careful not to demand students all organize the same way.** Many teachers are where they are in their careers because of their high level of executive functioning. They have discovered systems that work for them. Chances are they tried out many systems until they found the ones that worked well. The system of organization and planning that works for one person does not work for everyone. Teachers who impose methods of how to organize information, such as prescribing exactly how outlines should be completed, or precisely how a note card should be filled out are not allowing students to find what works.

- **Allow students to improve incrementally** in their abilities to organize, create and follow plans and encounter new situations without frustration. Imposing rigid fix-it-all-now executive systems are often met with resistance and apathy. This causes teachers to conclude that the student is incapable of change when he may simply need freedom to choose his own system.

- **Provide multiple methods and choices for organizing tasks**. For example, if you want the student to memorize information such as foreign language vocabulary, show them several ways to keep flashcards and a method of writing words in double columns, and how to speak into a tape and play it back.

- **Ask students to paraphrase instructions and objectives**. Executive functioning will improve when students are able to restate the instructions for any assignment, along with the objectives of the assignment, including what real life importance the assignment has for the students.

- **Assist students with time management.** As an example, when students are working to completion in class on an assignment that takes twenty minutes, call out how much time is remaining every five minutes, or write it on the board. Give students a schedule to follow and prompt them at each step of the way.

- **Provide structure and help with planning.** Use simple and clear plans or schedules for students to follow. Begin assignments and projects by providing rubrics so they know what standards are expected. Help students plan by breaking down long-term projects into shorter parts with deadlines along the way. Impose structure via positive support and encouragement so not to have students feel rushed.

- **Clearly articulate deadlines and standards in terms that the students can measure themselves against**. It is important when giving deadlines for assignments or project that teachers establish consistent expectations they are willing to stick to, despite the students' attempts to bargain. When teachers give in on something they have said is important, they

both reinforce the bargaining behavior and send the message that they don't care that much about the deadline, which in turn says they also don't care about the standards.

- **Help students stay organized**. This can be accomplished with regular classroom, desk and locker cleaning demonstrations and schedules. An example of a demonstration is to take photographs of organized spaces to show how they should be left at the end of the day. This method helps visual learners keep spaces organized.

- **Teach students to monitor their own behavior.** Anticipate problem situations and prepare students in advance by going over possible scenarios and expectations. Provide students with scripts to follow in target situations. Give pep talks and discuss what to do if things don't go the right way both in the classroom and in social situations.

- **Use self and class reflection techniques to increase meta-cognition**. Meta-cognition is the ability to understand and observe one's thought processes. Provide several methods for reflection such as journals, paired discussion, asking students questions such as, "How do you think you learn best?" and "What was the most frustrating aspect of that for you?"

- **Repeat important procedures to create lifelong habits.** Stress the importance of showing up for class on time and model this behavior by showing up ready to teach. Teachers are positive role models for executive functioning. Students know when teachers are prepared, start on time and use the class time wisely. There is no better way for students to respect teachers than by being well planned and organized and not wasting their time.

List 16.6. Ten Strategies for Developing Spatial Ordering

Spatial ordering allows students to understand relationships between objects. This includes the ability to understand shapes, symbols and images as well as understand the relationships between patterns. Since not all students will have developed their abilities to spatially order equally, it is important to provide instructional variation to ensure all students strengthen this construct.

1. Manipulatives. Whenever possible, use manipulatives and models to explain abstract concepts. This helps non-visual learners to grasp an understanding with greater ease. For example, when explaining the solar system and how far the planets are from the sun, use a model to demonstrate size and distance.

2. **Display memory prompts.** Hang charts, posters and/or timelines on the walls to remind students of important procedures such as the scientific method, the writing process or the seating chart. These reminders will jog their memories about the order or organization and get them seeing how it will look on the page. Don't have these be overly elaborate or wordy.

3. Keep it simple. Do not over stimulate the students with too many things on walls or on handouts. Try to keep images discrete so they can be absorbed fully. If you have a diagram or a chart, try and keep it on one page. This is especially true when creating PowerPoint presentations or writing information on the board. When there is too much text in a slide or on the board, it becomes distracting and students are not able to order the information properly to recall it later.

4. Be mindful of transition time. Allow students the time to pack up materials at the end of the class so they can be properly ordered for the next class. Often lack of materials organization is a result of rushing between classes. At the beginning of class, tell students what they will need for the class and give them time to get things out and organized before beginning instruction. Check to see that all students are ready before starting. Never shame students for being disorganized in front of others.

5. Be consistent. Present homework assignments in the same manner each day and try to use two methods. Write assignments on the board in the same place at the same time every day to get students in the habit of reading these assignments and writing them. Spatial consistency on the teacher's part will reduce chaos and facilitate learning. Other ways to assign homework may be to provide assignments in a handout, post them to a teacher website or send them to a class email list.

6. Use visual reminders, flags. Encourage student to use bookmarks and sticky notes to visually point them to places in texts where important information is stored. If they own books used in class, encourage them to underline and fold over the corners of pages with important text. The more a book can visually remind students about where to find important information the better they will understand the content.

7. Provide visual examples. Provide photographs of how the classroom looks when it is tidy so when students have to clean up after activities they can remember where things go. Visual clues about where things belong can remind student's of an order the teacher desires but one which the students did not create. To understand order, it often needs to be put together by the observer.

8. Try logic and sequencing games for practice. Use logic games and sequencing games to enhance spatial ordering. Find simple online problems that ask students to objects linearly, from front to back, up to down, or from left to right. Simple card games where students are asked to flip over cards and recall where the same card is can increase spatial ordering memory.

9. Use a variety of maps and charts. Using a different arrangement to show the same information may help students. Think of the difference between following directions by looking at a picture of a map versus reading the direction written in a column. Both can get the same result, but one will be easier and more logical to view than the other depending on who is looking at it.

10. Allow multi-modal assessment options. When giving assessment, allow for different modes of explaining concepts. Teachers often default to written responses. For example, if the learning objective is to demonstrate understanding of a setting, allow a student who is challenged with writing to explain it using a model. Sometimes photographs are useful in helping students to explain or demonstrate mastery of key concepts. Pictures, and graphs also work this way. Offer students as many as possible and don't forget to ask for their input about what they believe works best for them. Demonstrate using photo, pictures and graphic images.

List 16.7. Ten Strategies for Developing Higher Order Thinking

Complex problem solving involves using higher order thinking skills. Higher order thinking skills are the ability to function on tasks in Bloom's Taxonomy at the levels of analysis, synthesis and evaluation. When students are able to function at these levels, they are able to produce the most sophisticated work and critical thinking.

10 Strategies for Higher Order Thinking

1. **Brainstorming** is an effective way to generate ideas when taking thinking about a concept to the next level. Brainstorming can be used to generate topics, theme or even come up with experiments and hypothesis. When brainstorming, it is best to allow all ideas to flow and be part of the session, not censoring anyone. Sometimes with teenagers this can seem difficult because they have a tendency to get silly quickly. Be careful not to roll your eyes and try to find a way to validate all ideas. If the ideas are meant to offend, simply ignore the suggestion and move to the next person without feeding into the diversion.

2. **Barnstorming** is similar to brainstorming and instead of the ideas being separate and unrelated, each new idea offered is intended to add and build upon the last one creating a direct path from the original to a creative new idea.

3. **The 6 Thinking Hats** is a critical thinking tool developed by Edward deBono where throughout the life of a discussion, the class members all adopt the same approach. For example, everyone will consciously brainstorm, and then they will all play devil's advocate at once, followed by everyone going into decision-making mode. The point is to process the multiple layers of critical thinking for good decision-making

4. **Making Inferences** is the process where students are asked to come up with logical or creative ideas that extend on available information to create new information. Students make guesses at what is going to happen next. An example is when students are asked if they can determine what is going to happen next by looking at some pictures. The National Reading Panel concludes that making inferences is central to reading comprehension.

5. **Establishing Cause and Effect** is a way to develop student's higher order thinking skills there are many card games, literary exercises and online games for students to practice establishing cause and effect. Do a search for «cause and effect games» and many ideas including card games, [PowerPoint and lesson plans will be available at your finger tips for students of all ages.]

6. **Inventing** includes anything from building something new to thinking new ideas. This can be as complex as building a robot or a go-cart to taking students outside to look at the clouds and asking them what images they see. Some students will excel at this form of higher order thinking because they have an affinity or strength for it, while others will excel at some of the other suggestions ion this list. The point is to inspire all learners by trying a variety of approaches.

7. **Composing** can be done with music, words or pictures. Ask students to rewrite lyrics to songs, finish stories that are half told, and complete a verse that is not done. When students compose original works they are activating their higher order thinking and learning at deeper levels.

8. **Comparing and Contrasting** can be done with any two dissimilar objects, texts, characters, and theories. Any time students compare and the contrast the qualities of two dissimilar things they moving up the cognition ladder.

9. Presentation is a powerful way to tie together many higher order-thinking skills. Using today's technology students can create PowerPoint's, blogs, photos, stories, podcasts, and video blogs. (See Section 10, New Media and DI).

10. **Directing** is an offshoot of creating and is yet another way for students to think about things. When students direct films, plays or projects, they are forced to imagine the entire outcome and then move students along the steps in harmony to complete the product. Consider having student project and performance directors.

Resources

Cause and Effect at pppst.com

http://languagearts.pppst.com/cause-effect.html