The New Science of Learning: Effective Approaches for Older Students with Autism and Attention Disorders

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Why This Topic is Important

New brain science helps us understand how and why:
- Brain maturation differences among some students affect learning
- Attention and self regulation pose primary learning challenges in the adolescent
- Educational services can be individualized to meet each student’s unique needs

The Latest Brain Science

How does the latest brain science inform us about how we can ...?
- Individualize services
- Help our students
- Pay closer attention to oral instruction
- Develop self-regulation skills
- Complete assignments on time
- Meet educational goals

Martha Burns PhD
- Over 40 years practicing speech language pathology
- On the faculty of Northwestern University, department of communication sciences and disorders
- Consultant to The Rehabilitation Institute of Chicago for 35 years
- Dr. Burns is a Fellow of the American Speech-Language-Hearing Association
- Dr. Burns has authored 3 books and over 100 book chapters and articles
Learning Outcomes

- Know how to apply new research on the neuroscience of autism spectrum and attention disorders in older students.
- Understand how instructional and technological interventions can maximize auditory attention in the classroom and drive better results.
- Be able to implement instructional tools and methods to enhance self-regulation skills and decrease behavioral management issues in the classroom.

Understanding brain maturation

Moving beyond the older anatomical view of the human brain, here’s Brodmann’s area map and colored outlines by process.

Networks in the Brain
Understanding Network Theory: “Neurons that Fire Together Wire Together in Networks.”

Understanding Networks Requires Understanding How Regions are Connected: The Neuronal Communication System

So What is Autism Spectrum Disorder?
Most brain research indicates that the brains of children with ASD mature differently:
- Long association fiber tracts do not mature like those of typical children (see especially Wolff et al, 2012) for complex reasons:
  - Certainly genetics play a role – ASD is a polygenetic disorder (see especially Sanders, 2013 and State and Levitt, 2011)
  - Synaptic pruning deficits may lead to this altered maturation (Tang, G. et. al. 2014)
  - Hormonal disregulation that may increase inflammation and cell death has been identified in boys with ASD (Al-Zaid et al., 2014)

The Bottom Line
ASD is a very complex neurological disorder that is caused by genetic mutations that have various negative effects on brain development and maturation.
Identification of multiple De Novo mutations in the same gene reliably distinguishes ASD risk-associated mutations (Sanders et al., 2013)

So what might these genetic mutations do?

Trajectories of Mean Fractional Anisotropy for High-Risk Groups, Limbic (Fornix) and Association (ILF and Uncinate) Fiber Tracts (J. Wolff, et al 2012)

Conclusions (Wolff et al, 2012)
- The core behavioral manifestations of ASD are due to atypical patterns or connectivity that...
  - Differ across systems and time
  - Are not specific to one brain region or behavioral domain

Dendritic Spine Pruning Defect in the ASD Brain (Tang et al, 2014)
- Increased dendritic spine density with reduced developmental spine pruning in layer V pyramidal neurons in postmortem ASD temporal lobe
- Layer V pyramidal neurons are the major excitatory neuron
- Enhanced local excitatory connectivity, a feature of ASD, is proposed to...
  - Cause failure in differentiating signals from noise
  - Prevent development of normal long range cortical-cortical and cortical-subcortical communications
  - And, underlie neocortical excitation/inhibition imbalance

Early Identification: Karen Pierce, UC San Diego
  - 10,479 babies screened at one year checkups
  - 24 questions
  - Accurately predicted problems in 75% of children
  - False alarms for 25%
Pierce, continued

- Lack of shared attention – babies should try to pull your attention to their world
- Lack of shared enjoyment – may smile at mom but not engage if other people play peek-a-boo
- Repetitive behaviors – like spinning a car wheel rather than playing with the car
- Language problems seen with any of the above

Autism Treatment in the First Year of Life
A Pilot Study of Infant Start, a Parent-Implemented Intervention for Symptomatic Infants (Rogers 2014)

- 4 matched control groups
- Maintained skills after treatment ended
- Treated group of infants

Results
- Significantly more symptomatic than most comparison groups @ 9 months of age.
- Significantly less symptomatic than the two most affected groups between 18 & 36 months.
- At 36 months, the treated group had much lower rates of both ASD and DDs under 70 than a similarly symptomatic group who did not enroll in the treatment study.

And, the best news!

Because ASD affects white matter development – educational, speech and language, OT and social interventions drive neuroplastic changes in the white matter development

Education and Intervention do work!

Attention: Typical Maturation Allows for Changing from Global to Focused (Selective Attention)

Attentional maturation depends upon maturity of the dorsolateral prefrontal cortex — it is a core component of cognitive control

But Children With Attentional Problems Also Exhibit Problems With Cognitive Control!

Two different information processing systems in the brain battle for control of our response to temptation:

1. Impulses: aimed at immediate gratification
2. Reason: helps us pursue long-term objectives.
Drains on our cognitive resources, such as working memory, can render us less able to withstand temptation.

The dual-systems model of self-control

1. Failure at low levels of self-control may stem from strong impulses regions involved in reward (e.g., ventral striatum) and social information (e.g., medial prefrontal cortex)
2. Failure at higher levels (DLPFC) may result from weak control
Central to the incentive processing system is the ventral striatum (VS) involved in reward, and the medial prefrontal cortex (mPFC) especially involved in aspects of social processing—these are integral parts of the limbic system, the early developing, primitive emotional/reward processing systems of the brain.

Components of the Dual Systems Model of Self-Control – Low Level (Albert & Steinberg, 2011)

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Components of the Dual Systems Model of Self-Control – High Level: Dorsolateral Pre-frontal Cortex (DLPFC) (Albert & Steinberg, 2011)

Prolonged refinements over the course of childhood (Too et al., 2014) and adolescence (Casey et al., 2008) in (DLPFC) and posterior parietal lobe associated with Cognitive Control are thought to support reasoned behavior and adolescents’ emerging capacity for behavior regulation.

Plots of grey-matter density (based on data by Gogtay et al. 2004) illustrate the local grey-matter density in the mid-dorsolateral prefrontal cortex in red and the posterior parietal lobe in blue compared with other regions of students with typical brain maturation.

Components of Cognitive Control Network

- Selective and sustained attention
- Working memory
- Self-regulation
- Goal setting

Working Memory

- Working memory is your RAM
- It is closely tied to and can build fluid intelligence (ability to solve novel problems you have never seen before)
- It is a core component of executive function

Working Memory Can Be Trained … And When Trained, Helps Reasoning Skills

Jaeggi, et al., 2008
How Working Memory Problems Present in the Classroom

- Slow on multiple choice tests even though they know the material
- Re-read passages frequently
- Trouble with memorization activities but get the key ideas
- Take much longer to complete homework and in class assignments
- Word-finding problems
- Problems with spelling

Attentional vs Memory or Auditory Processing Problems

- Poor listener or tunes out (could be an auditory processing problem)
- Frequently asks “Huh?” or “What?” when given instructions — working memory
- Looks around to see what others are doing when teacher provides instructions — working memory or APD
- Fidgets, impulsive, intrusive, yells out answers, lack of self control — ADHD

Particular issues that effect education of the older student

Understanding the Adolescent Brain
Crone and Dahl (2012)

- The social and affective changes of adolescence begin early (near the onset of puberty)
- They appear to peak in mid-adolescence
- They influence behavior, decisions and learning throughout several years of adolescent experiences
- These social and affective influences interact with a broader set of changes in cognitive control and social cognitive development, which includes the acquisition of social and cognitive control skills that develop gradually across adolescence.

Summary: Cognitive Differences in the Adolescent Brain – Lower Levels Prevail

- Impulsivity is strong and inhibitory control is weak
- Preference for decisions that provide an immediate reward
- Learning and prediction from errors is reduced
- Emotion highly impacts decisions
- Social influences highly impact decision-making

So what can educators do about all of this?

Part II
Classroom Activities & Intervention Tools for Middle & High School Students

Cognitive Control
Teaching goal setting works the best with major projects and assignments ...
- Rather than assigning a due date, try giving incentives for steps achieved or project completion before the due date
- Due June 21 – but five extra points for full outline of report received before May 15; 5 extra points for first two sections of project received before May 25; 5 extra points for four out of five sections of project received before June 15
- Due June 21 – but ten extra credit points are added for students who hand their projects in more than a day early
- Try a sign-up sheet where students sign up for a due date with specific advantages for earlier sign up and/or earlier dates

Cognitive Control in the Classroom
Phrase goals in terms of incentives or advantages rather than penalties for being late helps students learn to self-reinforce goal attainment
- Some of your students are so used to being penalized for being late, that it becomes the status quo for them.
- Knowing what incentives work best (eg. group pizza parties if everyone gets something in on time, or personal bests) can be very effective ways of changing behavior

Take Aways from Research
(see especially Blakemore and Robbins 2012 and Crone & Dahl 2012)
When teaching adolescents ...
- They are impulsive and emotional, so reward patience.
- Their brains are designed to be overly responsive to rewards and peer influence, so use socially safe rewards.
- They are extremely flexible in goal setting, they will change instantly under peer pressure, so minimize peer influence through carefully selected group work.
- A teacher’s praise may have a social cost, so use other rewards (especially tangible, eg. access to a video game).

Four Quadrant Model of Facilitated Learning
Therapist Initiated (early stages or low functioning students)

- Task Specification
  - Explicit Instruction and Explanation
- Decision Making
  - Higher-Order Questions
  - Feedback
  - Prompts
  - Think-Aloud Modeling

Learner Initiated

- Automaticity
- Autonomy

Key Points

- Framing
- Mnemonics
- Verbal Self-Instruction
- Visual Cues
- Self-Prompting
- Mental Imagery
- Self-Instruction
- Self-Questioning
- Self-Monitoring
- Problem Solving

Developing Learner Strategies

**Framing:** Determining the most important key points
- Determining what the teacher is looking for
- Use headings, chapter questions, illustrations to guide outlines and study

**Mnemonics:** helpful for memorizing key points
**Verbal Self-Instruction:** difficult for language impaired and students with ASD
**Visual Cues:** best for language impaired & children w ASD
- Flash cards
- Graphic organizers
- Self-Prompting

Some Added Considerations

With respect to risk taking – remember:
- You see the risk – the student sees the reward

For students on the autism spectrum, social skills require executive functions as well
- Meta-cognition for taking the perspective of others
- Flexibility for adjusting to wants and needs of others
- Emotional control for handling social embarrassments and rejection

Middle School – Importance of Routines

- You are still the students’ frontal lobes but … the goal is emergence and gradual assumption of independence
- When students know what to expect they can focus on learning with fewer EF demands
- Establish routines to aid expectations
- Develop techniques to welcome students to the classroom: Try standing at the door and directing each student as they enter to take out warm-ups or materials to be used at the start of that class

End of Class Routines

Establish routines at the end of the class or day that provide comfort, direction and closure
- “You have ten minutes to finish team work and clean up”
- “Please watch the clock – we will spend the last five minutes closing together”
- “When finished with your assignment spend the last five minutes writing a headline to summarize your thoughts”

Activities That Build Selective Attention

- Listening for specific details such as: how many times the word _____ is used in a news cast, audio book, video, etc.
- “Where’s Waldo”-type visual search activities
- During book reports or oral classroom presentations provide a post-activity prize for specific details students recall
Ways to Enhance Classroom Attention (Listening) Outside of the Classroom

- Listening activities
  - Audio books with periodic comprehension questions (without the written book to follow along)
- Following complex oral directions

Supporting Students Who Need More Help

Specific Interventions for Specific Targets
- Planners
- Materials
  - Trapper Keeper
  - Locker Organizers with weekly checks
  - Google Docs or email to self to backup
  - TIGERS folder (for younger or students with greater disabilities)
- Reading
  - Warm-ups
  - $10 words

Managing Timelines with Planners

- Keep dates visible and break down projects into smaller chunks
- Start with adult supervision and guidance
- Then “deconstruct the scaffold” and allow the student more control of the planner content and process
TIGERS Folders = Take Initiative: Get Everything Ready for School

For younger or more severely impaired students

- Special homework folders
- Place daily work in one pocket and homework in the other pocket
- Be consistent and organize every day

Specific Interventions for Specific Targets: Reading

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<tr>
<th>Task</th>
<th>Org of Material</th>
<th>Planning &amp; Org</th>
<th>Working Memory</th>
<th>Task Monitoring</th>
<th>Task Initiation &amp; Completion</th>
<th>Emotional Control</th>
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Specific Interventions for Specific Targets: Writing

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<th>Task Monitor</th>
<th>Task Initiation &amp; Completion</th>
<th>Emotional Control</th>
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Enhancing literacy and writing skills in the older student

There Are Technological Alternatives with High Quality Research to Support Benefits

Neuroscience approaches can enhance attentional and memory skills in all children

- Technological approaches:
  - Fast ForWord
  - CogMed
  - Brain HQ (adolescents)
Warm Up 7-Minute Writing
- Write for an entire seven minutes, even if they have to make up a new topic to continue
- Double space work as a reminder that all are first drafts with room for improvement
- Focus on “talking on paper” – to simplify the task and use own writing voice
- Count number of words

Checking Your Work (COPS)
- Capitalization
- Overall Sound
- Punctuation
- Spelling

Graphic Organizers
- Can be used to visualize and organize information
- Often used as prompts for students to fill in the blanks
- Benefits
  - Help structure writing project
  - Encourage decision-making
  - Enhance classification of ideas and communication
  - Allow students to examine relationships
  - Guide students in demonstrating their thinking process
  - Help students increase reading comprehension
  - Ease brainstorming
  - Encourage organization of essential concepts and ideas

MS Level Book Report

Emotional Regulation (Dawson and Guere, 2010)
- For teens – anything that arouses emotion
  - Fear of social rejection
  - The need to look cool
  - Disappointing someone
  - Disagreements with parents
  - Can lead to hot (not rational) thinking
- www.guilford.com/guare-forms

Emotional Regulation: Putting Things in Perspective
- Children with ASD, especially Asperger’s may appear to over or under react to different situations
- Reviewing the concept of “Putting things in Perspective” can be helpful
- Make hierarchy of problems
- Discuss severity of problems
- Discuss how to express opinions as they relate to perspective
Self-Knowledge

- Who I am?
- Moods (positive and negative)
- Beliefs
  - Opinions
  - Opinions of others
- Desires (things, events, actions, people…)
- Sensations (pleasant and unpleasant)
- Personality – How am I different from other people

Emotional Awareness

- Emotion vocabulary
- Emotions and causes
- Feeling are ok, even if we don’t like them
- Asking for help
- Practice identification of own emotional state
- Practice expressing own emotional state
- Problem solving as related to emotional difficulties

Problem Solving w Emotion Vocabulary

Do social stories/choices for behavior for different feelings
Example:
- When I feel angry I can:
  - Ask for help
  - Take a break
  - Go for a walk

Person Perception

- Forming impressions of other people
- Using observations of behavior to make inferences
- Understanding motivation and how it affect people
- Practice drawing inferences about the personality and the emotional states of others
- Explain the nonverbal cues used to drawing inferences about others
- Practice interpreting nonverbal cues

Mind Reading

Social Skills: Michelle Garcia Winner

The Interactive Guide to Emotions - Version 1.3
Simon Baron-Cohen
http://mindwww.jkp.com/reading/demos/index.php

www.socialthinking.com
Theory of Mind
- Practice false-belief tasks
- Discuss others people’s ideas, thoughts, wants, needs, emotions, and intentions
- Practice forming hypotheses about others’ ideas, thoughts, wants, needs, emotions, and intentions
- Play games in which one person knows something the other doesn’t

Goal Setting
- Big Dreams can be overwhelming to a teen or young adult causing procrastination
- To break goals down into workable segments try Backwards Goal Design (from Jensen and Snider, 2013)

Goal Setting (Jensen & Snider, 2013)

Key Takeaways
- Early and purposeful intervention we now know can really enhance brain development and create a more typical brain.
- Consistent collaboration is essential.
- REWARD REWARD REWARD!
- Take advantage of all the free resources.

Resources (1 of 3)
Resources (2 of 3)


Resources (3 of 3)

- Kahn, Joyce, and Margaret Foster. Boosting Executive Skills in the Classroom: A Practical Guide for Educators. Print.

What to Expect Next

PresenceLearning will email you in the next few days:
- Certificate of Attendance for all attendees
- Link to the recording of the webinar & follow-up materials

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