



## Broad Overview of Language-Based Learning Disorders and Their Relationship with Executive Function

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August 12, 2019

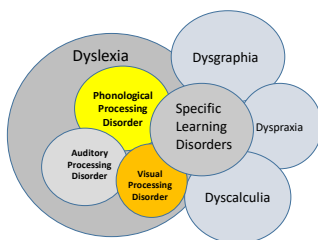
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## Overview

- Broad overview of learning disabilities
  - Dyslexia
  - Dysgraphia
  - Dyscalculia
- Broad overview of executive functions
- Interventions and strategies
- Q and A

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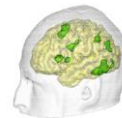


## How does the brain learn to read?

The brain is plastic and changeable

The brain can make new connections to accommodate inventiveness

The brain recycles older neuronal circuits used in oral language to accommodate written language



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## What Does It Take To Be A Reader?

### Word Recognition

- Phonemic Awareness
- Phonics: Decoding (print to speech correspondences)
- Sight Word Recognition
- Automaticity

### Vocabulary

### Comprehension

- Background knowledge
- Inference

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## Development of the Reading Brain: POSSM

**Phonology** – sound structure of the language

**Orthographic parts** – visual recognition of letters

**Semantic** – the meaning of words

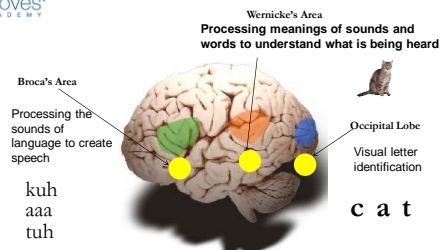
**Syntax** – how words combine in connected text (subject/verb, sentences/paragraphs)

**Morphemes** – word roots, prefixes and suffixes

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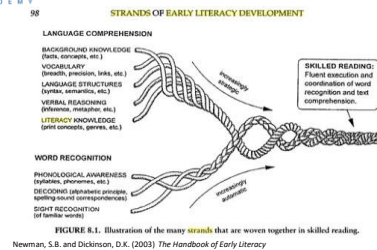
## How the Non-Dyslexic Brain Processes Language and Reading



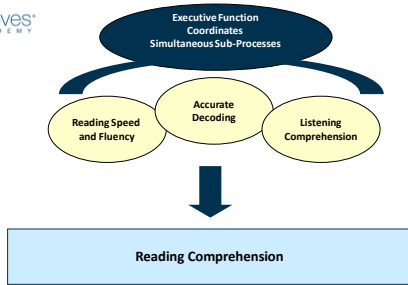
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## The Strands of Reading



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## Dyslexia

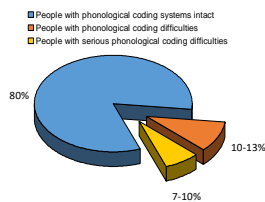
- A brain-based disorder that results from difficulty processing sounds in language
- Affects ability to learn to read, write, and spell
- Dyslexia accounts for 80% of all LDs
- Clinical criteria
  - Deficits in word reading, decoding, and spelling
  - Intervention prior to diagnosis
  - Difference with public school's Specific Learning Disability (SLD) category
  - Developmental and on a continuum
- Changes in reading disorders and prevalence

"Unexpected weakness in a sea of strength" – Sally Shaywitz, *Overcoming Dyslexia*, 2003

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## Percent of Population



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## Brain Glitch

- Brain regions important for reading have **atypical structure or function**
- Several **genes** are linked to dyslexia and play a role in early brain development (prenatal)
- **Atypical brain development** (postnatal) can affect the connections in the neural networks of the brain
- **Vision, hearing, and/or perceptual development** affects reading/language development
- **Environmental factors** – low home literacy, low parental educational background, and adverse cultural influences negatively affect reading development

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## Scientifically-Based Reading Instruction (SBRI)

Should be:

- Direct
- Explicit
- Sequential
- Multi-sensory
- For older students, analytical

And, ideally, SBRI should be diagnostic/prescriptive



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## Misconceptions about Dyslexia

- Related to IQ
- Uncommon
- Rare in females
- Related to motivation
- Letters are reversed
- Caused by visual impairments
- Can be outgrown or cured
  - Developmental course



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## Dyslexia Across a Spectrum

Core deficit: Phonological Processing

- Letter/sound correspondence is slow and effortful
- Spelling tends to be more difficult than reading
  - Letter reversals are common: b/d, p/q
  - Vowel sound confusion: e/i, a/o, o/u

Cognitive factors may affect learning to read and spell

- Slow processing and information retrieval
- Poor working memory

Language processing

- Expressive language deficit
- Receptive language deficit

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## What Can Parents Do to Help?

Psychoeducational Evaluation

- IQ test (measures cognitive function)
- Achievement tests (measures reading, spelling, math, writing, etc.)
- Additional tests (phonological processing, processing speed, etc.)
- Provides a diagnosis and recommendations for treatment

Follow Diagnostic Recommendations

- Tutoring
- Recommended treatment programs

Communicate/Partner with School

- IEP?
- Learning specialist?

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## Reading/Spelling Programs for Student with Dyslexia

### Orton-Gillingham Based Programs

- The Wilson Reading System® (grades 2-adult)
- Preventing Academic Failure® (young children)
- The Sonday System®

### Other Research-Validated Word Study and Spelling Programs

- Spell-Links Word Study and Spelling® (Created by SLPs)
- Lindamood-Bell (Seeing Stars® and LIPS®)

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## Building Reading Fluency

- Students should have consistent and regular oral reading practice
- Older students can benefit from oral reading practice as well as younger students
- Oral reading support does not require complicated strategies
- Oral reading practice does not need to be timed
- Decoding and vocabulary should be taught explicitly

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## Oral Reading: Best Practices

- Reading aloud is crucial to fluency growth
- Practice should be frequent and consistent
- Wide reading is preferable to repeated reading
- Students should be able to read 80% of the text
- Students need support for decoding unfamiliar words and understanding vocabulary
- Prosody is more important than speed

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## Reading at Home

- Choose text that child can read 80% accurately
- Child reads aloud for 15 minutes per day (at least)
- Support the reader:
  - Pronounce words that child cannot
  - Give a simple definition of words that child does not know
- Let child read with minimal interruption until he/she has finished reading

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## When Should We Intervene?

**As soon as possible!**

Remediation takes less time if you start when the child is in early elementary school...

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## Dysgraphia

- A child with dysgraphia may have trouble with:
  - Forming letters, numbers, and words
  - Spelling words correctly
  - Organizing thoughts and ideas into written expression
- Dysgraphia often occurs with dyslexia
- Clinical criteria
  - Often coded as either:
    - Developmental coordination disorder
    - Specific learning disorder with impairment in written expression

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## Symptoms of Dysgraphia

- A tight or awkward pencil grip
- Tires quickly while writing
- Writing is illegible, inconsistent, and has poorly formed letters and numbers
- Writing is slow and labored
- Complete avoidance of writing

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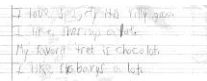
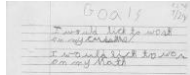
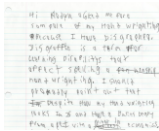
## Symptoms of Dysgraphia

- Difficulty organizing thoughts on paper
- Trouble with tasks that require concurrent thinking and writing
- Difficulty following spelling and grammar rules
- Incorrect spacing and positioning of letters, words, and lines of written text
- Trouble aligning columns in math problems

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## Images of Dysgraphia



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## Handwriting Instruction

### Rationale for Handwriting Instruction

- Keyboarding is also important, but it doesn't help students with writing tasks until Middle School at the earliest
- High stakes tests that require writing tasks don't allow students to use laptops and keyboarding
- Note taking is more effective when notes are taken by hand

### Handwriting Instruction Programs

- Preventing Academic Failure® Cursive [Handwriting](#)
- Wilson Language® Cursive Writing

### Spelling instruction is part of reading instruction!

- Develops phonological awareness
- Builds knowledge of orthographic patterns

### Whatever the Program, students must use it!

- Hold students accountable for using what they've been taught.

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## Importance of Handwriting

Direct and explicit handwriting instruction engages multiple brain systems

- **Grapho-motor** skill development
- **Sensory:** kinesthetic sensation plays an important role in learning to form letters
- **Language:** handwriting supports and strengthens the letter/sound connection necessary for reading and spelling
- **Cognition:** without handwriting instruction linked to spelling, writers may have trouble translating ideas into written language
- **Attention and Executive Systems:** brief but daily handwriting lessons lead to automaticity – frees up attention for higher order demands

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## Accommodations

### Assistive Technology

- Text-readers (Kurzweil 3000, Snap and Read)
- Audio Books (Learning Ally, Bookshare, Audible)
- Voice recognition (Dragon, e.g.)
- Keyboarding
- Spell Predict
- Spell-Check
- Grammar Check (Grammarly)
- **Extended Time on Tests**
- **Tests Read Orally**
- **Class Note-Takers**

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"How do you know I have a learning disability?"  
— Maybe you have a teaching disability!"

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## Dyscalculia



## Why do students struggle with math?

### Dehaene (1999)

- Exact calculation is language dependent
- Approximation relies on non-verbal visuo-spatial networks of the left and right parietal lobes
- Innate ability for approximation conflicts with requirements for calculation and problem solving, and both are mediated by language
- Calculation and higher level math more difficult than other cognitive processes

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## Dyscalculia and Math Disorders

- Math disorders can include difficulties with
  - Applied reasoning
  - Computation
  - Basic facts
- Dyscalculia
  - Associated with a breakdown in computation and fluent/accurate application of math facts
  - Often, this will affect higher-level applications (i.e., applied reasoning)

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## Relationship between innate and learned mathematical ability

- Number sense is genetic
  - Exact calculation requires cultural tools
    - Symbols
    - Algorithms
  - Calculation accomplished by parts of the brain that have evolved for other purposes
  - **Nature** provides number sense, and **culture** provides numerals and number words
- Stanislas Dehaene

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## Challenge of Memory, Language, and Working Memory

- Human memory is associative
  - Associations cause bits of knowledge to interfere with each other
  - $7 \times 6$  OR  $7 + 6$ ?
  - Multiplication facts have to be stored in a form that doesn't fit well with how human memory is organized
  - Adults make errors in single digit multiplication 10-25% of the time
- Language
  - English has special words for the numbers from 11-19 and for the decades 20-90
  - Language limits memory span of digits a person can hold
- Working Memory
  - Simple arithmetic depends on speedy and efficient retrieval from long-term memory
  - Temporary storage of numbers when attempting to solve a problem is crucial
  - Poor recall of facts leads to difficulties executing calculation procedures and immature problem-solving strategies

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## Why do students struggle with math?

### Semantic memory deficits

- Difficulty with math fact retrieval

### Procedural memory

- Errors carrying out procedures
- Difficulty sequencing multi-step procedures
- Delays understanding concepts

### Visual-spatial deficits

- Misalignment of numbers
- Misinterpretation of place value
- Great difficulty learning geometry

(Geary, 1993, 2000; Swanson, 2006)

Memory problems may reflect poor coordination of information in the *executive* system

### Working memory system is either:

- Not accessing numerical information from the phonological system
- Failing to provide adequate capacity for processing information

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## Supporting Students with Math Difficulties

- Intervention
  - Mastery should follow this order of operations:
    - Addition, subtraction, multiplication, division
    - Scaffold, progressive approach
- Accommodations
  - Calculators
  - Extended Time to Complete Problems
  - Graph paper to keep columns straight
  - Break problem solving into steps
- Modifications
  - Reduce the number of problems in class and for homework
  - Teach error analysis

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## Social-Emotional Effects of LD

### Students with LDs are at risk for

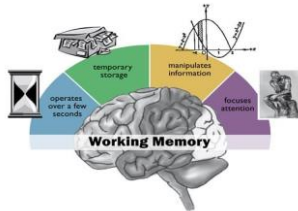
- Anxiety
- Depression and suicide
- Low self-esteem
- Inability to read social cues of others
- Learned helplessness
- Social isolation
- Poor ability to manage life tasks



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## Working Memory



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## Executive Functions

### Misunderstood

- NOT behavior disorders

### Affects self-regulation

- Writing : ability to plan
- Reading: ability to comprehend

### Extensive secondary impacts

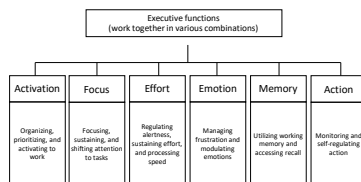
- Conduct disorders
- Mood disorders

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## Executive Functions

### Brown's Model of Executive Functions



Brown, T.E. (2003). Manual for Attention Deficit Disorder Scales for Children and Adolescents.

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## Activation

### Poor organizational skills

- Inability to organize and store notes and handouts
- Lost papers, assignments, books, etc.

### Difficulty prioritizing and activating

- Managing assignments
- Deciding what's most important
- Starting and finishing assignments

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## Focus

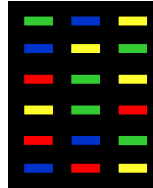
### Difficulty sustaining attention

- Papers and projects have inconsistent quality
- Distractions interfere with learning
- Gaps in learning

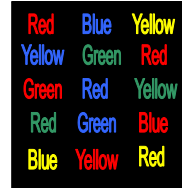
### Difficulty shifting attention

- Inconsistent performance from course to course
- Inconsistent quality within assignments requiring multiple steps

Reading left to right, name the colors of the bars as quickly as you can.



Reading left to right, name the color of the words as quickly as you can.



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## Effort

### Difficulty sustaining effort and alertness

- Incomplete assignments
- Poor study habits
- Frequently drowsy when not engaged
- Poor sleep hygiene
- Lack of motivation

### Slow processing

- Tasks take longer
- Poor written output

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## Managing Emotions

### Low threshold for frustration

- Irritability
- Angry outbursts
- Constant arguing

### Difficulty regulating emotions

- Insensitivity to others
- Moodiness
- Disproportionate emotional response to comments or actions of others

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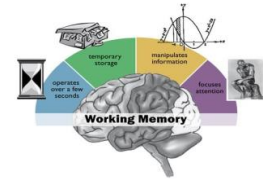
## Working Memory

### Chronic difficulty holding and processing current information

- Holding onto relevant thoughts during discussion
- Interrupting others for fear of losing a thought
- Poor test performance
- Reading comprehension gaps
- Writing tasks prove excessively difficult

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## Working Memory



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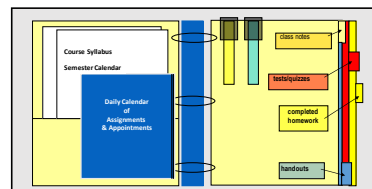
## Self-Regulation

### Impaired ability to monitor behavior

- Inappropriate comments in social situations
- Inability to monitor how others perceive them
- Difficulty slowing down
- Difficulty following directions
- Impulsive acts

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## Classroom Supports for Students with Executive Function Challenges





## EF Struggles

- Perfectionism, blocks, avoidance, late work or no work
- No actual writing – only conceptualization in head
- Freezes up when faced with large amounts of work
- Easily overwhelmed emotionally, which affects academics
- Fidgety and restless – unable to focus on what the teacher says
- Spacing out a lot in class – looking out the window or door – thinking of other things

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## Supportive Classroom Practices

- Offer Support**
  - scaffolding, check-ins: remain objective = don't judge
- Provide Structure**
  - establish and maintain routines, patterns
- Incorporate Novelty**
  - something new, change of pace
- Identify Expectations**
  - what is flexible, what is absolute (non-negotiable)
- Support Metacognition and a Growth Mindset Culture**
  - use mistakes and problem-solving as part of the teaching/learning
- Give Feedback**
  - frequent, constructive and elaborative

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## Multisensory Instruction

### Visual, Auditory, Tactile, Kinesthetic

- Promotes more activity and engagement through the use of multiple senses
- Include a visual component with lecture
- Promote innovative note taking through student collaboration and modeling

### Provide multiple learning activities that engage students actively

- Discussions
- Varied questioning
- Graphic organizers
- Manipulatives

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## Establish Routines

### Morning

- What comes first, next, and last
- Prep for morning the night before

### Homework

- When? Where? How long?

### Free time

- How much screen time?

### Bedtime

- When, what happens



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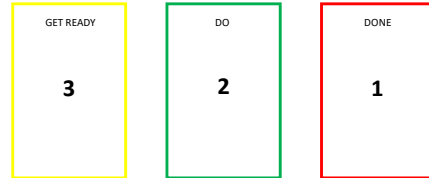
## Set Clear Expectations

- Use a matter-of-fact, non-judgmental tone
- Break chores down into steps
- Create a checklist and a timeline for chores
- Provide frequent and timely feedback on how your child is doing
- Reward your child for his/her accomplishments

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## Task Planning and Execution

### • Three Questions



## Transitions

Shifting from one activity to another is difficult

Allow time for transitions

Give warnings

- "In five minutes...."
- "Two more minutes"
- Countdowns: "Give Daddy the phone in 5, 4, 3...."

Avoid last minute, hurried transitions



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## Feedback

Feedback can be positive or negative

Must occur "at the point of performance"

Rewards should be immediate for young children

Older children and adolescents can work toward a reward

Make the reward something that is achievable in a reasonable period of time

Deliver constructive feedback in a neutral, non-judgmental tone

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## The Importance of Nutrition

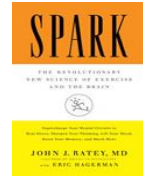
Good nutrition reduces susceptibility to stress and anxiety

1. Monitor Caffeine
2. Reduce Sugar
3. Emphasize fresh produce
4. Eat whole foods



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John Ratey,  
Harvard University



- Author of *Driven to Distraction* and other books about ADHD
- *SPARK*: the revolutionary new science of exercise and the brain



Dr. John Ratey,  
in his own words...

"I like to say that exercise is like taking a little Prozac or a little Ritalin at just the right moment... Exercise is really for the brain, not the body. It affects mood, vitality, alertness, and feelings of well-being."

"Moving is almost more important than anything else ... there is no better way to build resilience than challenging yourself through exercise."

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Advice from Dr. Ratey

Involve children in a physical activity that they like and that will be sustaining

- Consider doing it with them!

Activities such as yoga, Tae Kwon Do, Karate, and Pilates turn on the prefrontal cortex and interact with the attention system

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## Supporting Executive Function

Students who **believe** that intelligence & the ability to learn can be experienced & enhanced through **effort & experience over time** are more likely to use strategies of:

- effort regulation
- managing time and study environment
- peer learning
- help-seeking behavior

(Paulsen & Feldman, 2007)

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## Listening to Children and Teenagers

**Effective** Listening is Listening for: **Ineffective** Listening is Listening:

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• Accuracy</li> <li>• Empathy</li> <li>• Discovery</li> <li>• Learning</li> <li>• Action</li> </ul> | <ul style="list-style-type: none"> <li>• To reassure</li> <li>• To blame</li> <li>• To fix</li> <li>• To tell your opinion</li> </ul> |
|--|---|

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## Talking to Children and Adolescents

### External Process Questions

How are you doing in your classes?  
 Why didn't you start/complete....?  
 What happened?  
 Why didn't you just....?  
 Why don't you....?  
 What will you do next time?



### Internal Process Questions

What is due right now?  
 Where am I going now?  
 Why didn't I just....?  
 How was I supposed to know?  
 Why can't I get things done?  
 Why can't I be like...?  
 What's wrong with me?

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## Talking to Children and Adolescents

### Right Questions

#### External Process Questions

- What will you do if ....?
- What materials do you need?
- When will you start....?
- What might prevent you from -?
- Who could help you with that?
- What will your completed task look like?
- How will you know you have finished?



### Right Questions

#### Internal Process Questions

- What is my most important activity next week/tomorrow?
- What is due first?
- What information do I need?
- How long will it take me to....?
- When will I start?
- What things could prevent me from starting/finishing?



## Talking to Children and Adolescents

### External Process Questions

What will you do if ....?  
 What materials do you need?  
 When will you start....?  
 What might prevent you from -?  
 Who could help you with that?  
 What will your completed task look like?  
 How will you know you have finished?



### Internal Process Questions

What is my most important activity next week/tomorrow?  
 What is due first?  
 What information do I need?  
 How long will it take me to....?  
 When will I start?  
 What things could prevent me from starting/finishing?

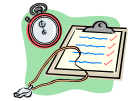
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## Elements of Coaching

### Establish a goal

- Daily
- Weekly
- Long term (older children)



### Identify obstacles to achieving the goal and how to avoid them

### Write down a plan for achieving the goal

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## Elements of Coaching (2)

### Review plans

- Did you complete the tasks you said you would do?
- Were you satisfied with the time and effort you spent?

### Make a new plan

- What do you have for today? (make list)
- When will you do these tasks?
- What might prevent you from completing these tasks?
- Do you have any long term projects to plan for?
- Are you on target to achieve your goal?

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