

## Executive Functioning: The "How" and the "Why" of Many Academic Challenges

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## A Word on the Presenter

- Clinical Neuropsychologist in private practice in Roslyn.
- Specializations include:
  - Neuropsychological Evaluations
  - Dyslexia / Learning Disability Testing
  - ADHD Testing
  - Testing for Autism spectrum disorders
  - Evaluations of Behavioral and Emotional Problems
  - Workshops to parents, teachers, & students on academic and emotional growth
- Evaluations help answer questions such as:
  - What is the problem? What is causing it? What can be done to help?
- Facebook page: "Dr. Edward M. Petrosky"
- [www.toolsforstudents.info](http://www.toolsforstudents.info)

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## For More Info About:

- Evaluations visit:  
[www.toolsforstudents.info](http://www.toolsforstudents.info)
- Teacher and School Administrator in-service training visit:  
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## Objectives

- Define executive functioning
- Provide a *sampling* of how executive functioning underlies select aspects of learning disabilities, Autism, and twice exceptional children.
- To pack in as much information as possible, consolidation of topics (e.g. executive functioning, 2e, and dyslexia).
- Provide practical intervention strategies

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A Definition

# Executive Functioning

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## Executive Functioning

- Executive functioning is a collection of skills used to strategize, plan, and organize as well as control and regulate behavior.
- Like the project manager of the brain.

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## Frontal Lobes

- The primary (but not the only) area responsible for executive functioning
- Are not fully formed (i.e. myelinated) until 18–30 years.
- One of the most sensitive areas to damage (e.g. anoxia)

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## Executive Functioning Abilities

- ✓ Attention
- ✓ Metacognition
- ✓ Working Memory
- ✓ Drawing inferences
- ✓ Planning
- ✓ Fluency
- ✓ Strategy formation
- ✓ Flexibility
- ✓ Others

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Integrating Information

## Executive Functioning and Reading Comprehension

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Johnny wanted a new bike for his birthday, but his parents could not afford one. Johnny's parents got an idea. They told Johnny they might be able to find him a bike at a garage sale in town. Johnny was disappointed because he really wanted a new bike. Reluctantly, he went with them to the garage sale. Johnny's mood went from glum to elated when he saw that, not only did the garage sale have bikes, but they were only gently used. Johnny realized he was going to get what he wanted for his birthday after all.

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**Question: What did finding a 'gently used' bike mean to Johnny?**

Johnny wanted a new bike for his birthday, but his parents could not afford one. Johnny's parents got an idea. They told Johnny they might be able to find him a bike at a garage sale in town. Johnny was disappointed because he really wanted a new bike. Reluctantly, he went with them to the garage sale. Johnny's mood went from glum to elated when he saw that, not only did the garage sale have bikes, but they were only gently used. Johnny realized he was going to get what he wanted for his birthday after all.

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**Question: What did finding a 'gently used' bike mean to Johnny?**

**Answer: It means it was not used that much.**

Johnny wanted a new bike for his birthday, but his parents could not afford one. Johnny's parents got an idea. They told Johnny they might be able to find him a bike at a garage sale in town. Johnny was disappointed because he really wanted a new bike. Reluctantly, he went with them to the garage sale. Johnny's mood went from glum to elated when he saw that, not only did the garage sale have bikes, but they were only gently used. Johnny realized he was going to get what he wanted for his birthday after all.

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**Question: What did finding a 'gently used' bike mean to Johnny?**

- Moral of the story: that he was essentially going to get what wanted after all, a bike that was *like* new.
- To appreciate the full significance of what seeing a "gently used" bike meant to Johnny the reader must link this detail with the detail that Johnny wanted a new bike.
- Requires the reader to integrate details in the text.

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### Integrating Information

- Integrating information is one of the executive functioning abilities.
- Forming inferences, concepts, generalizations, main ideas, etc. involves integrating information, that is, categorizing or grouping details.

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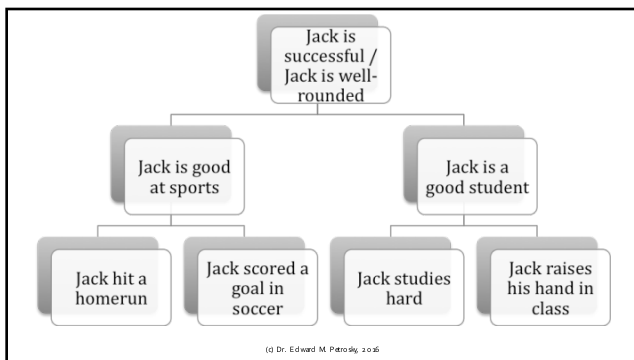
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# Interventions

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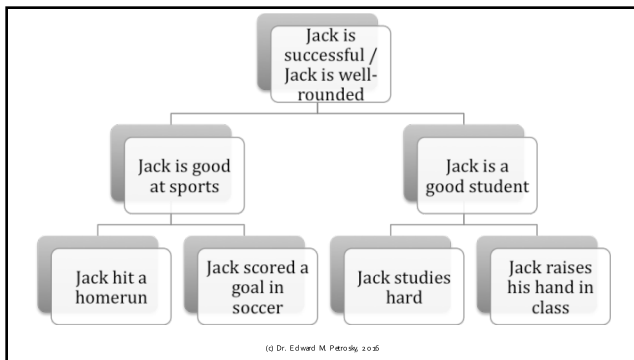
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- To help Student anchor her reading comprehension answers to the text and avoid providing answers that are true in general but do not pertain to the text specifically, teach Student the format:

It says \_\_\_\_, I know that \_\_\_\_, Therefore \_\_\_\_.

- "It says" prompts Student to cite specific information in the text.
- "I know that" elicits Student's background knowledge.
- "Therefore" then prompts Student to integrate her answer with the first two prompts to yield an inference.
- Example: It says an erupting volcano can cause tsunamis. I know that tsunamis are tidal waves that cause coastal flooding. Therefore, an erupting volcano could cause coastal flooding.

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## Integrating Information

- Prompting Student to make connections between details that you have presented (e.g. "How are 'x' and 'y' the same?").
- Provide advanced organizers. Tell her ahead of time what to be listening for (e.g. "We will be talking about the three causes of the Industrial Revolution –listen for the three causes.").
- Providing templates

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Facts or Details	Function (What is it used for?)	Location (Where do you find it?)	Association to Other Things (What goes with it?)
Roots	<ul style="list-style-type: none"> <li>• Absorb water/nutrients.</li> <li>• Anchor to ground</li> <li>• Store nutrients</li> <li>• Reproduction</li> </ul>	<ul style="list-style-type: none"> <li>• Bottom of the plant</li> <li>• Usually in the ground</li> </ul>	<ul style="list-style-type: none"> <li>• Soil</li> <li>• Stem</li> <li>• Growth of plant</li> </ul>
Next detail...			

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## Executive Functioning and Autism

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# Autism Spectrum Disorder

## Diagnostic Criteria

From: DSM-5 Published by the American Psychiatric Association

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### A. Persistent deficits in social communication and social interaction currently or by history

1. Social-emotional reciprocity
  - Abnormal social approach
  - Difficulty with back and forth conversation
  - Reduced sharing of interests or emotions
  - Not initiating or responding to social interactions

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### A. Persistent deficits in social communication and social interaction currently or by history

2. Nonverbal communication
  - Poorly integrated verbal and nonverbal communication
  - Abnormalities in eye contact and body language
  - Difficulty understanding and using gestures
  - Lack of facial expressions and other forms of nonverbal communications

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A. Persistent deficits in social communication and social interaction currently or by history

- 3. Developing, maintaining, and understanding relationships
  - Adjusting behavior to suit various social contexts
  - Difficulties in sharing imaginative play
  - Difficulties making friends
  - Absence of interest in peers

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B. Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least two of the following currently or by history

- 1. Stereotyped or repetitive
  - Motor movements,
    - E.g. arm flapping
  - Uses of objects, or
    - E.g. lining up toys, rolling back and forth for long time
  - Speech
    - E.g. echolalia: reflexively repeating back what someone else said.
    - Idiosyncratic phrases

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“Stereotyped”

- Stereotypy: non-functional behavior, it does not serve an apparent purpose
- Stereotyped speech or stereotyped behavior is non-functional speech or behavior, respectively.

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### “Stereotyped”

- Stereotyped speech: using words and phrases in a non-functional way, an example of which would be speaking in clichés that do not fit the situation.
  - “Up up and away” every time the child ends a task
  - “Hey person!”

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### “Stereotyped”

- Stereotyped motor movement: non-functional movement; movements that do not accomplish an apparent goal
  - Examples
    - Wiggling fingers
    - Arm flapping
    - Standing up, walking in a circle, and sitting down

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B. Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least two of the following currently or by history

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  - Speech
    - E.g. echolalia: reflexively repeating back what someone else said.
    - Idiosyncratic phrases

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B. Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least two of the following currently or by history

2. Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal and nonverbal behavior

- Extreme distress at small changes
- Difficulty with transitioning
- Rigid thinking patterns
- Greeting rituals
- Need to take same route home
- Need to eat the same food everyday

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B. Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least two of the following currently or by history

3. Highly restricted, fixated interests that are abnormal in intensity or focus

- Preoccupied with unusual objects
- Excessively circumscribed or perseverative interests (e.g. weather reports, lists of ingredients on shampoo bottles)

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B. Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least two of the following currently or by history

4. Hyper or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment

- High pain threshold
- Adverse response to specific sounds or textures
- Excessive smelling or touching objects
- Visual fascination with lights or movement

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C. Symptoms are present early in development.  
 D. Cause clinically significant impairment in social, occupational, or other important areas of current functioning.

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E. Disturbances not better accounted for by intellectual disability or global developmental delay

- Intellectual disability AND Autism can (and often do) co-occur. The above means that for both to be diagnosed the above symptoms of Autism would be worse than what low IQ would cause.
- Global Developmental Delay:
  - Under age of 5
  - Intellectual developmental milestones in several areas are not met, but severity can't be determined (e.g. not able to be tested).

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**Diagnostic Criteria of Autism Spectrum Disorder**

- A. Deficits in social communication and social interaction
- B. Restricted, repetitive patterns of behavior...
- C. Starts at a very young age
- D. Interferes with functioning
- E. Not simply the result of low IQ

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Key Symptoms

- A. Deficits in social communication and social interaction
- B. Restricted, repetitive patterns of behavior...
- C. Starts at a very young age
- D. Interferes with functioning
- E. Not simply the result of low IQ

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What's the difference between Autism, Asperger's Disorder, and Pervasive Developmental Disorder Not Otherwise Specified (PDD NOS)?

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DSM-IV

- Autism: Problems in social interaction, communication, and restricted repetitive and stereotyped behavior.
- Asperger's: Problems in social interaction and restricted repetitive and stereotyped behavior. ("Autism without the communication deficits")
- PDD NOS: Problems in one or more of the above that do not meet the criteria for Autism or Asperger's

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### DSM-5

- What used to be separately diagnosed as Autism, Asperger's Disorder, and PDD NOS now all fall under the category of "Autism Spectrum Disorder"
- Realization that the above distinction was artificial. All share similarities in terms of the nature of the disturbance, the difference is really in how many and how severe the symptoms are.

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### DSM-5 p. 51

*Individuals with a well-established DSM-IV diagnosis of autistic disorder, Asperger's disorder, or pervasive developmental disorder not otherwise specified should be given the diagnosis of autism spectrum disorder.*

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### Social (Pragmatic) Communication Disorder

- A. Deficits in social communication and social interaction
- B. ~~Restricted, repetitive patterns of behavior...~~

***Autism without the  
restricted, repetitive piece***

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# Executive Functioning and Autism

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## Autism

- A. Deficits in social communication and social interaction
- B. Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least two of the following currently or by history

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## Mental Flexibility

- One of the executive functioning abilities
- A lack of mental flexibility results in cognitive rigidity

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### Cognitive Rigidity

- Difficulty mentally shifting gears.
- As a result, the person is prone to getting locked into the same, narrow, repetitive response, which is known as perseveration.
- Perseveration reflects difficulty of the frontal lobes of the brain "changing the channel" – helping the individual switch from one response to another.
- As a result, the person continues the same response past the point at which it should have stopped.

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### Repetitive Speech

- "I'm just doing the best I can do."
- "Yes, doctor."

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### Other Examples of Rigidity

- Must eat out of the yellow bowl everyday.
- Lunch must be at 11:10 during the weekends (the same time it is at school)
- Blocks peer from passing her in the hallway because she must be first in line
- Screaming because it is time to leave the park.
- You tell me what the essay should be about
- Not wanting to leave the problem unsolved.

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Say as many toys and kitchen items you can, but I want you to switch – say a toy, then say a kitchen item, then say a toy, etc.

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Switching: Toys and Kitchen Items

- Pan
- Barbie doll
- Play Station
- Car
- Ball
- Chutes and Ladders
- American girl doll

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Difficulty Switching:  
Real Life Examples

- Compare and contrast
- "Point-counter-point"

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## Cognitive Rigidity and Leaving a "Mental Residue"

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## Mental Residue

- Troublematically "wiping his mind clean" and separating information from the previous problem from information on the current problem.
- Form of rigidity because it reflects trouble moving on to the next topic, task etc.
- Child provides an answer, and then provides an answer to a subsequent problem that had remnants of the original answer.

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## Cognitive Rigidity

- A narrow frame of reference
- Focusing on one concept or a narrow range of concepts

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# Strategies

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Make different pieces of information as distinctive as possible.

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## Novelty & Set Shifting

- A recent study found that one reason children on the Autism spectrum perseverated was that they did not notice what was *new* about the next topic, so they stayed locked into their old solution, their old mind set
- Implication:
  - Point out what is *new and distinctive* about the next topic.

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## Writers

### Maya Angelou

- African-American
- Born in USA
- Poet

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## Writers

### Maya Angelou

- African-American
- Born in USA
- Poet

### Gwendolyn Brooks

- African-American
- Born in USA
- Poet

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## Female African-American Poets

### Maya Angelou

- Born in St. Louis
- Influenced by traumatic childhood
- "I Know Why the Caged Bird Sings"

### Gwendolyn Brooks

- Born in Kansas
- Influenced by encouraging parents
- "A Street in Bronzeville"

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### More Distinction

- Start new topic on new page in notebook

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### Other Strategies

- Pause in between different chunks of information to allow the student to consolidate information and clear his/her mind for the next set of information.
- Emphasize where one piece of information ends and the next begins (e.g. "That's one point, here is the next point." "O.K., moving on now to something different" etc.).
- Provide extra structure in creating word banks to assist in content generation as a pre-writing exercise (e.g. multiple narrow categories to brainstorm words).

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### Cognitive Rigidity and Career Planning

- Good cognitive flexibility: Jobs that require you to think on your feet and come up with new and different solutions
- Poor cognitive flexibility: Jobs that require attention to protocol

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# Executive Functioning and 2e

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# "Twice Exceptional"

The person is gifted AND has a disability

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# Gifted and Talented

Elementary and Secondary Education Act (ESEA):  
*Students, children, or youth who give evidence of high achievement capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who need services and activities not ordinarily provided by the school in order to fully develop those capabilities (No Child Left Behind Act, P.L. 107-110 (Title IX, Part A, Definition 22) 2002).*

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### Types of Disabilities in 2e

- Physical Disability
- Sensory Disability
- Autism Spectrum Disorder
- Emotional Disturbance
- ADHD
- Learning Disability
  - Largest subgroup

From: National Education Association, Retrieved on 11/11/2015 from <http://www.nea.org/assets/docs/twicexceptional.pdf>

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### Prevalence of 2e

International Dyslexia Association:  
2 – 5 % of school age children.

From: Gifted and Dyslexic: Identifying and Instructing the Twice Exceptional Student Fact Sheet, Retrieved on 11/11/2015 from: <http://eidsa.org/gift-ed-and-dyslexic-identifying-and-instructing-the-twice-exceptional-student-fact-sheet/>

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### Three Common Predicaments

- Formally identified as gifted but not having an identified disability: giftedness masks disability
- Formally identified as having a disability but not gifted: disability masks giftedness
- Not formally identified as gifted or disabled: components mask one another; giftedness and the disability not readily apparent.

From: National Education Association, Retrieved on 11/11/2015 from <http://www.nea.org/assets/docs/twicexceptional.pdf>

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Identified as gifted  
but not with a disability may:

- Be unidentified for possible special education evaluation.
- Be considered an underachiever, often attributed to perceived laziness, poor motivation, or a low self-concept
- Maintain grade-level expectations until the difficulty level of the curriculum increases, often during middle and high school years.

From: National Education Association, Retrieved on 11/11/2015 from <http://www.nea.org/assets/docs/twicexceptional.pdf>

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Identified as having a disability  
but not gifted may:

- Be involved in programs, services, and instruction that are focused *solely* on remediation and/or compensation for the disability.
- Have an IQ score that underestimates true intellectual ability.
- Become bored in special programs if the services do not match their required level of challenge.
- Be misdiagnosed as having an emotional disability.

From: National Education Association, Retrieved on 11/11/2015 from <http://www.nea.org/assets/docs/twicexceptional.pdf>

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Not identified as having  
a disability or gifted may:

- Be achieving at grade level and assumed to have average ability.
- Show areas of difficulty as curriculum becomes more challenging.
- Be viewed as performing within expectations and, therefore, never referred for a special education evaluation.

From: National Education Association, Retrieved on 11/11/2015 from <http://www.nea.org/assets/docs/twicexceptional.pdf>

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Not identified as having a disability or gifted may:

- Have deflated achievement and standardized test scores due to the disability and may not qualify for gifted education services.

From: National Education Association, Retrieved on 11/11/2015 from <http://www.nea.org/assets/docs/twicexceptional.pdf>

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### Characteristics of 2e

- Advanced ideas and opinions
- High levels of creativity and problem-solving ability
- Extremely curious, imaginative, and questioning
- Wide range of interests not related to school
- Specific talent or consuming interest area
- Sophisticated sense of humor
- Clear peaks and valleys in cognitive test profile
- Discrepant verbal and performance skills

Gifted and Dyslexic: Identifying and Instructing the Twice Exceptional Student Fact Sheet, Retrieved on 11/11/2015 from: <http://eids.org/gifted-an-d-dyslexic-identifying-and-instructing-the-twice-exceptional-student-fact-sheet/>

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- Clear peaks and valleys in cognitive test profile
- Discrepant verbal and performance skills

Gifted and Dyslexic: Identifying and Instructing the Twice Exceptional Student Fact Sheet, Retrieved on 11/11/2015 from: <http://eids.org/gifted-an-d-dyslexic-identifying-and-instructing-the-twice-exceptional-student-fact-sheet/>

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# Intelligence Test Scores

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## Standard Scores

- Exactly Average = 100
- Average range.
  - ◉ Different ways of defining it
    - 85-115
    - 80-120
    - 90-110

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## Standard Scores

- Exactly Average = 100
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### WISC-V

- Extremely High: >130
- Very High: 121 – 130
- High Average: 111 – 120
- Average: 90 – 110
- Low Average: 80 – 89
- Very Low: 70 – 79
- Extremely Low: <70

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### Full Scale IQ Score (Overall IQ)

- Provides an overall index of intelligence, averaging together child's different mental abilities into one score.
- However, if the scores/abilities that go into that average widely vary, then the FSIQ score may be misleading or even meaningless.

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### Examples with the WISC-IV (a common intelligence test)

	Composite Score	%ile
Verbal Comprehension Index	121	92
Perceptual Reasoning Index	84	14
Working Memory Index	94	34
Processing Speed Index	88	21
Full Scale IQ	98	45

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Examples with the WISC-IV  
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To make educational decisions about this student based on his/her "average" IQ would be like...

	Composite Score	%ile
Verbal Comprehension Index	121	92
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Full Scale IQ	98	45

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In this case, the "average" doesn't correspond to anything

	Full Scale IQ	%ile		%ile
	98	45	?	
			→	Verbal Comprehension Index
			→	Perceptual Reasoning Index
				92
				14

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### Academic Discrepancy

- Mathematical Calculation = 99<sup>th</sup> percentile
- Mathematical Reasoning = 98<sup>th</sup> percentile
- Mathematical Fluency = 50<sup>th</sup> percentile

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# Fluency

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## Fluency

- In the context of executive functioning, fluency refers to the ability to generate a *variety* of responses.
- Examples
  - Brainstorming ideas to include in a book report
  - Coming up with different ways of creating a 3-dimensional science project or a diorama.
  - Ways of arranging a poster board.
- Can lead to creativity, such as in the above contexts but also can create liabilities.

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# Fluency and Liabilities

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### Idiosyncratic or Irrelevant Associations

How a dog and a parakeet alike?

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### Idiosyncratic or Irrelevant Associations

How a dog and a parakeet alike?

*They are both pets and they are both not allowed in most restaurants.*

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### Idiosyncratic or Irrelevant Associations

How a dog and a parakeet alike?

*They are both pets and they are both not allowed in most restaurants.*

How are a house and an apartment alike?

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### Idiosyncratic or Irrelevant Associations

How a dog and a parakeet alike?

*They are both pets and they are both not allowed in most restaurants.*

How are a house and an apartment alike?

*They are both places where you live and they both do not move.*

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### Idiosyncratic or Irrelevant Associations

How a dog and a parakeet alike?

*They are both pets and they are both not allowed in most restaurants.*

How are a house and an apartment alike?

*They are both places where you live and they both do not move.*

Common characteristic of children with Autism Spectrum Disorder.

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### Inaccurately Defined Concepts Concepts with Fuzzy Boundaries

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### Remember These Words

- Cement
- Helmet
- Stone
- Ski Goggles

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Tell me all the words that were building materials

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Tell me all the words that were building materials

- *Cement*
- *Stone*

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### Tell me all the words that were building materials

- *Cement*
- *Stone*
- *Helmet. You could built a fort by stacking helmets and making walls out of them.*
- *Ski goggles, you could lean them up against each other and make like a pretend glass greenhouse.*

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### Interventions

- Providing outlets for creative expression.
- What would *most* people say.
- Be on the lookout for the student including irrelevant or non-essential details in her definitions and explanations of concepts so that this can be pointed out to her to tighten her understanding.

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### Interventions

- Try exercises in which he has to define the word/concept with an antonym of the irrelevant or non-essential information. For example, if the student included in her definition of a "conscientious" worker the adjective "friendly" one could ask him to describe an "unfriendly conscientious worker."

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### Interventions

- Emphasize and be explicit about the difference between a concept and an *example* of the concept...e.g. "The ocean is the whale's *habitat* because that's where it lives in nature...A rain forest is not a whale's habitat because that is not where whales live.").

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### Interventions

- Emphasize and repeat the essential or defining features of the concept. As a simple example, if one were covering what a "mammal" is, the instructor would want to underscore the specific defining features (e.g. how it is warm blooded, etc.) so that the student's concept is not overly general (e.g. a mammal is an animal).

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### Other 2E Interventions

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### Willard-Holt (2014)

- Based on research on 2E students, he found that 2e children did not feel school learning experience helped them live up to their potential.
- Instructional Implications. Teachers to allow more:
  - Ownership over their learning
  - Choice and flexibility in topic
  - Method of learning (e.g. presentation or report), assessment, and pace

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### Interventions

- Include a focus on developing higher order thinking and reasoning skills

From: National Education Association, Retrieved on 11/11/2015 from <http://www.nea.org/assets/docs/twicexexceptional.pdf>

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### Example: History

*Authors of history texts often have an implicit rationale for sequencing information in the way that they do. Help Student identify these implicit sequences. Have him briefly summarize each section in writing. Then, have him identify the relationship between section 1 and section 2, the relationship between section 2 and section 3, etc. That is, he should answer the question, "What does section 1 have to do with section 2? This can help illuminate the thread that runs through the information.*

From: Dr. Tim Shanahan

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### Interventions

- Include a focus on developing higher order thinking and reasoning skills
- Use interdisciplinary curriculum to allow the student to find connections between topics.

From: National Education Association, Retrieved on 11/11/2015 from <http://www.nea.org/assets/docs/twicexexceptional.pdf> (c) Dr. Edward M. Petrosky, 2005

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*Provide her with verbal activities that require critical thinking and creativity. When having class discussions, adapt the lesson by including difficult questions about the material to challenge her. This includes asking her about the implications of the information (e.g. "If glaciers are moving at 'x' rate, what could happen in 1,000 years? How long would it take that glacier to reach NY?") or hypothetical questions (e.g. "If we were currently living in an Ice Age, how would life in NY be different?").*

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### Interventions

- Include a focus on developing higher order thinking and reasoning skills
- Use interdisciplinary curriculum to allow the student to find connections between topics.
- Address passion areas in student instruction.
- Offer alternative ways to demonstrate understanding.

From: National Education Association, Retrieved on 11/11/2015 from <http://www.nea.org/assets/docs/twicexexceptional.pdf> (c) Dr. Edward M. Petrosky, 2005

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## Executive Functioning , 2E, and Dyslexia

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## Berninger (2014)

Gifted Children (Verbal Intelligence  $\geq 125$  with Dyslexia

- Versus -

Non-Gifted Children (Verbal Intelligence = 90 to 99) with Dyslexia

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## Berninger (2014)

- Gifted + Dyslexia compared to Dyslexia Only
  - Better: reading, spelling, morphological skills (ability to analyze parts of words, specifically roots, prefixes, and suffixes) and syntactic skills.
  - NOT Better: verbal working memory

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### Implications

- Strong verbal intelligence can allow a student with dyslexia to compensate for weaknesses and be stronger in reading, writing, and overall language skills than would otherwise be the case.
- Giftedness may mask dyslexia.
- Weak working memory a marker for dyslexia
- Why?

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### Working Memory

- Stores information we are thinking about at the moment (e.g. information we're analyzing, such as when we are reading).

From: Nieto, Abbott, and Berninger (2014)

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### Working Memory

- Part of the information working memory stores is words while we analyze them:
  - Sounds of words
  - Parts of words (e.g. prefixes and suffixes)
  - Written letters that represent sounds and words (what words look like).
  - Syntax—the order in which words should be placed to build a sentence.

From: Nieto, Abbott, and Berninger (2014)

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### Working Memory

- Working memory allows the above to occur, like your internet connection allowing you to keep clicking on links to find out what you want to know.
- Working memory keeps the information "online"
- E.g. a weak working memory makes it hard to keep track of all the sounds of words, interfering with reading, causing sounds to become lost, added, or distorted along the way.
  - "drop" = /d/.../r/.../o/.../p/...dop.

From: Nieto, Abbott, and Berninger (2014)

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### "Supervisory Attention"

- A "panel" or set of different types of attention that manages working memory.
- Enables working memory to operate, like overseeing it

From: Nieto, Abbott, and Berninger (2014)

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### Supervisory Attention

- Focusing attention: *inhibit* what is irrelevant, block out distractions
- Switching attention: *change* focus of attention (e.g. stop attending to what a word says and start attending to its meaning).
- Sustaining attention: *maintaining* focus over time.

From: Nieto, Abbott, and Berninger (2014)

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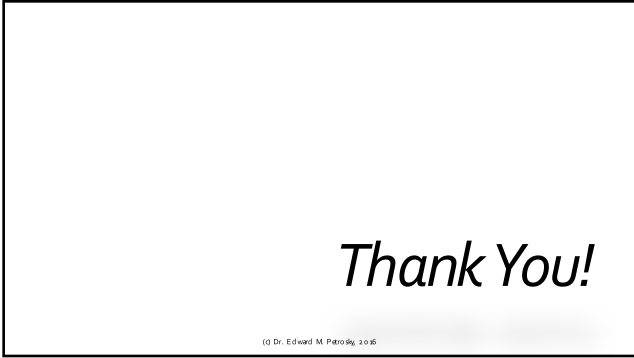
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