

## NCTM Conference 2019 – Empowering the Mathematics Community

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### Promoting Mathematical Literacy: What Our Students Need to Know, Why They Struggle, and How We Can Help!

#### Maths – Honoring our Differences:

- Mathematics is for all.
- Mathematics is developmental.
- It requires work, patience, and determination.
- What we say matters – it matters deeply.

#### Warm Up:

1. Reflect on this Picture...

What do you notice?  
What do you wonder?  
What do you think?



2. How Many?



*How Many?* Christopher Danielson  
(Danielson, 2018)

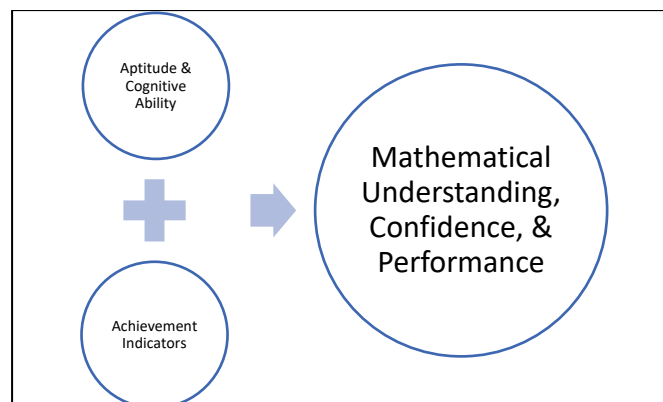
**A. What do our students need to know?**

- Content Standards – NCTM – [What do our kids know?](#)
  - Numbers and Operations, Algebra, Geometry, Measurement, Data Analysis and Probability
- Processing Standards – NCTM – [What can our kids do?](#)
  - Problem Solving, Reasoning and Proof, Communication, Connections, Representations
- Quantitative Literacy – [How can our kids function?](#)
  - Being able to successfully navigate in the world mathematically

**B. Why do our students struggle?**

1. Mathematics as a Language and Discipline is Complex
  - a. Conceptual Understanding
  - b. Procedural Fluency
  - c. Automaticity and Developmental Progress
2. Social and Emotional Considerations
  - a. Mindset – Growth or Fixed
  - b. Confidence, Insecurities, Anxiety
  - c. Motivation, Interest, Work Attitude
3. Environmental Influences
  - a. Parents and Teachers
  - b. Curriculum – Coherent Scope and Sequence
  - c. Resources – Materials and Technology
4. Learning Profiles – Maths Learning Difficulties
  - a. Dyscalculia: Difficulty with Number Concepts and Facts (Price, 2007)
  - b. Dysgraphia: Difficulty with Written Language, Handwriting
  - c. Dyspraxia: Difficulty with Fine and Gross Motor Skills

When students struggle with maths, we observe, reflect, and work to determine why. While there are many variables in play, understanding the struggle will enable us to better support their learning. It is critical for us as educators to know mathematical content and to know the learner.



## Educational Evaluations – Intelligent Testing with the WISC - V

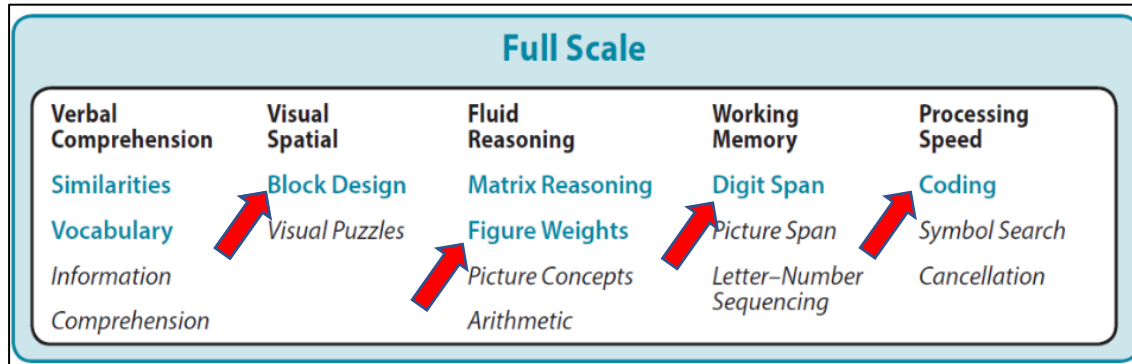


Figure taken from: (Alan S. Kaufman, 2016, p. 3)

### 1. Visual Spatial Index (VSI)

#### Definition:

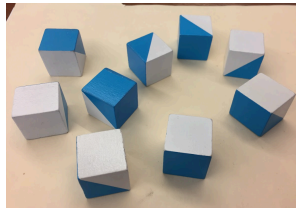
“The ability to perceive patterns and solve problems...” (Flanagan, 2017, p. 37) – the ability to analyze and assess visual information and details, recognize part-whole relationships, and apply this knowledge.

#### Subtest:

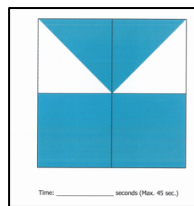
##### Block Design:

Sample test items taken from: *Preparation Workbook for the WISC-V Test* (Publishing, 2015)

Given Blocks.



Given a Picture.



Produce a Model.



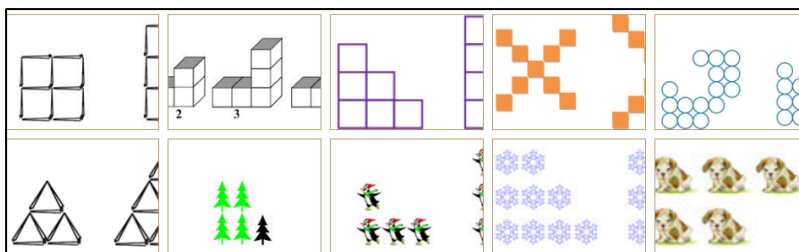
#### Impact on Mathematics:

\*Problem Solving and Mathematical Thinking – Decision Making with Multiple steps.

#### Support:

Visual Patterns – Fawn Nguyen (<http://www.visualpatterns.org/>)

What is the answer to step 4? 43? 100? Mathematical formula?



## 2. Fluid Reasoning Index (FRI)

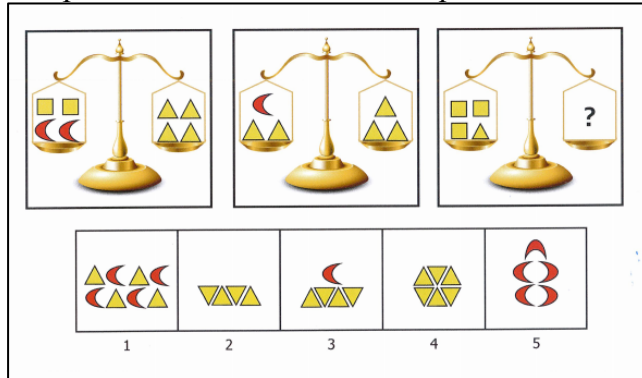
### Definition:

“Fluid reasoning is the ability to use logic to solve unfamiliar problems.” (Flanagan, 2017, p. 35)

### Subtest:

#### Figure Weights

Sample test items taken from: *Preparation Workbook for the WISC-V Test (Publishing, 2015)*



### Impact on Mathematics:

\*Understanding Mathematical Concepts and Relationships; Algebra; Deductive and Quantitative Reasoning

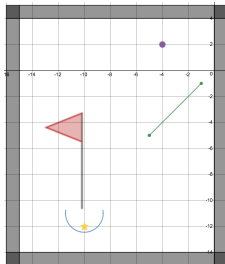
### Support:

Estimation 180 – Andrew Stadel - <http://www.estimation180.com/>

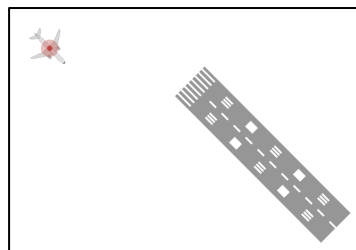


Desmos Activities – Dan Meyer CAO and team - <https://teacher.desmos.com/>

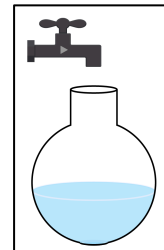
### Marble Slide Mini Golf



### Land the Plane



### Water Line



### 3. Working Memory Index (WMI)

#### Definition:

“The ability to maintain and manipulate information in short term memory in order to solve multistep problems.” (Flanagan, 2017, p. 37)

#### Subtest:

**Digit Span**  
(Auditory)

› Three Parts:

- |                                |         |                     |
|--------------------------------|---------|---------------------|
| - Digit Span <b>Forward</b> :  | 2-3-6-8 | <b>Ans: 2-3-6-8</b> |
| - Digit Span <b>Backward</b> : | 2-1-8-3 | <b>Ans: 3-8-1-2</b> |
| - Digit Span <b>Sequence</b> : | 5-3-9-2 | <b>Ans: 2-3-5-9</b> |

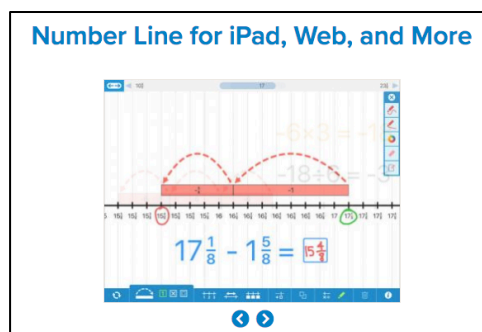
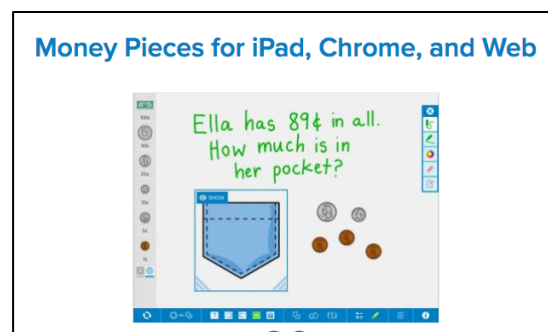
#### Impact on Mathematics:

\*Numeracy, representation, and one-to-one correspondence; procedural fluency with multistep problems.

#### Support:

The Math Learning Center (Free Math Apps)

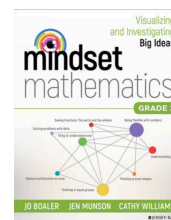
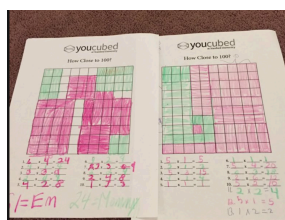
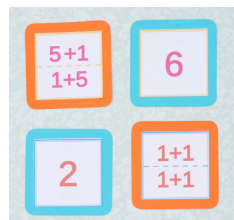
<https://www.mathlearningcenter.org/home>



Card Game – Concentration with Direct Instruction – Location – Array of Image and Location Math Facts and Subitizing.

“How close to 100?” – <https://www.youcubed.org/tasks/many-rows-many-row/>

Jo Boaler – Mindset Mathematics



#### 4. Processing Speed Index (PSI)

##### Definition:

“The ability to fluently deploy the focus of one’s attention to process information quickly.”  
(Flanagan, 2017, p. 39)

*This is about output – performance.* How quickly and efficiently a person is able to produce.

##### Subtest:

##### Coding

Sample test items taken from: *Preparation Workbook for the WISC-V Test (Publishing, 2015)*

A	B	C	D	E	F	G	H	I
○	△	☉	⊙	=	⊥	:	>	⊖

Practice Items:

D	B

##### Impact on Mathematics:

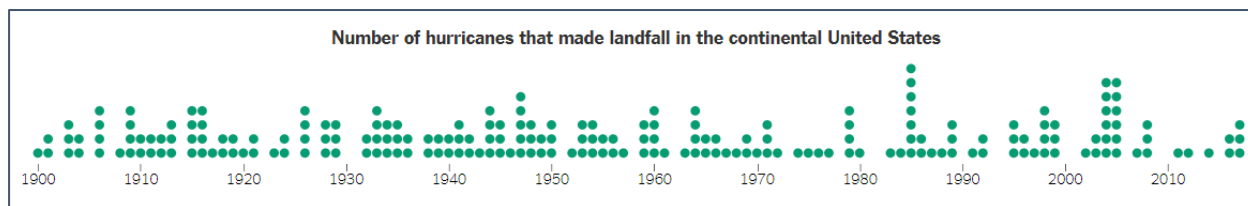
\*Working with mathematical symbols (Algebra) and real-world tasks (money)

##### Support:

Annie Fetter – New York Times – “What’s Going On in This Graph?”

<https://www.nytimes.com/column/whats-going-on-in-this-graph>

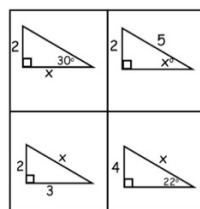
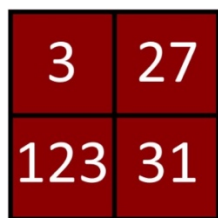
What do you wonder? What do you notice?



Mary Bourassa and Christopher Danielson – Which One Doesn’t Belong (WODB)

<http://wodb.ca/>

Be able to justify, for each number/image, why it doesn’t belong with the other three.



Thank you to Cynthia Richardson and Philippe Ernewein at Denver Academy, who are experts in how information from the WISC-V can positively inform our work with students.

**C. How can we help?**

1. Embrace Mathematics
2. Share a Positive Attitude and Know that Appropriate Challenge is Critical
3. Promote Curiosity
4. Think Mathematically
5. Ask Questions: “What do you notice, wonder, think?”

**Closing and Reflection:**

1. Select an item...

What do you notice?  
What do you wonder?  
What do you think?



2. Please consider the following:
  - a.) As a learner I would like to be viewed as (3 words) ...
  - b.) Math is...

Thank you!

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## References

- Alan S. Kaufman, S. E. R., Diane L. Coalson. (2016). *Intelligent Testing with the WISC-V*. Hoboken New Jersey: John Wiley & sons.
- Danielson, C. (2018). *How Many? A Counting Book*: Stenhouse Publishers.
- Flanagan, D. P., & Alfonso, V. C. . (2017). *Essentials of WISC-V Assessment*: John Wiley & Sons.
- Price, G. R., Holloway, I., Räsänen, P., Vesterinen, M., & Ansari, D. . (2007). Impaired parietal magnitude processing in developmental dyscalculia. *Current Biology*, 17(24). doi:<https://doi.org/10.1016/>
- Publishing, T. T. (2015). *Preparation Workbook for the WISC-V Test*: Test Tutor Publishing, LLC.

## Additional Resources:

Understood.org

Parent organization with helpful resources

<https://www.understood.org/en>

Rocky Mountain Branch – International Dyslexia Association

<http://idarmb.org/>

Dyscalculia

<http://www.dyscalculia.org/>

YouCubed – Jo Boaler

<https://www.youcubed.org/>

Desmos – Beautiful, Free Math

<https://www.desmos.com/>

The Math Forum @ Drexel – Wonderful problems, puzzles, and tasks

<http://mathforum.org/>

University of Colorado Boulder – PhET – Interactive Simulations for Math and Science

<https://phet.colorado.edu/>

National Library of Virtual Manipulatives – Modules are interactive. Works best with Safari

<http://nlvm.usu.edu/en/nav/vlibrary.html>

GeoGebra – Free dynamic mathematics software

<https://www.geogebra.org/>

NCTM – Illuminations

<https://illuminations.nctm.org/>