Students With Disabilities CAN Do Math!

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WHO are we talking about?
Neurodevelopmental Disorders...

...are a group of conditions with onset in the developmental period...characterized by developmental deficits that produce impairments of personal, social, academic, or occupational functioning. The range of developmental deficits varies from very specific limitations of learning or control of executive functions to global impairments of social skills or intelligence” (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition).

This includes...

Intellectual Disabilities - Communication Disorders - Autism Spectrum Disorder - ADHD
Specific Learning Disorder - Motor Disorders - Other Neurodevelopmental Disorders
WHAT does the research say?
Pedagogical Orientation of Journal Article

- Medical: 1.1%
- Behavioral: 4.4%
- IP: 3.8%
- Constructivist: 23%
- Social constructivist: 17.2%
- Sociopolitical/critical: 10.4%

Lambert & Tan, 2016
Pedagogical Orientation of Journal Article

- Disability
- No Disability

Medical: 23.9, 1.1
Behavioral: 4.4, 28.6
IP: 3.8, 21.4
Social Constructivist: 23, 17.2
Sociopolitical/Critical: 4.6, 10.4

Lambert & Tan, 2016
What should the instructional focus be for students with developmental disabilities?

(Browder, Spooner, Ahlgrim-Delzell, Harris, Wakeman, 2008.)
<table>
<thead>
<tr>
<th>Assumptions about learners with developmental disabilities</th>
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<tr>
<td>Limited potential/intelligence</td>
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Shifting assumptions about learners, shifting teaching and learning of mathematics . . .
WHY do we do it differently?
Disability Rights Movement

Judy Moiseff, Disability Rights Activist & Willowbrook survivor

Justin Dart, founder of Justice for All (JFA)

Judith Heumann, Civil Rights Activist

Harriet McBride Johnson, Lawyer & Disability Rights Activist

Nadina La Spina, Disability Rights Activist & Artist
"The language of disability is often unnoticed in daily conversations. Consider for example the following questions: "Are you blind?"; "Are you deaf?"; Are you retarded?"; Are you crazy?" Or the phrases: "a dumb question," "a lame answer," "a blind spot," "being shortsighted," and "the blind leading the blind." Or name-calling: "moron," "cretin," "lunatic," and "imbecile." The commonality among all of the above is that disability-related language reinforces the connection between disability and inability, negativity, undesirability, abnormality, and inferiority. Pervasiveness of such language use is most likely because people do not consider disability issues on a par with those of race, ethnicity, gender, and sexual orientation. Disability still remains a depository of bad images and associations, a concept that people continue to devalue and look down upon" (Valle & Connor, 2011, p. 24).
“I have cerebral palsy, and I prefer identity-first language. I consider my disability to be an inextricable part of my identity as a human being. It isn’t negative to say I’m disabled; it’s a statement of fact. [My disability] is a huge part of my identity and how I experience the world. To me, person-first language implies a degree of shame or negativity about disability. I embrace my disability because it influences so much of how I see and experience the world.”

— Tonia
We don’t pathologize a calla lily by saying that it has a “petal deficit disorder.” We simply appreciate its unique beauty...Similarly, we ought not to pathologize children who have different kinds of brains and different ways of thinking and learning. (Armstrong, 2012)
Neurodiversity in the Classroom

*Positive Niche Construction* is a strengths-based approach to inclusive education

- Comprehensive assessment of student’s strengths
- The use of assistive technology and *universal design for learning*
- Collaboration between teachers and related service providers
- Implementation of strengths-based learning strategies
- Envisioning positive role models with disabilities (i.e. Albert Einstein)
- Affirmative career aspirations (related to student’s strengths)
- Engineering of appropriate environmental modifications to support the development of neurodiverse students

*From Thomas Armstrong’s Neurodiversity in the Classroom*
Find the barriers and design around them!

- How can the environment be made more accessible to all?
- How can relationships be more accessible to all?
- How can content be more accessible to all?
- How can routines and norms be more accessible to all?
- How can engagement in problem-solving be more accessible to all?
- How can strategic thinking be more accessible to all?
Universally Designed!

#Multimodal
Universally Designed **AND** Cognitively Demanding

**You** have 47¢ in your pocket and exactly 6 coins. What pennies, nickels, dimes, and quarters could **you** have?

*Adapted from Openmiddle.com*
Focus on the Standards for Mathematical Practice

**MP.1.** - Make sense of problems and persevere in solving them

**MP.2.** - Reason abstractly and quantitatively

**MP.7.** - Look for and make use of structure

**MP.8.** - Look for and express regularity in repeated reasoning
What should the instructional focus be for students with developmental disabilities?

(Browder, Spooner, Ahlgrim-Delzell, Harris, Wakeman, 2008.)
1. To raise money for a new science lab, Martinez Elementary is selling T-shirts and hats with the school’s name on it. They sell 73 T-shirts and 29 hats. How many more T-shirts did they sell than hats?
HOW we do it...

Instructional Routines:
- I Notice/ I Wonder
- Counting Collections
- Contemplate then Calculate
Instructional Routines
Instructional Routine

I Notice...

I Wonder...
What do you notice?
What do you wonder?

from Dan Meyer
Instructional Routine Norms

Allowing students to become familiar with the routines and expectations, will eventually give them the opportunity to engage with deeper mathematical thinking.

We began by exploring what it means to “notice” and what it means to “wonder”

Now my students notice and wonder unprompted!
My students noticed...

- The black lines that are straight
- There are 5 boxes
- The brush is brown
- The paintbrush is made out of wood or plastic
- The paintbrush is 5 measuring long
- There are two lines on the side of the paintbrush

My students wondered...

- How long is the paintbrush?
- Why are there lines on both sides?
- What are the squares for?
- How big is the paintbrush?
- What are the lines?
- What are the boxes?
- Why is the paintbrush not moving?
What do you notice?
What do you wonder?

from Contexts for Learning Mathematics
A baker wants to find out how many muffins he made this morning. He has three trays. One tray has 5 rows with 4 muffins in each row. The second tray has 4 rows with 4 muffins in each row. The third tray has 9 rows with 4 muffins in each row.

Researchers in mathematics and mathematics education and cognitive psychologists have long recognized that a very important, if not essential, component of problem solving is the ability to translate between different symbolic representations of information (Webb, Gold, Qi, 1990).
<table>
<thead>
<tr>
<th>I notice...</th>
<th>I wonder...</th>
</tr>
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Universal Design for Learning Guidelines

Find the barriers and design around them!

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<table>
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<th>I wonder...</th>
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T-Chart Graphic Organizer
- Supports *executive functioning* during problem solving
- Prepares use of *receptive/expresive language*
- Reduces load on *working memory*
For more information about I notice/I wonder visit MathForum.org
Instructional Routine
Counting Collections
School Store
<table>
<thead>
<tr>
<th>Have</th>
<th>Need to buy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doritos-Cheese</td>
<td>14</td>
</tr>
<tr>
<td>Doritos-Cool Ranch</td>
<td>9</td>
</tr>
<tr>
<td>Fritos</td>
<td>16</td>
</tr>
<tr>
<td>Lays Chips</td>
<td>3</td>
</tr>
<tr>
<td>Cuties</td>
<td>4</td>
</tr>
<tr>
<td>Hershey's Bar</td>
<td>2</td>
</tr>
<tr>
<td>Hershey's Bar (with almonds)</td>
<td>4</td>
</tr>
<tr>
<td>Nuts</td>
<td>7</td>
</tr>
<tr>
<td>Cookies</td>
<td></td>
</tr>
<tr>
<td>Reese's</td>
<td>13</td>
</tr>
<tr>
<td>Juice</td>
<td>10</td>
</tr>
<tr>
<td>Ginger Ale</td>
<td></td>
</tr>
<tr>
<td>Gum (mint)</td>
<td>3</td>
</tr>
<tr>
<td>Gum (fruit)</td>
<td>16</td>
</tr>
</tbody>
</table>
“A math/science project by the LC-Egic/UC-LaFrance cohorts. At the CSA, we count and weigh vegetables and fruit. The fruits and vegetables come from Norwich Meadows Farm. We sell vegetables and fruit to customers. The customers are teachers and students.” -Ms. Egic’s students
Universally Designed!
Universal Design for Learning Guidelines

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- **Realia**
  - Makes problem solving and mathematical thinking more *concrete*
  - Cooperative learning structures for *multiple means of expression* of knowledge.
  - Use of *space outside the classroom* to support the social and physical environment for learning
For more information about Counting Collections visit TEDD.org
Instructional Routine
Contemplate
Then Calculate
Notice

Pair Share

Group Share

Reflect

Contemplate then Calculate Sequence
Get Ready to Notice...
What Do You Notice?
I noticed _______________
What Do You Notice?
Pair Share

**Shortcuts?**

A shortcut is __________

it works because...
Group Share

Fill in the blanks with your partner

We noticed ___________ so we _______________

We knew ___________ so we _______________

Our shortcut works because ___________________

Listen to others

They noticed ___________ so they _______________

They knew ___________ so they _______________

Their shortcut works because ___________________
Reflect

Choose One...

Paying attention to __________ is helpful because...

Next time I will...

Something I learned about dominoes is...
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Notice

Pair Share

Group Share

Reflect
Universal Design for Learning Guidelines

Find the barriers and design around them!

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Guided Sequence
- Supports *executive functioning* during problem solving
- Sentence frames aid *receptive/expansive language*
- Visual aids cue *working/short term memory*

Notice

Pair Share

Group Share

Reflect
For more information about *Contemplate then Calculate* visit Math.Newvisions.Org
Have your assumptions about learners with developmental disabilities shifted? How?
Any other questions?
You can find out more about us and our work on our blogs...