Skills Sequences in Mathematics for Students with Autism

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#ptnmath
PaTTAN’s Mission

The mission of the Pennsylvania Training and Technical Assistance Network (PaTTAN) is to support the efforts and initiatives of the Bureau of Special Education, and to build the capacity of local educational agencies to serve students who receive special education services.

PDE’s Commitment to Least Restrictive Environment (LRE)

Our goal for each child is to ensure Individualized Education Program (IEP) teams begin with the general education setting with the use of Supplementary Aids and Services before considering a more restrictive environment.
Mathematics learning is an intricate web of connected logical ideas. Accessing new content requires the ability to identify and verify the needed prerequisite skills and instruct students accordingly so there are no gaps in knowledge. In this session, participants will examine mathematical content, the necessary prerequisites, and determine how to access content contained with the PA Math Standards.

Objectives
- Participants will be able to apply the concept of task analysis to structure verbal prompts and analyze error patterns.
- Participants will understand the need to identify prerequisite skills for math topics.
- Participants will be able to design an instruction sequence.

Session Outline

1. ABA stuff
2. Instructional Sequencing
3. Teaching Counting (me)
4. Teaching Early Computation (we)
5. Create your own Sequence! (you)
ABA Background

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5 Strands of Mathematical Proficiency

(NRC, 2001)

Prerequisites → Conceptual Understanding → Math Topic

Strategic Competence
Adaptive Reasoning
Productive Disposition
Procedural Fluency

Math Topic
What is conceptual understanding?

Extended Tacts

- **Generalization** must occur
  - Can apply to novel items without explicit teaching
  - Across...
    1. People
    2. Places
    3. Materials
  - Feature/Function/Class
    - Tacting critical features may facilitate concept acquisition
  - The tact is involved in the process of **joint control** which assists students in effective verbal recall and effective listener responding

What is conceptual understanding?

**Atomic Repertoires**

- New combination of skills applied to new behaviors
- Most of our spoken language is a result of ARs

What are the prerequisite skills needed for the atomic repertoires for the math content?

- Imitation
- Echoic
- Tacts
- Textual Behavior (reading texts/symbols)
- Transcriptive Behavior (copying text/symbols)
- Etc...

**We must identify the skills and outline in a matrix!**
Textual Behavior…

It is important for students to be able to “read” mathematics.

However, textual behavior is only relevant when students understand the meaning of the words.

OR

Interpreting math symbols is only relevant when they understand their meaning.

From this point on…

I am going to simplify the ABA Vocabulary so we can focus on the math.

You can still make connection/improvements if you have that level of background.
Outlining Instruction

- **Conceptual Understanding**
  - Set up Matrix for pre-req’s
    - Identifies needed math skills
    - Works across operants
    - Ensure connectivity between ideas
    - Sets up the “why”

- **Procedural Understanding**
  - Uses CRA Progression
    - Can develop algorithmic thought while working of facts
    - Will need facts for Abstract

Fact Fluency
1. IT
2. Fluency drills
3. Can develop with CRA
4. Need facts for Abstract

Conceptual Understanding of new math content

Process

- What math procedure?
  - Diagram the procedures
  - List the prerequisites

- What are the prerequisites?
  - Build a Concept Matrix
  - Teach/Assess all of the matrix

- Teach procedures
  - Work towards fluency in all areas
  - Work towards generalization
Let’s Teach Counting

3 **One-to-one** – Counting one “thing” at a time; transfer from uncounted group to counted group (1:1 Correspondance)

2 **Cardinal** – The last count represent the quantity in the counted group (*Cardinality*)

1 **Stable-order** – Establishes consistent sequence

**Abstraction** – applying counting to like objects, actions, sounds, etc…

**Order-irrelevance** – Can count in any order
Prerequisites

Say the number name
Know the words
Write the symbol/digit
Know the quantity
Identify the symbol/digit

Conceptual

The Counting Progression

5. Inter-relationships (Matrix)

1. Number Speech
2. Number Quantity
3. Number Symbols
4. Number Words

6. Cardinality
7. Stable Order
8. 1:1 Correspondence

9. Abstraction
10. Order Irrelevance

Procedural
## Concept Matrix

<table>
<thead>
<tr>
<th>Teacher (antecedent)</th>
<th>digit</th>
<th>verbal</th>
<th>text</th>
<th>dice</th>
<th>10-frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>digit</td>
<td>MtS (Trans.)</td>
<td>Tact</td>
<td>MtS (Trans.)</td>
<td>MtS</td>
<td>MtS</td>
</tr>
<tr>
<td>verbal</td>
<td>Tact</td>
<td>Echoic</td>
<td>Tact</td>
<td>Tact</td>
<td>Tact</td>
</tr>
<tr>
<td>text</td>
<td>MtS</td>
<td>Tact (Textual)</td>
<td>MtS</td>
<td>MtS</td>
<td>MtS</td>
</tr>
<tr>
<td>dice</td>
<td>MtS</td>
<td>Tact</td>
<td>MtS</td>
<td>MtS</td>
<td>MtS</td>
</tr>
<tr>
<td>10-frame</td>
<td>MtS</td>
<td>Tact</td>
<td>MtS</td>
<td>MtS</td>
<td>MtS</td>
</tr>
</tbody>
</table>

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**check-in**

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Prerequisites

examples

“Concept Matrix”

Teacher (antecedent)

Student (behavior)

?  ?  ?  ?

?  ?  ?  ?

?  ?  ?  ?

?  ?  ?  ?

Tact ×
Our plan...

In teams....
- Outline procedures
- List Prerequisites
- **Share/Feedback**
- Refine
- Develop Matrix

Gallery Walk...
- 3-5 minutes
- Add sticky notes with questions/suggestions
- Snap a picture

Each group will address sticky notes.
The Content

Place Value Concepts
Number Lines
Addition Algorithm
Subtracting Single-Digit #'s
Subtraction Algorithm
Multiplying Single-Digit #'s
Dividing Single-Digit #'s
Understanding Fractions as Numbers
Adding Fractions
Dealer’s Choice!

Contact Information

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Commonwealth of Pennsylvania
Tom Wolf, Governor