Standards-based Math Instruction for Students with Intellectual Disabilities

Karen Ross-Brown, BS, MLS
Ben Satterfield, Ed.D
Who are We Talking About?

Students with...

cognitive disabilities

motor challenges

non-verbal abilities or limited language

autism

multiple disabilities
Who are We Talking About?

Students who...

• complete math tasks and algorithms, but don’t know how or when to use them
• learn functional skills+
• may be stuck at matching and sorting
• make little or no progress in math
• watch, give directions, or make comments with a communication device in math class... and that’s it
Where We Have Been...  
...in the Last 30 Years

1. Functional math
2. Pick and choose math activities
3. Theme-driven instruction
4. Lack of appropriate, high quality materials
General Education curriculum

High quality but...

...too difficult even at the lowest levels
...too fast
...little differentiation

Special Education

Piece of the puzzle..
...some content areas
...single tool
...single intervention
What was it like to teach math for students with mild, moderate, and severe disabilities?

What can my student do?
What is useful for my student?

- functional skills, sorting, counting, addition, subtraction

Where have I been?
Where am I going?
What’s Wrong with All of That?

1. Limits potential

2. Increases confusion and frustration

3. Decisions based on assumptions

4. Gaps in learning

5. Altered experiences & stages of development
IEP goals ≠ Curriculum

Goals: what to measure
Curriculum: guide for progression of learning

Practice is not instruction

or...”Playing Clock Bingo is not a math lesson.”

Teach thinking skills and understanding + provide practice opportunities

Concept knowledge is as essential to math as comprehension is to literacy
Expectations & Opportunity
What’s Been Right?

Creative
Resourceful
Hard-working
Best that could be done
Learning
Why are We Changing How We Deliver Math Instruction?

Educators raising expectations

= 

Students have better opportunities to learn math
The only thing worse than not being able to see...

...is being able to see & having no vision

-- Helen Keller
We are on the brink...

...of something spectacular

...in math education for students with disabilities.
Where We Need to Go

Math + Access

Good Instruction is Good Instruction

Start with the math….
How do I get my students to it?
What does that look like?

- **Scope and Sequence** of skills aligned to standards
- **Comprehensive and Systematic**: progression of learning
- Multiple hands-on math tools, methods, materials
- **Differentiated** tools, materials, and instruction
- Break skills down...slow the pace down
What are Some of Those Methods?

Communication

Representation

Concrete – Semi-Concrete - Abstract
**Equals Math Instruction**

- **Concrete** - teach with hands-on manipulatives & sensory experiences

- **Semi-concrete** – teach with representational materials to bridge concrete objects and abstract numbers

- **Abstract** – teach with numerals, signs, and symbols
What are Some of Those Methods?

Communication

Representation

Concrete – Semi-Concrete - Abstract

Connections

Problem Solving

Teach Vocabulary
What can I add to the lessons to meet individual needs and in forming meaning and challenging my students... no matter where they are?
School

Look for Math!
What Does Differentiation Look Like for Students with Mild, Moderate, Severe and Multiple Disabilities?
Differentiation: How Can I....?

Talk & write about math (communication challenges)

Understand math (cognitive, LD, autism, low vision)

Perform a math task (motor challenges)

Be safe (throwing, mouthing materials)

Learn in the best way for me (preferred style)

Engage in math (motivation, attention)
How Can I Talk About Math?

Provides…

• Choices (objects, pic-symbols)
• Means to communicate
  eye gaze
  touch
  point
  select with sound

• Communication device or board
  E-Z Tech
  Student’s AAC device
  Tactile/visual symbols
How Can I Understand?

• Touching tools
How Can I Understand?

• Touching tools
• Cause and effect
How Can I Understand?

• Touching tools

• Cause and effect

• Patterns and routine
How Can I Understand?

• Touching tools
• Cause and effect
• Patterns and routine
• Interest
How Can I Understand?

• Touching tools
• Cause and effect
• Patterns and routine
• Interest
• Using tools
How Can I Understand?

- Touching tools
- Cause and effect
- Patterns and routine
- Interest
- Using tools
- Quantity
How Can I Compose & Decompose?
How Can I Compose & Decompose?
How Can I Divide?
Five groups...How Many in Each Group?

$10 \div 5 = 2$
How Can I Divide?
Five in each group...How Many Groups?

10 / 5 = 2
# How Can I Find a Number?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>31</td>
<td>32</td>
<td>33</td>
<td>34</td>
<td>35</td>
<td>36</td>
<td>37</td>
<td>38</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>41</td>
<td>42</td>
<td>43</td>
<td>44</td>
<td>45</td>
<td>46</td>
<td>47</td>
<td>48</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>51</td>
<td>52</td>
<td>53</td>
<td>54</td>
<td>55</td>
<td>56</td>
<td>57</td>
<td>58</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>61</td>
<td>62</td>
<td>63</td>
<td>64</td>
<td>65</td>
<td>66</td>
<td>67</td>
<td>68</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>71</td>
<td>72</td>
<td>73</td>
<td>74</td>
<td>75</td>
<td>76</td>
<td>77</td>
<td>78</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>81</td>
<td>82</td>
<td>83</td>
<td>84</td>
<td>85</td>
<td>86</td>
<td>87</td>
<td>88</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>91</td>
<td>92</td>
<td>93</td>
<td>94</td>
<td>95</td>
<td>96</td>
<td>97</td>
<td>98</td>
<td>99</td>
<td></td>
</tr>
</tbody>
</table>

MATH TOOLS: hundreds chart
How Can I Sort?
How Can I Sort with a Venn Diagram?
How Can I Sort with a Venn Diagram?
How Can I Graph Coordinates?

(4, 6)
How Can I Make a Graph I Can Touch?
How Can I Learn the System of Numbers?
How Can I Find Shapes Around Me?
How Can I Use Manipulatives to Count?
How Can I Use Manipulatives to Count?
How Can I Use Manipulatives to Add?
How Can I Play a Game?
How Can I Manage Fraction Manipulatives?
How Can I Understand Ratio in Fractions?

part \[ \frac{1}{4} \] whole
How Can I Show What I Know?

What do I know about rectangles?
Geometry

7
Show line, angle, and vertex. Point to vertex. Ask, "What is this?"

Adaptation
Say, "Show the line." Move counting window over choices until student
marks correct choice.

8
Note: Student assessment page is only for item 7.
Show student response booklet. Say, "Show the rectangle. Draw it.
" Item 8

Adaptation
Show long Ang-legs, short Ang-legs, and inset in pocket chart. Show
one side at a time. Repeat 3 more times.
Geometry

7
Show line, angle, and vertex. Point to vertex. Ask, “What is this?”

Adaptation
Say, “Show the line.” Move counting window over choices until student indicates an answer.

8
Note: Student assessment page is only for item 7.
Show student response booklet. Say, “Show the rectangle. Draw it.”

Adaptation
Show long Angel legs, short Angel legs, and insect in pocket chart. Say, “Make a rectangle.” Student chooses one side at a time. Repeat 3 more times.
How Can I Focus on My Learning?
How Can I Focus on My Learning?
Action Dictionary

**Example 1**
The student activates the LITTLEmack or BIGmack communicator to say something.

**INSTRUCTOR:** The instructor records a single message into the LITTLEmack or BIGmack communicator. The instructor may provide a choice of picture symbols so student can choose what is recorded.

**STUDENT:** The student activates the LITTLEmack or BIGmack communicator to say a single message.

**Example 2**
The student activates the Step-by-Step communicator to say a series of messages or ask a series of questions.

**INSTRUCTOR:** The instructor records a sequence of messages or questions on the Step-by-Step communicator.

**STUDENT:** The student activates the Step-by-Step communicator multiple times to say a series of messages or steps, or to ask a series of questions for a survey.

**Example 3**
The student chooses the message to say with the SuperTalker, Talk2 or Talking Brix.

**INSTRUCTOR:** The instructor loads different picture symbols and records corresponding messages on the SuperTalker or Talk2 or on two or more Talking Brix. For errors learning, the instructor interprets the student's choice to frame it within context.

**STUDENT:** The student chooses and activates his/her choice of messages by using the picture symbols.

**Example 4**
The student indicates a choice of picture symbols or objects to say something.

**INSTRUCTOR:** The instructor places three picture symbol or object choices near the student. For errors learning, the instructor interprets the student's choice to frame it within context.

**STUDENT:** The student eye gazes to, touches, or takes a picture symbol or object to communicate. The student may make a choice whether or not objects or picture symbols are presented as choices or are simply available.
I joined sets.

More!
Action Dictionary

iBook: AbleNet’s Action Dictionary
Shift: More Hats

1. I am a math teacher.
   - Math comes first
   - Comprehensive & Systematic: progression of learning
   - Teach math seriously and thoughtfully.

2. I am a special educator.
   - Access for all
   - Active learning
   - Higher expectations
Research
A year-long test of the effectiveness of the Equals curriculum was conducted (2011-2012)

• 72 students with disabilities
• Grades K-8; ages 5-14
• Daily Equals instruction
• Small group (3-8) 40 min. sessions
• 21 participating teachers
Equals Study

Data collection using Equals Assessment
• Pre-testing in September
• Post-testing in April
• Test administered
  – by trained assessors
  – unaffiliated with students they assessed

Teachers also given survey
• 12 question Likert survey
• Rate the effectiveness and ease of use of the Equals curriculum
• Comments collected
Analysis

Progress = raw score April – raw score Sept.

• Every one of the 72 students demonstrated progress
• No student regressed
• Taken altogether students gains averaged 38%
Equals Study Analysis
Level 1 Students by Disabilities

<table>
<thead>
<tr>
<th></th>
<th>Avg All Students</th>
<th>Autism</th>
<th>Cognitive Disabilities</th>
<th>Multiple Disabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>raw score</td>
<td>28.04</td>
<td>30.09</td>
<td>19.2</td>
<td>10.5</td>
</tr>
</tbody>
</table>
Equals Study Analysis
Level 2 Students by Disabilities

<table>
<thead>
<tr>
<th></th>
<th>Avg All Students</th>
<th>Autism</th>
<th>Cognitive Disabilities</th>
<th>Multiple Disabilities</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series1</td>
<td>28.04</td>
<td>24.17</td>
<td>25.5</td>
<td>22.22</td>
<td>23.5</td>
</tr>
</tbody>
</table>
Equals Study Analysis
Level 3 Students by Disabilities

<table>
<thead>
<tr>
<th>Category</th>
<th>Avg All Students</th>
<th>Autism</th>
<th>Cognitive Disabilities</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series1</td>
<td>28.04</td>
<td>52.16</td>
<td>35.08</td>
<td>31</td>
</tr>
</tbody>
</table>
# Equals Research Analysis of Teacher Surveys

<table>
<thead>
<tr>
<th>No.</th>
<th>Question</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>How effective is the lesson layout with regards to lesson planning?</td>
<td>4.33</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>How effective is the lesson layout with regards to execution of the lesson?</td>
<td>4.00</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>How effective is the curriculum organization?</td>
<td>4.38</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>How effective is the curriculum content/ skills taught with regards to student growth?</td>
<td>4.52</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>How effective is the spiraling curriculum (continually building upon skills in later lessons) to our students?</td>
<td>4.62</td>
<td>5</td>
</tr>
<tr>
<td>6.</td>
<td>How effective has the Equals program been at increasing student knowledge of a variety of math concepts?</td>
<td>4.57</td>
<td>5</td>
</tr>
<tr>
<td>7.</td>
<td>How effective has the planning and implementation of lessons in a group setting been in contrast to previous practice (individual lessons for each student)?</td>
<td>4.33</td>
<td>4</td>
</tr>
<tr>
<td>8.</td>
<td>How effective are the skill drill worksheets?</td>
<td>3.76</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>How effective are the problem solving worksheets?</td>
<td>3.33</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>How effective are the chapter assessments?</td>
<td>4.04</td>
<td>4</td>
</tr>
<tr>
<td>11.</td>
<td>How effective are the manipulatives in conjunction with the lesson?</td>
<td>4.48</td>
<td>5</td>
</tr>
<tr>
<td>12.</td>
<td>How effective is the students’ placement test in correctly assessing students for placement?</td>
<td>4.39</td>
<td>4</td>
</tr>
</tbody>
</table>
Thank you!

Karen Ross-Brown
kbrown@ablenetinc.com

Equals Math
www.ablenetinc.com/equals

Ben Satterfield
Ben@GATFL.org
Ben@Center4ATexcellence.com