

Making Mathematics Meaningful for Students with Learning Problems: Powerful Teaching Strategies that Work

David Allsopp, Ph. D.
Department of Special Education
University of South Florida
dallsopp@tempest.coedu.usf.edu

Agenda

- Introduction/Objectives
- Topic #1: Importance of Meaning and Teacher Self-Reflection
- Topic #2: Why Do Students with Learning Disabilities Have Difficulty Learning Mathematics
- Topic # 3: Ten Powerful Teaching Techniques
- Topic #4: Long-Term Professional Development: Introduction to MatheVIDS
- Topic # 5: Questions/Discussion

Learning Objectives

- Self-reflect on beliefs and preparedness to teach mathematics to students with learning disabilities.
- Prioritize several important areas for long term professional development.
- Identify learning characteristics that make learning mathematics difficult for students with learning disabilities.
- Identify powerful/effective instructional strategies & determine how you can use at least one to improve mathematics learning for your students.
- Learn about one resource, MathVIDS, and how to use it for my personal professional development goals.

Topic #1: Importance of Meaning & Teacher Self-Reflection

- Meaning...
 - Why is meaning important?
 - Some examples



Conceptual Meaning

$$2 \times 4 = ?$$

$$\frac{1}{2} \times \frac{1}{4} = ?$$

Can you explain your
answer for each
problem?

How can we enhance
the meaning?

Use Language

$2 \times 4 = ?$
two groups of four Nittany Lions is how many Lions

$\frac{1}{2} \times \frac{1}{4} = ?$
one-half of a one-fourth piece of pizza is how much pizza

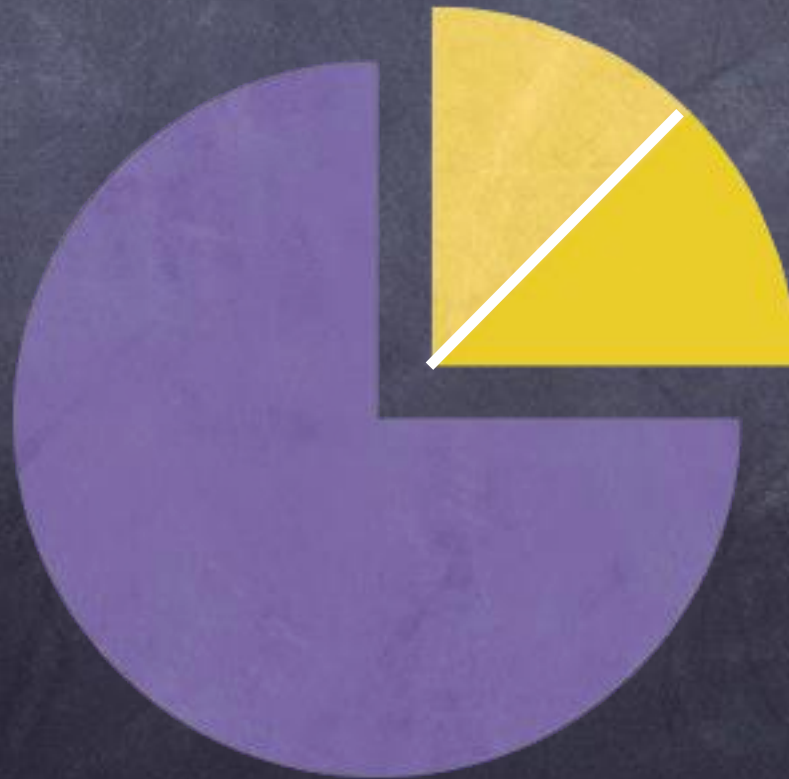
Provide Concrete Experience

2 X 4 = ?
two groups of four Nittany Lions is how many Lions



Provide Concrete Experiences

$\frac{1}{2}$ x $\frac{1}{4}$ = ?
one-half of a one-fourth piece of pizza is how much pizza



Contextual Meaning

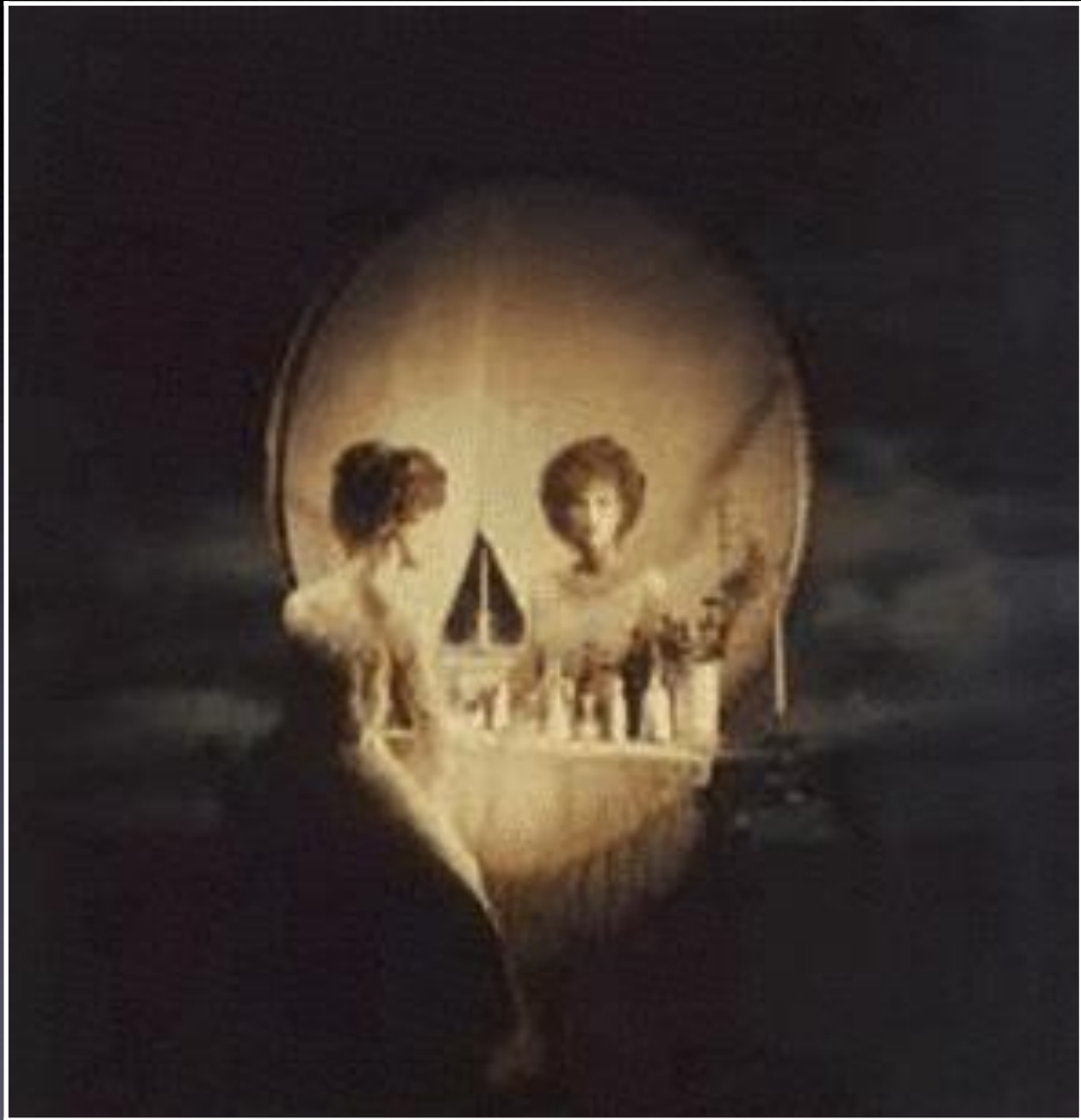
- What is...
- $4+2+4+4+3+3+5+4+4$?

Contextual Meaning

- Solution:
- 3 under par! (Golf)

Meaning and Disability

Write a title for a short story you might write for the following picture...



Write Your Title

One thing I would like to remember from the learning activities for this topic is... 📝

Topic #2: Why is it Difficult for Students with Learning Disabilities to Learn Mathematics?

- Brief reflection on what learning problems feel like
- 7 Learning Characteristics That Are Barriers for Learning Mathematics

Let's Take A Quiz

Informal Mathematics Teacher
Competency Inventory

Lets Take a Quiz!!

Directions: Solve the following basic facts. **You have 1 minute** to complete this quiz. Please remember that the + symbol means multiply, the - symbol means divide, the ÷ symbol means add, and the x symbol means subtract.

$8 + 2 =$

$14 \div 7 =$

$12 \times 2 =$

$10 - 2 =$

$6 \times 5 =$

$9 \div 9 =$

$9 + 6 =$

$12 \div 2 =$

$5 + 6$

$16 - 4 =$

$6 \div 6 =$

$10 - 5 =$

$17 \times 2 =$

$8 \div 4 =$

$4 \times 3 =$

$15 - 3 =$

$9 \div 2 =$

$15 \times 3 =$

$9 - 3 =$

$4 + 4 =$

$6 \div 6 =$

$8 + 3$

$8 \times 7 =$

$2 \times 1 =$

$14 - 7 =$

$6 \times 2 =$

$8 + 5 =$

$9 - 1 =$

$6 + 6 =$

$8 - 4 =$

$20 - 1 =$

$8 + 2 =$

$6 \div 2 =$

Lets Take a Quiz!!

Directions: Solve the following basic facts. You have 1 minute to complete this quiz. Please remember that the + symbol means multiply, the - symbol means divide, the ÷ symbol means add, and the x symbol means subtract.

$8 + 2 =$

$14 - 7 =$

$12 \times 2 =$

$10 - 2 =$

$6 \times 5 =$

$9 \div 9 =$

$9 + 6 =$

$12 \div 2 =$

$5 + 6 =$

$16 - 4 =$

$6 \div 6 =$

$10 - 5 =$

$17 \times 2 =$

$8 \div 4 =$

$4 \times 3 =$

$15 - 3 =$

$9 \div 2 =$

$15 \times 3 =$

$9 - 3 =$

$4 + 4 =$

$6 \div 6 =$

$8 + 3 =$

$8 \times 7 =$

$2 \times 1 =$

$14 - 7 =$

$6 \times 2 =$

$8 + 5 =$

$9 - 1 =$

$6 + 6 =$

$8 - 4 =$

$20 - 1 =$

$8 + 2 =$

$6 \div 2 =$

Don't Be Last!

Lets Take a Quiz!!

Directions: Solve the following basic facts. You have 1 minute to complete this quiz. Please remember that the + symbol means multiply, the - symbol means divide, the ÷ symbol means add, and the x symbol means subtract.

$8 + 2 =$

$14 \div 7 =$

$12 \times 2 =$

$10 - 2 =$

$6 \times 5 =$

$9 \div 6 =$

$9 + 6 =$

$12 \div 2 =$

$5 + 6 =$

$16 - 4 =$

$6 \div 6 =$

$10 - 5 =$

$17 \times 2 =$

$8 \div 4 =$

$4 \times 3 =$

$15 - 3 =$

$9 \div 2 =$

$15 \times 3 =$

$9 - 3 =$

$4 + 4 =$

$6 \div 6 =$

$8 + 3 =$

$8 \times 7 =$

$2 \times 1 =$

$14 - 7 =$

$6 \times 2 =$

$8 + 5 =$

$9 - 1 =$

$6 + 6 =$

$8 - 4 =$

$20 - 1 =$

$8 + 2 =$

$6 \div 2 =$

FASTER!

Lets Take a Quiz!!

Directions: Solve the following basic facts. You have 1 minute to complete this quiz. Please remember that the + symbol means multiply, the - symbol means divide, the ÷ symbol means add, and the x symbol means subtract.

$8 + 2 =$

$14 \div 7 =$

$12 \times 2 =$

$10 - 2 =$

$6 \times 5 =$

$9 \div 9 =$

$9 + 6 =$

$12 \div 2 =$

$5 + 6$

$16 - 4 =$

$6 \div 6 =$

$10 - 5 =$

$17 \times 2 =$

$8 \div 4 =$

$4 \times 3 =$

$15 - 3 =$

$9 \div 2 =$

$15 \times 3 =$

$9 - 3 =$

$4 + 4 =$

$6 \div 6 =$

$8 + 3$

$8 \times 7 =$

$2 \times 1 =$

$14 - 7 =$

$6 \times 2 =$

$8 + 5 =$

$9 - 1 =$

$6 + 6 =$

$8 - 4 =$

$20 - 1 =$

$8 + 2 =$

$6 \div 2 =$

Lets Take a Quiz!!

Directions: Solve the following basic facts. You have 1 minute to complete this quiz. Please remember that the + symbol means multiply, the - symbol means divide, the ÷ symbol means add, and the x symbol means subtract.

$8 + 2 =$

$14 \div 7 =$

$12 \times 2 =$

$10 - 2 =$

$6 \times 5 =$

$9 \div 9 =$

$9 + 6 =$

$12 \div 2 =$

$5 + 6 =$

$16 - 4 =$

$6 \div 6 =$

$10 - 5 =$

$17 \times 2 =$

$8 \div 4 =$

$4 \times 3 =$

$15 - 3 =$

$9 \div 2 =$

$15 \times 3 =$

$9 - 3 =$

$4 + 4 =$

$6 \div 6 =$

$8 + 3 =$

$8 \times 7 =$

$2 \times 1 =$

$14 - 7 =$

$6 \times 2 =$

$8 + 5 =$

$9 - 1 =$

$6 + 6 =$

$8 - 4 =$

$20 - 1 =$

$8 + 2 =$

$6 \div 2 =$

FASTER!!!

Lets Take a Quiz!!

Directions: Solve the following basic facts. You have 1 minute to complete this quiz. Please remember that the + symbol means multiply, the - symbol means divide, the ÷ symbol means add, and the x symbol means subtract.

$8 + 2 =$

$14 \div 7 =$

$12 \times 2 =$

$10 - 2 =$

$6 \times 5 =$

$9 \div 9 =$

$9 + 6 =$

$12 \div 2 =$

$5 + 6 =$

$16 - 4 =$

$6 \div 6 =$

$10 - 5 =$

$17 \times 2 =$

$8 \div 4 =$

$4 \times 3 =$

$15 - 3 =$

$9 \div 2 =$

$15 \times 3 =$

$9 - 3 =$

$4 + 4 =$

$6 \div 6 =$

$8 + 3 =$

$8 \times 7 =$

$2 \times 1 =$

$14 - 7 =$

$6 \times 2 =$

$8 + 5 =$

$9 - 1 =$

$6 + 6 =$

$8 - 4 =$

$20 - 1 =$

$8 + 2 =$

$6 \div 2 =$

98%

Lets Take a Quiz!!

Directions: Solve the following basic facts. You have 1 minute to complete this quiz. Please remember that the + symbol means multiply, the - symbol means divide, the ÷ symbol means add, and the x symbol means subtract.

$8 + 2 =$

$14 \div 7 =$

$12 \times 2 =$

$10 - 2 =$

$6 \times 5 =$

$9 \div 9 =$

$9 + 6 =$

$12 \div 2 =$

$5 + 6$

$16 - 4 =$

$6 \div 6 =$

$10 - 5 =$

$17 \times 2 =$

$8 \div 4 =$

$4 \times 3 =$

$15 - 3 =$

$9 \div 2 =$

$15 \times 3 =$

$9 - 3 =$

$4 + 4 =$

$6 \div 6 =$

$8 + 3$

$8 \times 7 =$

$2 \times 1 =$

Work it Baby!!

$6 \times 2 =$

$8 + 5 =$

$9 - 1 =$

$6 + 6 =$

$8 - 4 =$

$20 - 1 =$

$8 + 2 =$

$6 \div 2 =$

Lets Take a Quiz!!

Directions: Solve the following basic facts. You have 1 minute to complete this quiz. Please remember that the + symbol means multiply, the - symbol means divide, the ÷ symbol means add, and the x symbol means subtract.

$8 + 2 =$

$14 \div 7 =$

$12 \times 2 =$

$10 - 2 =$

$6 \times 5 =$

$9 \div 9 =$

$9 + 6 =$

$12 \div 2 =$

$5 + 6$

$16 - 4 =$

$6 \div 6 =$

$10 - 5 =$

$17 \times 2 =$

$8 \div 4 =$

$4 \times 3 =$

$15 - 3 =$

$9 \div 2 =$

$15 \times 3 =$

$9 - 3 =$

$4 + 4 =$

$6 \div 6 =$

$8 + 3$

$8 \times 7 =$

$2 \times 1 =$

$14 - 7 =$

$6 \times 2 =$

$8 + 5 =$

$9 - 1 =$

$6 + 6 =$

$3 - 4 =$

$20 - 1 =$

$8 + 2 =$

$6 \div 2 =$

Just

Try

Harder!!!

Lets Take a Quiz!!

Directions: Solve the following basic facts. You have 1 minute to complete this quiz. Please remember that the + symbol means multiply, the - symbol means divide, the ÷ symbol means add, and the x symbol means subtract.

$8 + 2 =$

$14 \div 7 =$

$12 \times 2 =$

$10 - 2 =$

$6 \times 5 =$

$9 \div 9 =$

$9 + 6 =$

$12 \div 2 =$

$5 + 6 =$

$16 - 4 =$

$6 \div 6 =$

$10 - 5 =$

$17 \times 2 =$

$8 \div 4 =$

$4 \times 3 =$

$15 - 3 =$

$9 \div 2 =$

$15 \times 3 =$

$9 - 3 =$

$4 + 4 =$

$6 \div 6 =$

$8 + 3 =$

$8 \times 7 =$

$2 \times 1 =$

$14 - 7 =$

$6 \times 2 =$

$8 + 5 =$

$9 - 1 =$

$6 + 6 =$

$8 - 4 =$









$20 - 1 =$

$8 + 2 =$






$6 \div 2 =$

The Last Group
Was FASTER!

7 Learning Characteristics That Create Barriers for Learning Mathematics

-  **Learned helplessness**
-  **Passive approach to learning**
-  **Metacognitive thinking deficits**
-  **Attention problems**
-  **Anxiety about learning mathematics**
-  **Cognitive Processing deficits (auditory, visual/spatial, fine motor)**
-  **Memory problems (nickname test)**
-  **Low level of academic achievement (gaps) (piglatin word problem)**

Let's Reflect On Our Experiences with the Math Quiz

-  **Learned helplessness**
-  **Passive approach to learning**
-  **Metacognitive thinking deficits**
-  **Attention problems**
-  **Anxiety about learning mathematics**

What is it?

How does it impact learning mathematics?

Memory Problems

Storage
Retrieval

Do you know the nicknames?

Directions: Write these university names on a sheet of paper

- Penn State
- Pittsburgh
- Bucknell
- Penn
- Ohio State
- Michigan
- Mississippi State
- Mississippi
- Florida
- Florida State
- Furman
- Idaho
- Northern Arizona
- Ferrum
- James Madison

The National College Nickname Memory Test

Using your list of school names, write the nickname for each school name given orally.

The National College Nickname Memory Test - Answers

- | | |
|---------------------|---------------|
| ✓ Penn State | Nittany Lions |
| ✓ Pittsburgh | Panthers |
| ✓ Bucknell | Bison |
| ✓ Penn | Quakers |
| ✓ Ohio State | Buckeyes |
| ✓ Michigan | Wolverines |
| ✓ Mississippi State | Bulldogs |
| ✓ Mississippi | Rebels |
| ✓ Florida | Gators |
| ✓ Florida State | Seminoles |
| ✓ Furman | Paladins |
| ✓ Idaho | Vandals |
| ✓ Northern Arizona | Lumberjacks |
| ✓ Ferrum | Panthers |
| ✓ James Madison | Dukes |

Reflection: Your Experiences

- How many nicknames were you able to recall?
- What either helped or inhibited your ability to recall the nicknames?
- What role does memory play in doing mathematics?
 - Multi-step operations
 - Multiple meanings for a math symbol or term
 - Recalling formulas
 - Employing problem solving strategies

One thing I would like to remember from the learning activities in Topic #2 is... 📝

Topic #3 Ten Powerful Teaching Techniques

- What are they?
- Key instructional features
- Examples
- How do they help students with learning disabilities?

10 Powerful Teaching Techniques

- 1) Support **Student Connections** Between New Mathematics Concepts & Prior Knowledge/Experiences
- 2) Provide **Explicit Models** of Target Mathematics Concepts, Skills, & Processes
- 3) Imbed Instruction and Practice in **Authentic Contexts**
- 4) Teach Problem Solving **Strategies**
- 5) **Cue** Important Features of a Mathematics Concept/Skill **Using Multisensory Methods**
- 6) Use **Language Experiences** to Enhance Meaning & Understanding
- 7) Ground Abstract Concepts & Processes in **Concrete Experiences**
- 8) Provide Students **Many Opportunities to Respond**
- 9) **Monitor Student Learning** & Provide Them Concrete Ways to Visualize Their Learning
- 10) Provide Continuous **Maintenance** Activities for Previously Mastered Concepts/Skills

PTT #1:

Support Student Connections Between New Mathematics Concepts & Prior Knowledge/Experiences



Where we are

Where our students are

Meet Your Students Where They Are...

• L - I - P

- L ink to prior knowledge/previous experiences.
- I dentify what students will learn.
- P rovide meaning/rationale.

LIP



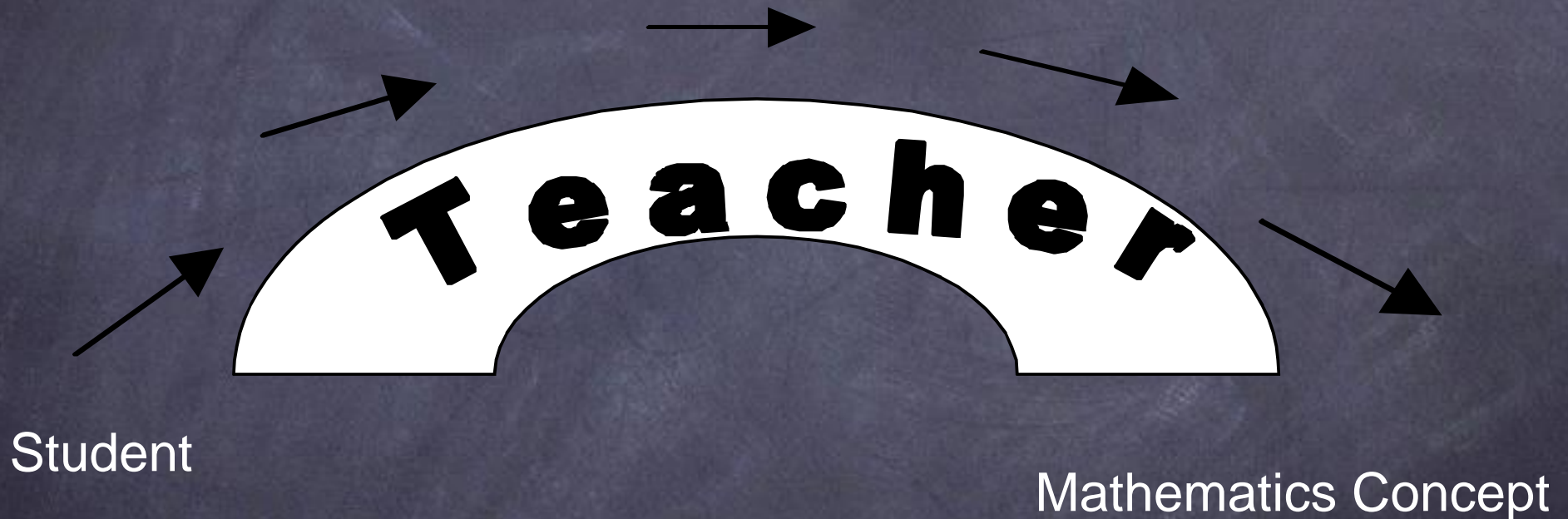
Where we are

Where our students are



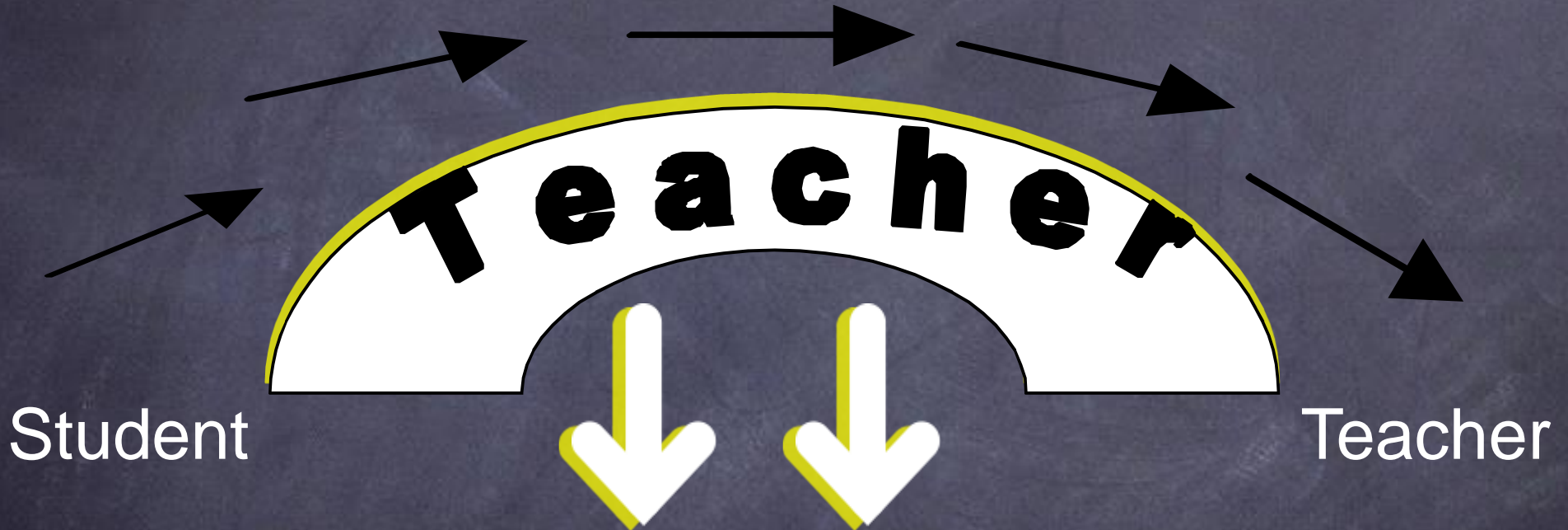
PTT #2:

Provide Explicit Models of Target
Mathematics Concepts, Skills, &
Processes



- “You can’t hit what you can’t see...”

Make the mathematics concept accessible to your students by...



- Multiple Senses
- Cue Important Information
- Examples & Non-examples
 - Think Aloud
- Engage Student Thinking

PTT #3:

Imbed Instruction and Practice in Authentic Contexts

Age/Grade

Interests/Hobbies

Family/Culture

Student Interest Inventory

Student Interest Matrix

(See Special Connections Website)

Student Name:

Age/Grade Level:

Period/Class:

| Things I Like To Do On My Own | Special Hobbies I Have | Fun Things My Family Does | Things I Like To Do With My Friends | Things I Like To Learn About |
|-------------------------------|------------------------|---------------------------|-------------------------------------|------------------------------|
| | | | | |

Mathematics Class Interest Matrix

(see Special Connections Website)

| Period/Class: School Year: | | |
|-------------------------------|--|---------------------------------------|
| Interests | Relevant Mathematics Concepts/Skills I Teach That Match Interest | Ideas for Creating Authentic Contexts |
| Individual/Peer Activities | | |
| 1. | | |
| 2. | | |
| Family Activities | | |
| 1. | | |
| 2. | | |

PTT # 4:

Teach Problem Solving Strategies

☞ *Students with learning disabilities do not naturally employ problem solving strategies like successful mathematics students do...*

What Are They?

An efficient & learnable process for:

- 1) solving a particular type of problem
- 2) developing conceptual understanding of important mathematics concepts

What do they include?

- limited number of steps (3 to 7 steps)
- accurately reflect the problem/concept
- provide cueing
- actions & thinking
- they are taught

Strategy Examples

Mnemonic Strategies

Examples:

DRAW-operations

FASTDRAW- story problems

SPIES - greater than/less than

ADD - adding + & - integers

DRAW for Algebra - one-variable equations

FASTDRAW for Algebra - algebra story problems

(See MathVIDS for these and others)

DRAW for Algebra

Discover the variable

Read the problem

Answer the problem or draw & check

Write the answer

SPIES

Say the integer out loud.

Point to each integer and circle negative signs.

Identify whether integer is pos. or neg.

Evaluate the magnitude of each integer.

Select integer of greatest value.

Rules of Value

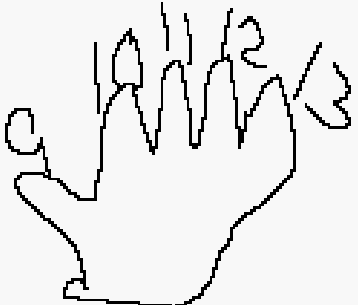
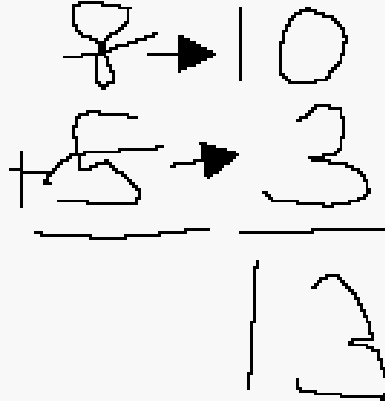
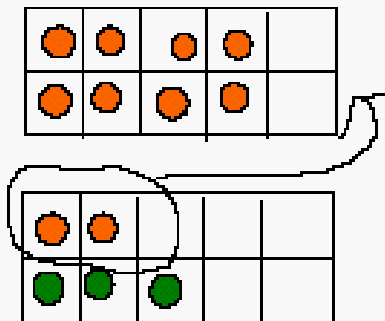
1) + & - = positive integer is of greater value

2) + & + = integer farthest from zero on #line is of greatest value

3) - & - = integer closest to zero on # line is of greatest value

Example: Chart to Help Students Generate Problem-Solving Strategies

Ways We Know to Add

| Counting Up | Make a Ten | Near Doubles | Other |
|---|---|---|--|
| <p>Start at 8. Count 9, 10, 11, 12, 13.</p>  |  | $\begin{array}{r} 5 \\ + 6 \\ \hline \end{array}$ $\begin{array}{r} 5 \\ + 5 \\ \hline 10 + 1 = 11 \end{array}$ | $\begin{array}{r} 8 \\ + 9 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ + 10 \\ \hline 18 - 1 = 17 \end{array}$ |
| |  | | |

Example: Helping Students Think About/Monitor Their Use of Different Strategies

| STRATEGY SHEET | |
|---|---|
| <i>Paste problem here.</i> | |
| I solved the problem by: | |
|  | Counting Chips or Base Ten Materials |
|  | Counting Up |
|  | Make a Ten |
|  | Other Strategy |
| $\underline{\quad} + \underline{\quad} = \square$ | |

PPT # 5:

Cue Important Features of a Mathematics Concept/Skill Using Multisensory Methods

Visual

Auditory

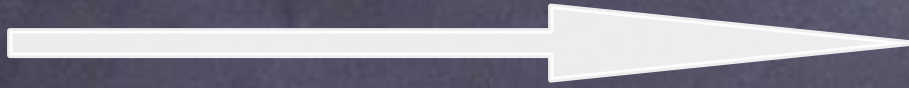
Tactile (Touch)

Kinesthetic (Movement)

Cognitive/Thinking

Examples of Visual Cuing

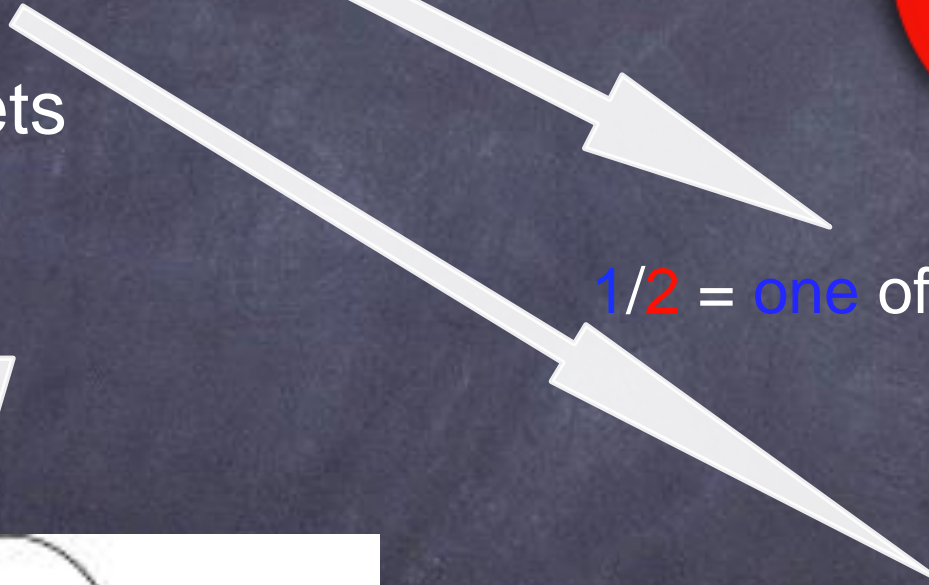
color



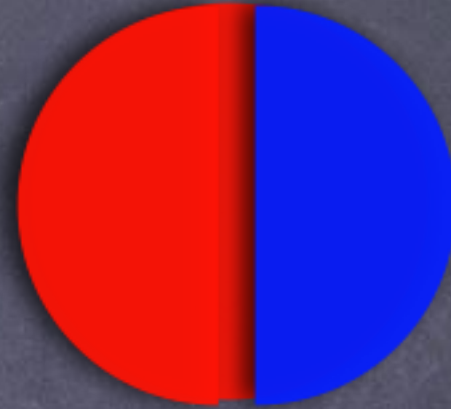
words/language



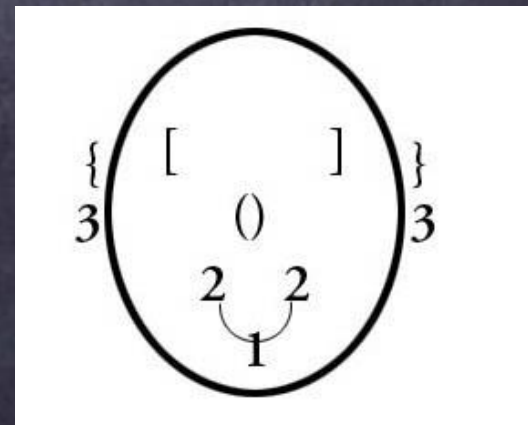
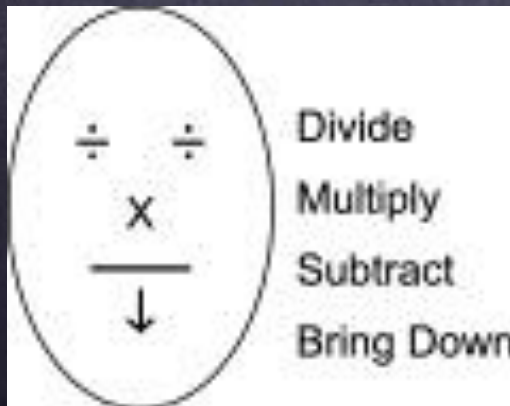
pictures



cue sheets



$1/2 =$ one of two equal parts



Example: Cue Sheet to Enhance A Student's Independent Practice

Goal: To solve a math problem.

Checklist

You are to:

1. Write the problem at the top of the page.

2. ❖ Use a strategy to solve the problem.

❖ Use pictures or words to explain your strategy.

3. Write your answer in the blank.

4. Write the items or ideas you used to solve the problem.

PPT # 6:

Use Language Experiences to Enhance Meaning & Understanding

Incorporate the following language expression modalities:

Speech

Writing

Drawing

Acting Out/Drama

Song

Videotape, photography/technology

How?

Examples - Describe what numbers & symbols mean:

Describe what numbers & symbols mean:

$$\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$$

one-half of one-fourth is one-eighth

$$\frac{1}{2} \div 4 = \frac{1}{8}$$



PTT # 7

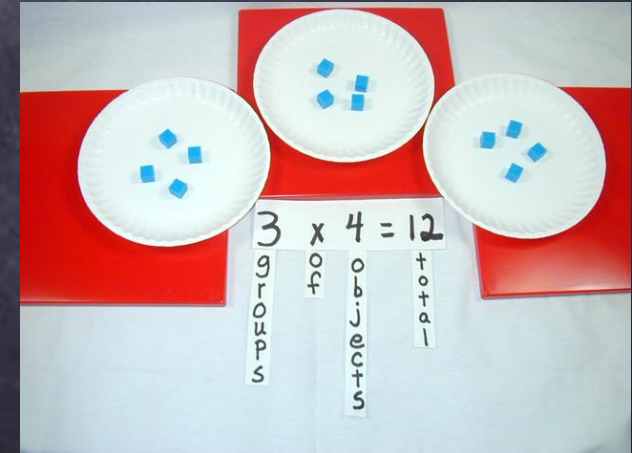
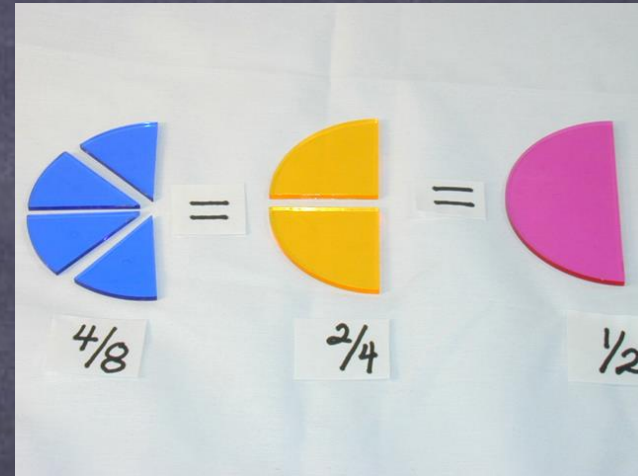
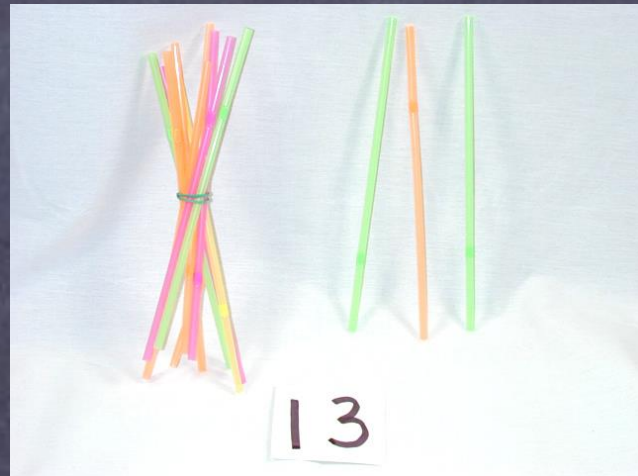
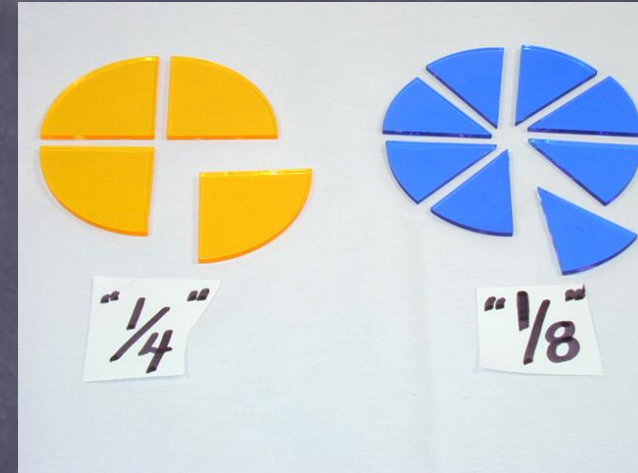
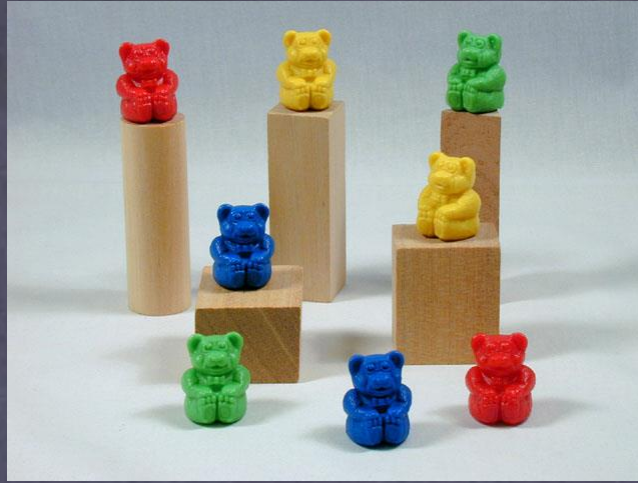
Ground Abstract Concepts & Processes in Concrete Experiences

Manipulatives

Teach Drawing Strategies

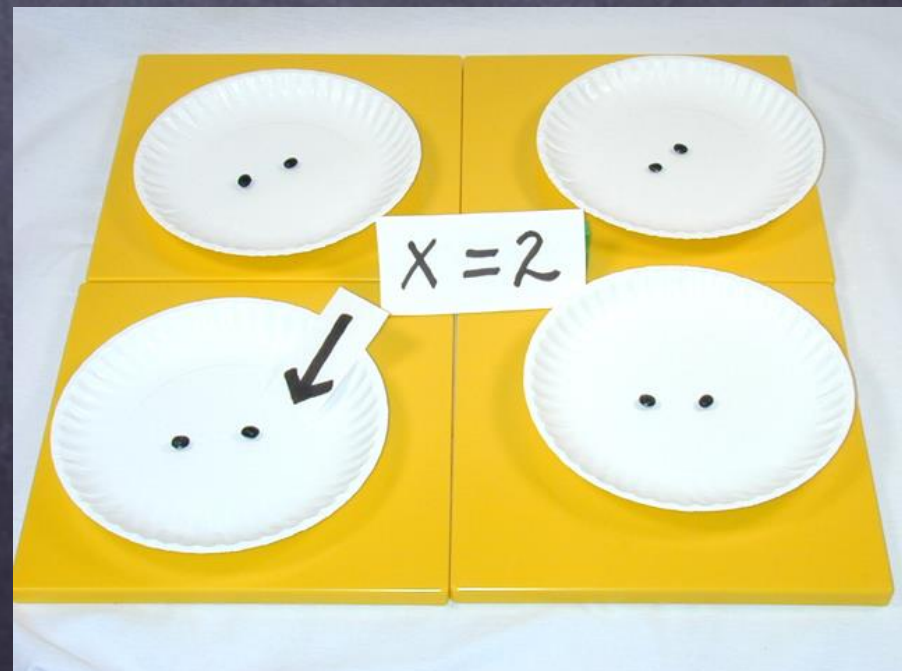
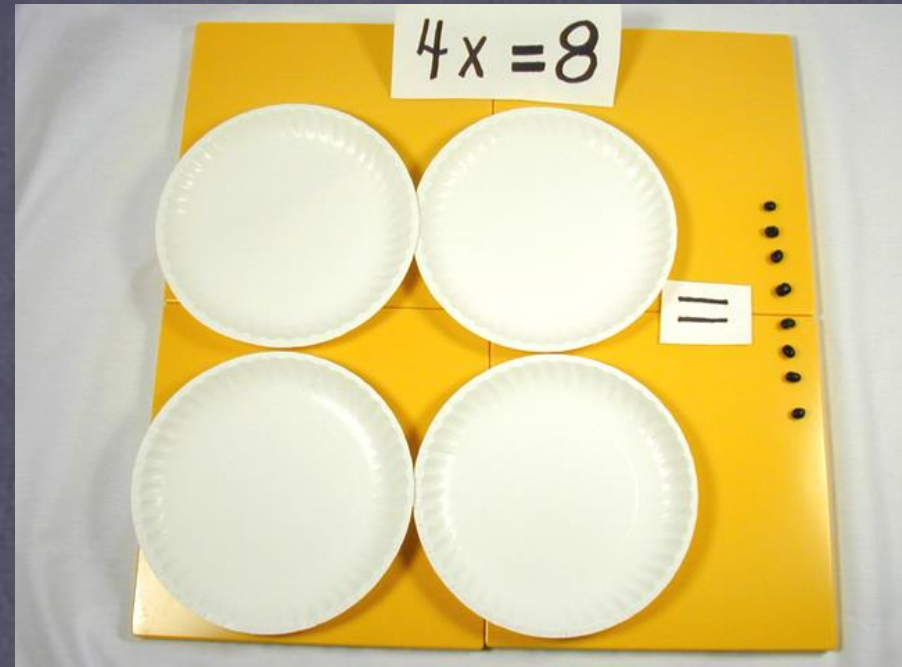
Manipulative Examples (Discrete):

- Attributes more “accessible”
- Can be “manipulated” more easily



Teach Drawing Strategies

- Start with concrete experiences
- Move to drawing representations of concrete experiences



Drawing Example:

3x

+

4

=

16



x = 4

Other Drawing Examples (see MathVIDS website)

Ones = $||||$
or
 $—$
(horizontal)

Tens = $|||||$
or
 $—$
(long vertical)

Combining/Bundling/Grouping Ones = $|||||$
or
 $—$

$\frac{4}{+3}$
 $\frac{7}{}$

$\frac{12}{+8}$
 $\frac{20}{}$

$\frac{8}{-4}$
 $\frac{4}{}$

$\frac{14}{-7}$
 $\frac{7}{}$

$3 \times 5 = 15$

$12 + 3 = 4$

$3x + 4 = 16$

$x = 4$

Circles/Boxes

$4 \times 5 = 20$

$4 \times 5 = 20$ (array) or $5 + 5 + 5 + 5 = 20$ (repeated addition)

$14 + 3 = 4$

$\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$ or $\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$

$3 \times \frac{2}{3} + 2 \times \frac{2}{3} = 5 \frac{4}{3}$

$5 \frac{1}{4} + 2 \frac{3}{4} = 2 \frac{2}{4}$

$5 + -3 = 2$ $-5 + -2 = 3$ $-4 + 3 = -1 = -1$

Enhancing Abstract Understanding

- Reasons for Difficulty

Lack of conceptual understanding

Memory problems

Organization/writing/visual processing problems

- Provide Many Practice Opportunities/Link to concrete & drawing experiences! → MASTERY

PTT # 8:

Provide Students Many Opportunities to Respond

*The more **opportunities students with learning disabilities have to respond** to a learning task, the more likely it is they will master that learning task...*

initial acquisition → *advanced acquisition (Teacher Directed Instruction)*

proficiency → *maintenance (Student Practice)*

generalization → *adaption (Extension)*



How?

Ensure that...

- students have a motivational context
- the practice activity focuses on the target math concept/skill
- students have multiple opportunities to respond
- teachers have a way to evaluate student responses

Examples

Instructional Games

Self-correcting Materials

Structured Peer-Mediated Learning Groups

Structured Language Experiences

Planned Discovery Experiences

Math Instructional Games/Self-Correcting Materials - A Few Ideas

| <u>Instructional Games</u> | <u>Self-Correcting Materials</u> |
|----------------------------|----------------------------------|
| Board Games | Flip Cards |
| Checker Board/Checkers | Flip Cards with Scaffolding Cues |
| Spinners | "Punch Hole" Cards/Folders |
| Dice | Puzzles |
| Cards | Versatiles |

(See MathVIDS for more ideas)

PPT # 9:

Monitor Student Learning & Provide Them Concrete Ways to Visualize Their Learning

- At least 2-3 times weekly
- Incorporate at concrete, drawing & abstract levels
- Use short, easy to evaluate “probes”
- Pinpoint key concepts for monitoring
- Teach students to chart their learning
- Use as a way to engage students in setting learning goals
- **CELEBRATE SUCCESS!!**

How?

| Level of Understanding | Method | Criterion |
|------------------------|--------------------|------------------------------|
| Abstract | 1-2 minute timings | Fluency (Rate & Accuracy) |
| Drawing | 8-10 tasks | Accuracy 90-100% 3 times |
| Concrete | 3 tasks | Accuracy 100% 3 times |

Examples

Abstract Level

Probe/Curriculum Slice

Skill: See/Write 2 digit addition without regrouping (sums < 20) ⁶⁹ C 69
I 1

Narib

| | | | | | |
|--|--|--|--|--|----|
| $\begin{array}{r} 21 \\ +35 \\ \hline \end{array}$ | $\begin{array}{r} 44 \\ +62 \\ \hline \end{array}$ | $\begin{array}{r} 38 \\ +50 \\ \hline \end{array}$ | $\begin{array}{r} 61 \\ +43 \\ \hline \end{array}$ | $\begin{array}{r} 29 \\ +60 \\ \hline \end{array}$ | 12 |
| 56 | 106 | 88 | 104 | 89 | |
| $\begin{array}{r} 84 \\ +52 \\ \hline \end{array}$ | $\begin{array}{r} 26 \\ +73 \\ \hline \end{array}$ | $\begin{array}{r} 75 \\ +42 \\ \hline \end{array}$ | $\begin{array}{r} 30 \\ +31 \\ \hline \end{array}$ | $\begin{array}{r} 45 \\ +83 \\ \hline \end{array}$ | 25 |
| 136 | 99 | 117 | 61 | 128 | |
| $\begin{array}{r} 10 \\ +48 \\ \hline \end{array}$ | $\begin{array}{r} 12 \\ +93 \\ \hline \end{array}$ | $\begin{array}{r} 56 \\ +73 \\ \hline \end{array}$ | $\begin{array}{r} 72 \\ +72 \\ \hline \end{array}$ | $\begin{array}{r} 34 \\ +34 \\ \hline \end{array}$ | 37 |
| 58 | 105 | 129 | 144 | 68 | |
| $\begin{array}{r} 92 \\ +96 \\ \hline \end{array}$ | $\begin{array}{r} 40 \\ +35 \\ \hline \end{array}$ | $\begin{array}{r} 32 \\ +76 \\ \hline \end{array}$ | $\begin{array}{r} 76 \\ +20 \\ \hline \end{array}$ | $\begin{array}{r} 63 \\ +64 \\ \hline \end{array}$ | 50 |
| 188 | 75 | 108 | 96 | 127 | |
| $\begin{array}{r} 53 \\ +34 \\ \hline \end{array}$ | $\begin{array}{r} 52 \\ +57 \\ \hline \end{array}$ | $\begin{array}{r} 93 \\ +82 \\ \hline \end{array}$ | $\begin{array}{r} 34 \\ +25 \\ \hline \end{array}$ | $\begin{array}{r} 77 \\ +51 \\ \hline \end{array}$ | 63 |
| 87 | 109 | 175 | 59 | | |
| $\begin{array}{r} 68 \\ +11 \\ \hline \end{array}$ | $\begin{array}{r} 44 \\ +84 \\ \hline \end{array}$ | $\begin{array}{r} 13 \\ +14 \\ \hline \end{array}$ | $\begin{array}{r} 64 \\ +92 \\ \hline \end{array}$ | $\begin{array}{r} 22 \\ +44 \\ \hline \end{array}$ | 75 |
| 79 | 128 | 27 | 156 | | |

Visual Display

“corrects”

“incorrects”

“goal line”





















What does this learning picture show?

Learning Picture Example: Student Use of Strategies


Name: Carlos

Concept/Skill: Two-Digit Addition Strategies

| | | | | | | |
|--|--|---|--|---|---|---|
| # of Different Strategies Used  Successful  Unsuccessful | 5 | | | | | |
| | 4 | | | | |  |
| | 3 | | |  |  |  |
| | 2 |  |  |  |  |  |
| | 1 |  |  |  |  |  |
| | | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 |
| Strategy/ies used: |  Add Tens | Add Tens | Add Tens Make a Ten | Add Tens Make a Ten | Add Tens Make a Ten Use easier number | |
| |  Make a Ten | Make a Ten | Use easier number | Use easier number | Compensation | |

PTT # 10: Provide Continuous Maintenance Activities for Previously Mastered Concepts/Skills

- Purposefully plan maintenance opportunities
- Emphasize foundational concepts for the mathematics curriculum you teach
- Make sure target maintenance concepts are ones students have previously mastered
- Vary the type of activities
- Avoid “drill & practice”
- Include students in developing ideas for maintenance activities
- Emphasize connections between abstract & concrete
- Engage students in “talking/writing/drawing” about target maintenance concepts

One thing I would like to
remember from the
learning activities in
Topic #3 is ... 

Topic #4 Long-term Professional Development Resources



<http://coe.jmu.edu/mathvidsr>



The Learning Toolbox

<http://coe.jmu.edu/learnngtoolbox>

Special Connections

Connecting teachers to strategies that help students with special needs successfully access the general education curriculum

<http://www.specialconnections.ku.edu/cgi-bin/cgiwrap/speconn/index.php>

Topic#5: Questions/Discussion

