# A Multisensory Approach to Reasoning, Logic and Proof

NCTM 2012 Regional Conference and Exposition
Dallas TX

Nadia Carrell, PhD
The Multisensory Training Institute of ASDEC
www.asdec.org

### Reasoning and Proof Standard for Grades 9-12

- recognize reasoning and proof as fundamental aspects of mathematics;
- make and investigate mathematical conjectures;
- develop and evaluate mathematical arguments and proofs;
- select and use various types of reasoning and methods of proof.

### It's all about the language

conditional antecedent

And disjunction Modus Tollens

conjunction

contrapositive consequence

statement Modus

Ponens Conjecture

Or

consequent

postulate

### **Our Challenge**

Take abstract concepts
and make them concrete
in order to make them
understandable and
memorable

### **CRA Instructional Sequence**

- Concrete teaches the concept
- Representational provides practice and makes memorable
- Abstract calculates with numbers and symbols

## Venn Diagrams and the Inclusive "OR"

- Do you like ice cream or lima beans?
- Do you like cabbage or candy?
- Do you like supervising lunch detention or grading exams?

### Venn diagrams

**Concrete:** construct diagrams using attributes of class (sports, where are our grandparents, clothing, etc.)

**Representational:** Shade regions "and", "or". "not"

**Abstract**: Analyze diagrams with numerical values

## Determining Truth Values & Truth Tables

- Concrete/Kinesthetic: double-sided markers replace T and F (handout)
- Representational: code with color and symbols
- Abstract: symbols only

#### **Conditional Statements**

Language:

Conditional

Converse

Inverse

Contrapositive

#### **Conditional Statements**

- Construct conditional using index cards and foam
- Write out the compound sentence
- Code the sentences for p and q
- Write in symbols
- Code and then write the truth value

### Modus Ponens and Modus Tollens

- Coding the statements aids in pattern recognition
- Code each statement (p,q,~q, etc) and conclusion
- Look for pattern of MP or MT

#### **Visual Theorem bank**

|                     | BC  |
|---------------------|---|
|                     | MCDBA+MCABC= MCDBC  |
| Complement Theorem  | complementary angles  |
|                     | complementary angles  m<1 + m<2 = 90°   |
| Def of Linear Pair  | A poir of adjacent (nevro and angles whoose non-  |
|                     | common sides are  |
|                     | D 2 K OKPOSITE (MV)   |
| Supplement Theorem  | supprementary angles (1/2)  |
|                     | m L1+m L2 = 180   |
| Vertical Angles     | Two nonadjacent angles formed by two intersecting lines.  Vertiles are = 122 (1:63 - vertice) |
| Theorem             | Vert I's are \$= \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\  |
|                     | Vert 12's are = 2 (1 \$ (3 - vertico  |
| Definition of Angle | A ray that divides an angle into two congruent angles.  |
| Bisector            | Cauding a value?  |

## Parallel Lines and Transversals

Interior Exterior

Transversal Alternate & Same Side

Vertical Corresponding

Linear Pair

## Concrete: Discovering Angle Relationships





# It really is all about the language..

Vocabulary Development Activities

Hit my Rhombus
One more Time

Nadia Carrell, PhD

ncarrell@asdec.org

The Multisensory Training Institute of ASDEC Rockville MD www.asdec.org