Common Core Math -Concrete, Representational, Abstract-

2017 Fall Institute

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Objectives

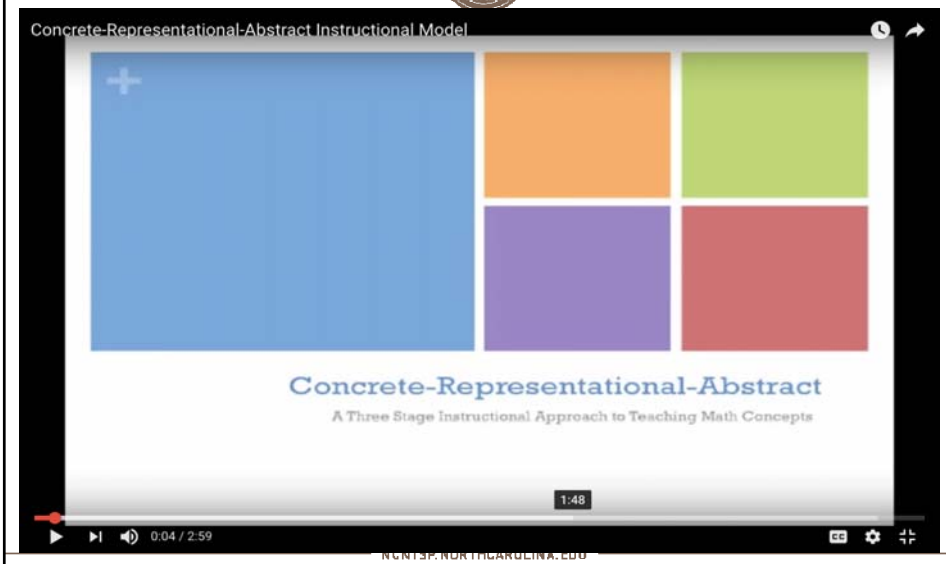
At the end of this session you will be able to:

- describe the components of concrete-representational-abstract (CRA) instruction
- create a lesson supported by the CRA sequence
- relate the benefits of CRA

True or False

1. Manipulatives may be used before or after a procedure is learned with generally equal success.
2. Manipulatives are more useful with less-experienced students than more-experienced students.
3. Almost any manipulative can be used to teach any mathematical concept.

Video



Research Based Concept

- Teaching equivalent fraction concepts and procedures (Butler et al., 2003)
  - Fraction circles and beans
  - Coloring portion of items to make fraction
  - Abstract symbols and algorithm
- Teaching multiplication facts and related word problems (Morin and Miller, 1998)
  - Paper plates and wooden blocks
  - Pictures of containers and items
  - Numbers

Explaining C-R-A

C

- Concrete or hands-on instruction that involves the manipulation of objects

R

- Representational stage, with different levels including pictures, technology, or tally marks

A

- Abstract stage, involving the use of numerals and operational symbols to represent the previous levels

CRA Principals

The CRA sequence should be very *explicit* and *systematic*, with multiple opportunities for both *guided practice* and *independent practice*.

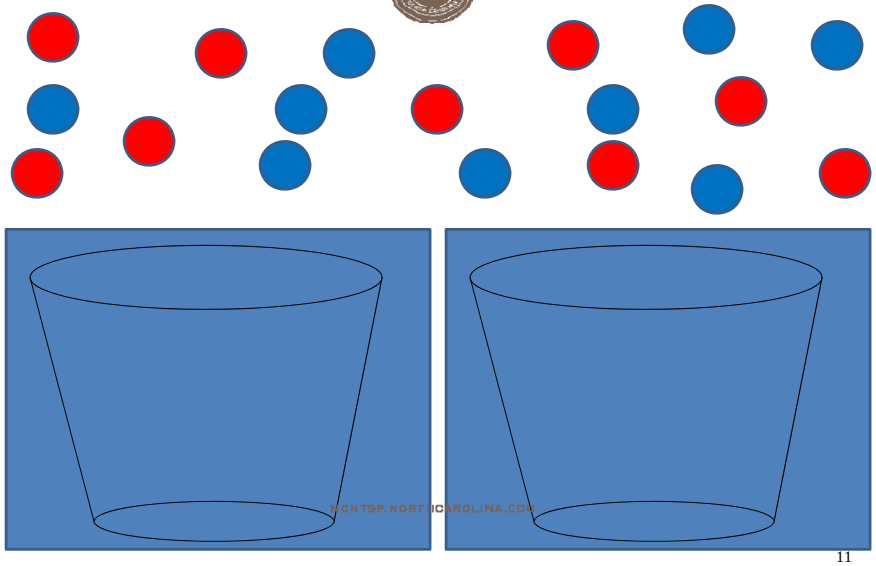
Definition of Concrete

- The use of manipulatives or models that represent the concept being studied is critical.
- It is the "doing" step of instruction.
- Students must be fluent in manipulation of the concrete materials and must be able to explain the connection to the skill.
  - Howell and Barnhart (1992) identified six steps in teaching from concrete to representational levels.

Stage 1: Concrete

Step 1: Free exploration
Step 2: Purposeful exploration
Step 3: Number cards
Step 4: Number sentence
Step 5: Mathematical word problems
Step 6: Verbal explanation

Purposeful Exploration



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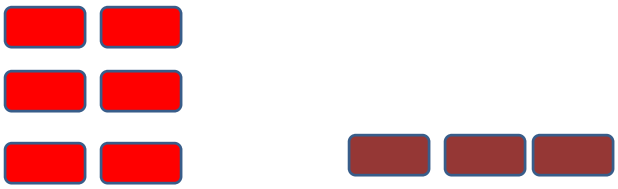
Step 3: Number Cards



6 + 3 = 9

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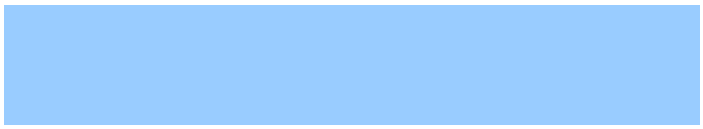
3 stars + 4 stars = 7 stars



Step 5: Mathematical Word Problems

There are three green buttons in a box. There are also two yellow buttons in the box. How many buttons are in the box altogether?

3 2

\+ = 5

Step 6: Verbal Explanation

- Students should verbalize what they did to solve the problem and why.
- Students should be taught to mastery level for each step before moving to the next step.

Activity

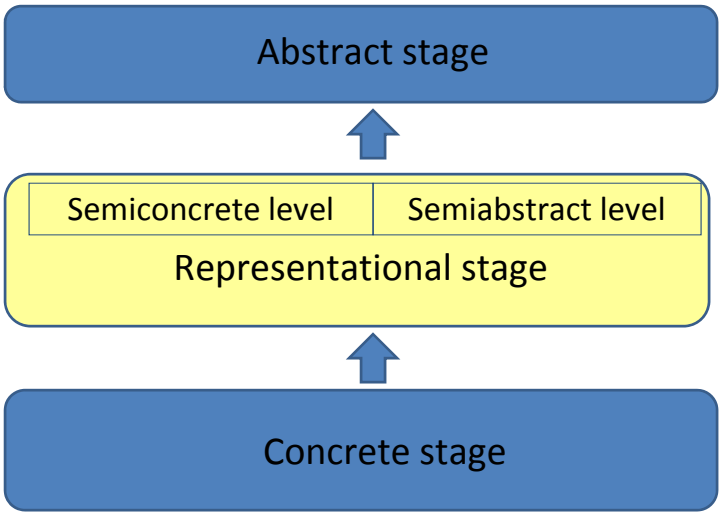
- Working with a partner, teach students to solve a subtraction, addition, or multiplication problem by using manipulatives.
- Keep the steps in mind:

Step 1: Free exploration
Step 2: Purposeful exploration
Step 3: Number cards
Step 4: Number sentence
Step 5: Mathematical word problems
Step 6: Verbal explanation

Definition of Representational

- Replacing concrete manipulative objects with pictures or drawings
- The "seeing" step of instruction
- Division into a semiconcrete level and a semiabstract level
- Six steps in the representational stage (Howell and Barnhart, 1992)

Stages and Levels



(Howell and Barnhart, 1992)

Representational

Step 1: Picture representation cards
Step 2: Number sentences (semiconcrete)
Step 3: Mathematical word problems
Step 4: Graphic representation
Step 5: Number sentences (semiabstract)
Step 6: Mathematical word problems

(Howell and Barnhart, 1992)

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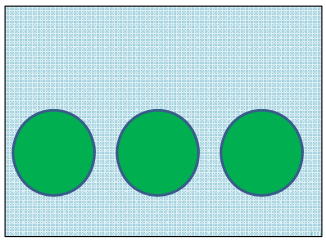
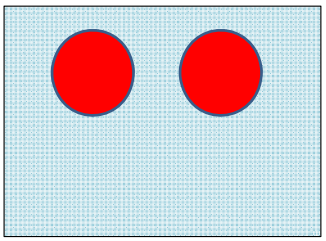
Step 1: Picture Representation Cards





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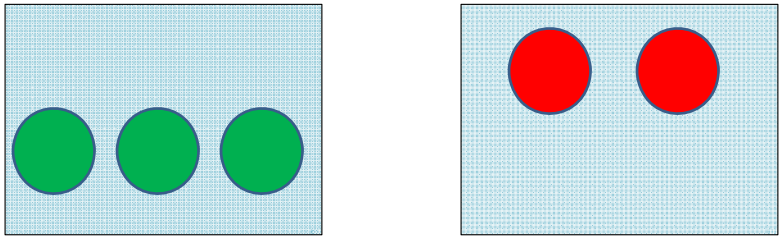
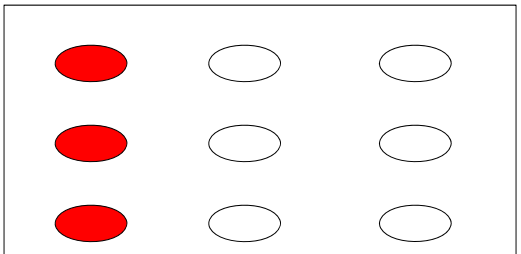
Step 2: Number Sentence



3+2=5

Step 3: Mathematical Word Problems



Number sentence: 3 + 6 = 9

Step 4: Graphic Representation

Red Ovals	White Ovals	Total
///	////	~~////~~ //

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Step 5: Number Sense

Red Ovals	White Ovals	Total
///	////	~~////~~ //
3 + 4 = 7		

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Step 6: Mathematical Word Problems

Jackie has $4 allowance left. Her mom gives her $12 more today. How much allowance does she have altogether?

Allowance	Allowance	Total
////	𝍸 𝍸 //	𝍸 𝍸 𝍸 /

4 + 12 = 16

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Definition of Abstract

- The "symbolic" step of instruction
- Written mathematical numbers are used to represent concepts or skills
- Thinking strategy to solve word problems, with five questions to ask (Howell and Barnhart, 1992)

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Stage 3: Abstract

Five questions used as procedural prompts that help students become independent problem solvers:

1. What is the question?
2. What are the numbers in the problem?
3. What do I need to do with the numbers?
4. What is the answer?
5. How can I check the answer?

(Howell and Barnhart, 1992)

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Guidelines for using Manipulatives

1. Select manipulatives that clearly illustrate the concept.
2. Use a variety of manipulatives that illustrate the concept.
3. Provides verbal explanations while incorporating the manipulatives.
4. Provide multiple opportunities for guided practice.
5. Encourage the use of manipulatives and strategies across settings.
6. Plan a graduated instructional sequence that will allow transition from concrete to symbolic representation.

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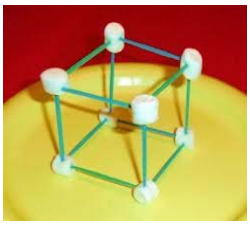
This or That?

Expensive	Cost Effective

Meaningful Manipulatives



Manipulatives

Lesson Planning

- Look at the standard for your grade level.
- Working with a partner, plan an appropriate math lesson.
- Make sure you include the CRA approach and manipulatives.

Closure

Think about what you learned in this session, and relate it to your classroom. Write down some ideas of what you want to start using in your classroom on the chart paper provided. Be prepared to share 1-2 responses with the entire group.

Explore Resources/Thoughts/Question, Answer