

## NATIONAL INSTITUTE FOR LEARNING DEVELOPMENT

### Course Syllabus

#### **I. COURSE DESCRIPTION:**

This is a lecture and laboratory course designed to train teachers to provide mathematical intervention in a group setting. Rx 4 Discovery Math is specifically intended for students in grades K-5 who would benefit from early intervention or whose basic math skills are below expected standards as determined by a local educational agency.

RX 4 Discovery Math will build and strengthen number sense, math fluency, math vocabulary, and problem solving strategies within three 30-minute or two 45-minute weekly small group sessions. Students who need to master basic number sense skills as well as those who rely on procedural understanding without a conceptual understanding would benefit the most from this program. Students will be challenged to apply their growing understanding of number sense to novel problem solving activities that challenge thinking and reasoning. Hands-on, research-based, number sense activities will be utilized as the core content in this dynamic intervention while mediation, Socratic questioning, and the strengthening of cognitive functions will serve as the core methodology. In this dynamic intervention, students' foundational math concepts will be strengthened while their thinking and problem solving skills will be challenged, all within an atmosphere where math anxiety is reduced and thinking is maximized.

- A. **Research** – *Neuropsychology of mathematics; the power of mediation; cognitive functioning abilities related to mathematics*
- B. **Philosophy** – *Hands-on, research-based number sense activities, brain-based, Socratic questioning, theories of group dynamic, and cognitive functions*
- C. **Intervention** – *Balanced, mediated application of mathematically-based activities and techniques addressing 1) conceptual understanding of number, 2) procedural fluency, and 3) problem solving skills*
- D. **Assessment** – *Identify specific difficulties with math skills and concepts; gather pre/post data using KTEA III and informal observation*

## II. COURSE OBJECTIVES

- A. **General:** Successful completion of this course will enable the participant to better understand student needs in math based on the four subtypes of math disabilities and understand how to strengthen number sense, develop math fluency, and bolster problem solving skills, while also learning how to utilize the group model for Rx 4 Discovery Math to teach students conceptual, procedural, and problem solving math skills and strategies to strengthen students' foundational grasp of number.
- B. **Specific:** Upon completion of this course, the participant will be able to:
1. Communicate an understanding of the differences between group and individualized interventions
  2. Demonstrate an ability to work with groups of 4-6 students in the teaching of basic mathematical skills focused on number sense
  3. Communicate the theories of mediated learning in a group setting
  4. Design a plan for group implementation that would meet the learning needs of a specific groups of students

## III. COURSE RESOURCES

- A. RX 4 Math training manual
- B. *The Neuropsychology of Mathematics* by Dr. Steven G. Feifer
- C. *Coming to Know Number* by Grayson H. Wheatley & Anne M. Reynolds – required text
- D. *Number Sense Routines* by Jessica F. Shumway
- E. *Mediating Math* by Sue Hutchison, Kathy Keafer & Pattie Perry
- F. *Mediated Learning In and Out of the Classroom* by Cognitive Research Program
- G. *Playing with Math: The Name of the Game* by Chris Horne and Steven Feifer

## IV. COURSE REQUIREMENTS

- A. **Prerequisite:** none
- B. **Pre-Course Preparation:**
- 1) Obtain permission from the school or program supervisor to use group models in classrooms, resource rooms, or after school settings. **No written permission is required for this course**, but we ask that you secure permission ahead of time in order to ensure ease of implementation after the training is completed.
  - 2) Read Part I, “Helping Children Learn Mathematics”, of *Coming to Know Number* and print Part II, “Pupil Activities”, for use in demonstrations during the course.

3) Read the following 4 articles:

- *Early Number Sense Plays a Role in Later Math Skills*  
by Lauren Neergaard
- *Is It Counting or Adding?*  
by Sara Eisenhardt, Molly H. Fisher, Jonathan Thomas, Edna O. Schack, Janet Tassell, and Margaret Yoder
- *What is Conceptual Understanding?*  
by Balka, Hull, and Harbin Miles
- *Using Concreteness in Education*  
by Megan C. Brown, Nicole M. McNeil, and Arthur M. Glenberg

**C. Materials:**

1. **Required** - *Coming to Know Number* by Grayson H. Wheatley & Anne M. Reynolds – Part II, “Pupil Activities” printed and prepared for use during the course
2. **Suggested** – *Number Sense Routines*  
by Jessica F. Shumway  
*Playing with Math: The Name of the Game*  
by Chris Horne and Steven Feifer  
*Mediating Math*  
by Sue Hutchison, Kathy Keafer and Pattie Perry

**D. Course Activities:**

1. Acquire an understanding of number sense:
  - a) What is number sense?
  - b) Why is it so important?
  - c) How is number sense developed in young learners?
2. Demonstrate techniques taught with peers in a group setting
3. Explain the differences between group and individualized models of instruction
4. Read research on group effectiveness and discuss the social aspects of learning

**V. COURSE WORKLOAD**

The time required for assignments and prerequisite assignments has been estimated at 7 hours.

**VI. COURSE EVALUATION**

Participants will practice the math techniques with a small group and receive feedback on their demonstrations. Proficiency with number sense activities and the ability to articulate their importance will be assessed.

**VII. SELECTED BIBLIOGRAPHY**

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## **PURPOSE**

1. To provide small-group mathematical intervention that includes activities to strengthen the foundation of mathematical thinking: Number Sense
2. To immerse students in dynamic activities that foster the understanding of what numbers mean as well as think and reason flexibly with numbers, use numbers to solve problems, spot unreasonable answers, understand how numbers can be taken apart and put together in different ways, see connections among operations, figure mentally, and make estimates
3. To strengthen conceptual understanding of numbers and encourage the development of self-generated mathematical strategies for efficient mathematical methods that produce independent thinkers
4. To provide instruction in mathematical language and problem solving through mediation, questioning, and small-group interactions where students' competency in routine and non-routine mathematical problems and awareness of patterns and relationships is strengthened

## **GOALS**

### **Students will:**

1. Develop number sense by learning to:
    - Think in collections
    - Think in tens
    - Think strategically
    - Think conceptually
  2. Develop math fluency
  3. Develop math vocabulary
  4. Develop problem solving strategies
  5. Strengthen cognitive functions through targeted intervention activities and specific questioning and feedback
  6. Apply growing understanding of number in problem solving activities
  7. Practice essential math skills through dynamic group activities
  8. Reduce math anxiety
  9. Learn how to effectively work in a small group setting with others
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| <b><u>CONTENT</u></b>  | <b><u>METHOD</u></b>   | <b><u>FOCUS</u></b>   |
|--|--|---|
| <p><b>Math Disability Subtypes</b></p> <ol style="list-style-type: none"> <li>1. Verbal Dyscalculia</li> <li>2. Procedural Dyscalculia</li> <li>3. Semantic Dyscalculia</li> <li>4. Visual-Spatial Dyscalculia</li> </ol> <p><b>Cognitive Functions</b></p> <p><u>INPUT</u></p> <ul style="list-style-type: none"> <li>• Clear Perception</li> <li>• Exploration of the Learning Situation</li> <li>• Receptive Verbal Tools &amp; Concepts</li> <li>• Spatial Orientation</li> <li>• Temporal Orientation</li> <li>• Conservation of Constancies</li> <li>• Precise &amp; Accurate Data Gathering</li> <li>• Use of two or more Sources of Information</li> </ul> <p><u>ELABORATION</u></p> <ul style="list-style-type: none"> <li>• Definition of the Problem</li> <li>• Select relevant cues</li> <li>• Spontaneous comparative behavior</li> <li>• Broad and Wide Mental Field</li> <li>• Planning Behavior</li> <li>• Summative Behavior</li> <li>• Project Virtual Relationships</li> <li>• Pursue Logical Evidence</li> <li>• Ability to internalize events</li> <li>• Inferential-Hypothetical Thinking</li> <li>• Hypothesis Testing</li> <li>• Planning Behavior</li> <li>• Elaboration of Cognitive Categories</li> <li>• Grasp of Reality</li> </ul> <p><u>OUTPUT</u></p> <ul style="list-style-type: none"> <li>• Communication Modalities</li> <li>• Participatory Output Responses</li> </ul> | <p><b>Socratic Questioning</b></p> <p><b>Small-Group Learning</b></p> <p><b>Multi-Sensory</b></p> <p><b>Dynamic Activities</b></p> <p><b>Games</b></p> <p><b>Mediated Learning Experience</b></p> <ul style="list-style-type: none"> <li>• Intentionality</li> <li>• Reciprocity</li> <li>• Transcendence</li> <li>• Meaning</li> <li>• Competence</li> <li>• Shared Behavior</li> </ul> | <ul style="list-style-type: none"> <li>• Worked through Output Responses</li> <li>• Expressive Verbal Tools</li> <li>• Data Output</li> <li>• Visual Transport</li> <li>• Behavior</li> </ul> <p><b><u>CONTENT</u></b></p> <p><b>Quantitative Abilities</b></p> <ul style="list-style-type: none"> <li>• Number Sense (collections, patterns and relationships)</li> <li>• Primary Numeric Abilities (subitizing, ordinality, counting, arithmetic)</li> <li>• Secondary Numeric Abilities (number-counting system, arithmetic computations, word problems)</li> <li>• Conceptual Understanding</li> <li>• Math Fluency (efficiency, accuracy, flexibility)</li> <li>• Math Vocabulary</li> <li>• Problem Solving Strategies</li> </ul> |

## COURSE SCHEDULE / OUTLINE

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### *Day 1 & 2 - Daily Schedule*

|             |   |              |
|-------------|---|--------------|
| 8:30 - 9:45 | - | SESSION 1    |
| 9:45-10:15  | - | <i>Break</i> |
| 10:15-12:00 | - | SESSION 2    |
| 12:00-1:15  | - | <i>Lunch</i> |
| 1:15 - 2:30 | - | SESSION 3    |
| 2:30-2:45   | - | <i>Break</i> |
| 2:45-4:00   | - | SESSION 4    |

#### DAY 1

- 1 - Neuropsychology of Mathematics: Diagnosis and Intervention, Pt. 1
- 2 - Neuropsychology of Mathematics: Diagnosis and Intervention, Pt. 2
- 3 - Number Sense
- 4 - Demonstration of Rx 4 Discovery Math

#### DAY 2

- 1 - Rx 4 Discovery Math Technique Procedure
- 2 - Math Anxiety  
Small Group Instruction
- 3 - Participant Practice
- 4 - Participant Practice  
Discussion of pre-course reading

### *Day 3 - Daily Schedule*

|             |   |              |
|-------------|---|--------------|
| 8:30 -10:00 | - | SESSION 1    |
| 10:00-10:15 | - | <i>Break</i> |
| 10:15-12:00 | - | SESSION 2    |

#### DAY 3

- 1 - Supplemental Games & Materials  
Record Keeping/Data Collection  
Participant Practice
- 2 - Participant Practice