



## NATIONAL INSTITUTE FOR LEARNING DEVELOPMENT

### Rx 4 Math I

### Workshop Syllabus

#### I. WORKSHOP DESCRIPTION

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

Rx 4 Math I 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.

The following topics are discussed in the workshop:

- A. **Research** - Neuropsychology of mathematics; the power of mediation; cognitive functioning ability related to mathematics
- B. **Philosophy** - Hands-on, research-based, number sense activities, brain-based, Socratic questioning, theories of group dynamics, and cognitive functions
- C. **Intervention** - Balanced, mediated application of mathematically based activities and techniques addressing:
  - 1. Conceptual understanding of number
  - 2. Procedural fluency

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. WORKSHOP OBJECTIVES

- A. **GENERAL:** Successful completion of this workshop will enable the participant to understand student needs in math based on the four subtypes of math disabilities. It will also enable the participant to understand how to strengthen number sense, develop math fluency, and bolster problem solving skills. He or She will learn how to use the group model for Rx 4 Math I to teach students conceptual, procedural, and problem-solving math skills and strategies to strengthen students' foundational grasp of numbers.
- B. **SPECIFIC:** Upon completion of this workshop, 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 implementation that would meet the learning needs of a specific group of students

## III. WORKSHOP RESOURCES

### A. REQUIRED:

1. Rx For Math Training Manual (***will be provided before the training***)
2. *Coming to Know Number* by Grayson H. Wheatley & Anne M. Reynolds  
(Purchase this e-book at [www.mathematicslearning.org](http://www.mathematicslearning.org))
3. CD containing printable Pupil Pages for *Coming to Know Number*  
(Purchase card games and printable CD at [www.learninghouse.ca](http://www.learninghouse.ca))
4. *Mediating Math* by Sue Hutchison, Kathy Keafer, and Pattie Perry  
(Purchase at [www.learninghouse.ca](http://www.learninghouse.ca))
5. Complete set of 4 Mediating Math Student Workbooks: ***Number Patterns; Calculation and Estimations; Fractions, Decimal and Percents; Measurements***  
(Purchase at [www.learninghouse.ca](http://www.learninghouse.ca))

### B. OPTIONAL:

1. Card Games: "Dot Pattern Match"; & "Ten Frame Pairs" (Many find this resource helpful after familiarizing themselves with the materials during the two-day training)  
(Purchase this resource at [www.mathematicslearning.org](http://www.mathematicslearning.org))

## IV. WORKSHOP REQUIREMENTS

A. **PREREQUISITE:** None

B. **PRE-WORKSHOP PREPARATION:**

1. Read Part I “Helping Children Learn Mathematics” of Coming to Know Number, and familiarize yourself with Part II, “Pupil Activities”.
2. Read four articles
3. Watch three asynchronous lectures
4. Complete a knowledge assessment

C. **WORKSHOP 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. WORKSHOP WORKLOAD**

The time required for assignments has been estimated at four hours.

**VI. WORKSHOP 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. PURPOSE**

- A. To provide small-group mathematical intervention that includes activities to strengthen the foundation of mathematical thinking which develops Number Sense.
- B. To immerse students in dynamic activities that foster the understanding of what numbers mean, to 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.
- C. To strengthen the conceptual understanding of numbers and encourage the development of self-generated mathematical strategies for efficient mathematical methods that produce independent thinkers
- D. 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.

## VIII. GOALS

Students will:

- A. Develop number sense by learning to:
  1. Think in collections
  2. Think in tens
  3. Think strategically
  4. Think conceptually
- B. Develop math fluency
- C. Develop math vocabulary
- D. Develop problem-solving strategies
- E. Strengthen cognitive functions through targeted intervention activities and specific questioning and feedback
- F. Apply growing understanding of numbers in problem-solving activities.
- G. Practice essential math skills through dynamic group activities.
- H. Reduce math anxiety.
- I. Learn how to effectively work in a small group setting with others.

## Rx For Math Workshop Breakdown

<u>CONTENT</u>	<u>METHOD</u>	<u>FOCUS</u>
<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 and 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>	<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 Behaviour</li> </ul>	<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>INPUT</p> <ul style="list-style-type: none"> <li>• Clear Perception</li> <li>• Exploration of the learning situation</li> <li>• Receptive verbal tools and concepts</li> <li>• Spatial Orientation</li> <li>• Temporal Orientation</li> <li>• Conservation of Constancies</li> <li>• Precise and accurate data gathering</li> <li>• Use of two or more sources of information</li> </ul> <p>ELABORATION</p> <ul style="list-style-type: none"> <li>• Definition of the problem</li> <li>• Select relevant cues</li> <li>• Spontaneous comparative behaviour</li> <li>• Broad and wide mental field</li> <li>• Planning Behaviour</li> <li>• Summative Behaviour</li> <li>• Project virtual relationships</li> <li>• Pursue logical evidence</li> <li>• Ability to internalize events</li> <li>• Inferential-Hypothetical thinking</li> <li>• Planning Behaviour</li> <li>• Elaboration of cognitive categories</li> <li>• Grasp of reality</li> </ul> <p>OUTPUT</p> <ul style="list-style-type: none"> <li>• Communication modalities</li> <li>• Participatory Output Responses</li> <li>• Worked through Output Responses</li> <li>• Expressive verbal tools</li> <li>• Data Output</li> <li>• Visual Transport</li> <li>• Behaviour</li> </ul>

## SELECTED BIBLIOGRAPHY

- Albrami, P. C., Lou, Y., Chambers, B., Poulsen, C., Spence, J. C. (2000). Why should we group students within-class for learning? *Educational Research and Evaluation*, 6(2).
- Ashcraft, Mark. (2002) *Math anxiety: personal, educational, and cognitive consequences. Current Directions in Psychological Science*, 11 (5), 181-185.
- Boaler, Jo. (2012). *Times tests and developmental math anxiety*. Retrieved April 9, 2014, from Education Week website:  
<http://www.edweek.org/ew/articles/2012/07/03/36boaler.h31.html>
- Burns, Marilyn. *About Teaching Mathematics: A K-8 Resource*. 3rd ed. Sausalito, CA: Math Solutions, 2007. Print.
- Burns, Marilyn. "How I Boost My Students' Number Sense." *Instructor Magazine*, April 1997: 49-54. Web.
- Carlyle, Ann, and Brenda Mercado. *Teaching Preschool and Kindergarten Math: More than 175 Ideas, Lessons, and Videos for Building Foundations in Math, a Multimedia Professional Learning Resource*. Sausalito, CA: Math Solutions, 2012. Print.
- Cartney, P., & Rouse, A. (2006). The emotional impact of learning in small groups: highlighting the impact on student progression and retention. *Teaching in Higher Education*, 11(1), 79-91.
- Chapin, Suzanne H., and Art Johnson. *Math Matters: Understanding the Math You Teach, Grades K-8*. Sausalito, CA: Math Solutions Publications, 2006. Print.
- Chapin, Suzanne H., Mary Catherine. O'Connor, and Nancy Canavan Anderson. *Classroom Discussions: Using Math Talk to Help Students Learn, Grades K-6*. Sausalito, California: Math Solutions, 2009. Print.
- Cognitive Research Program. (1996). Mediated learning in and out of the classroom. Arlington Heights, IL: IRI/SkyLight Training and Publishing, Inc.
- Conklin, Melissa, and Stephanie Sheffield. *It Makes Sense! Using the Hundreds Chart to Build Number Sense*. Sausalito, CA: Math Solutions, 2012. Print.
- Emory, Mike. (2009). UH psychology professor focusing on anxiety's effect on learning. Retrieved April 9, 2014 from University of Houston's website:  
<http://www.uh.edu/news-events/stories/2009articles/september2009/0916AnxietyResearch.php>
- Feifer, Steven. *The Neuropsychology of Mathematics: Diagnosis and Intervention*. Middletown, MD: School Neuropsych Press, LLC, 2005.
- Foorman, B. R., & Torgesen, J. (2001). Critical elements of classroom and small-group instruction promotes reading success in all children. *Learning Disabilities Research & Practice*, 16(4), 203-212.
- Fuchs, D. (2001). *Upgrading preparatory work to augment reading development: UPWARD for students with disabilities*. Final Report, Vanderbilt University, Nashville, TN.

- Fuchs, D., Fuchs, L., Yen, L., McMaster, K., Svenson, E., Yang, N., Young, C., Morgan, P., Gilbert, T., Jaspers, J., Jernigan, M., Yoon, E., King, S. (2001). Developing first-grade reading fluency through peer mediation. *Teaching Exceptional Children*, Nov/Dec. pp.34-40.
- Fulk, B. M., & King, K. (2001). Classwide peer tutoring at work. *Teaching Exceptional Children*, Nov/Dec. pp. 49-53.
- Geary, D.C. (2000). From infancy to adulthood: the development of numeric abilities. *European Child and Adolescent Psychiatry*, 9(2), 11-16.
- Gersten, R., and D. Chard. "Number Sense: Rethinking Arithmetic Instruction for Students with Mathematical Disabilities." *The Journal of Special Education* 33.1 (1999): 18-28. Print.
- Haskell, S. H. (2000). The determinants of arithmetic skills in young children: Some observations. *European Child and Adolescent Psychiatry*, 9, 1177-1186.
- Jones, A. (2002). Teaching for learning is in education: Assessing the effectiveness of small group problem-solving/discussion events in large class teaching. *Proceedings of the 15th Annual Conference of the International Academy for Information Management*.
- Kaufman, R. & Burden, R. (2004). Peer tutoring between young adults with severe and complex learning difficulties: The effects of mediation training with Feuerstein's Instrumental Enrichment programme. *European Journal of Psychology of Education*, XIX (1).
- Kaufman, Alan S., PhD, & Nadeen L. Kaufman, EdD. (2004). Pearson Assessments, KTEA II.
- Korkman, M., (1999). Applying Luria's diagnostic principles in the neuropsychological assessment of children. *Neuropsychology Review*, 9 (2), 89-1103.
- Kozulin, A. (1990). Vygotsky's psychology: A biography of ideas. Cambridge, MA: Harvard University Press.
- Lavoie, R. (2005). It's so much work to be your friend. New York: Touchstone
- Lerner, J. (2000). Learning disabilities: Theories, diagnosis, and teaching strategies. Boston, MA: Houghton Mifflin Company.
- Neergaard, Lauran. "Early Number Sense Plays Role in Later Math Skills." *Associated Press (2013): n. page*. Yahoo! News. 26 Mar. 2013. Web.
- Ormrod, J.E. (2010). Anxiety in the Classroom. Retrieved April 9, 2014 from Education Week website:  
<http://www.education.com/reference/article/anxiety-classroom/>
- Parrish, Sherry. *Number Talks: Helping Children Build Mental Math and Computation Strategies, Grades K-5*. Sausalito, CA: Math Solutions, 2010. Print.
- Russell, Deb. (2014). Dispel the Math Myths. Retrieved April 9, 2014 from About.com "Mathematics" website:  
[http://math.about.com/cs/mathreform/a/myths\\_2.htm](http://math.about.com/cs/mathreform/a/myths_2.htm)

- Schuster, Lainie. *Enriching Your Math Curriculum: Grade 5: A Month-to-month Resource*. Sausalito, CA: Math Solutions, 2010. Print.
- Shumway, Jessica F. *Number Sense Routines*. Portland, Maine: Stenhouse Publishers, 2001.
- Smith, Wendy Hageman & B. Sidney Smith. (2014). *Coping with math anxiety*. Retrieved on April 9, 2014 from:  
<http://platonicroams.com/minitexts/Coping-With-Math-Anxiety>
- Sousa, D. (2006). How the brain learns. Thousand Oaks, CA: Corwin Press
- Stanescu-Cosson, R., Pinet, P., van de Moortele, P.F., Le Bihan, D., Cohen, L., & Dehaene, S., (2000). Understanding dissociations in dyscalculia: A brain imaging study of the impact of number size on the cerebral networks for exact and approximate calculation. *Brain*, 123, 2240 – 2255.
- Texas State University Counseling Center. Math anxiety. Retrieved on April 9, 2014
- Tzuriel, D. & Shamir, A. (2007). The effects of peer mediation with young children (PYMC) on children’s cognitive modifiability. *British Journal of Educational Psychology*, 77.
- Understanding Number Sense*. Retrieved April 9, 2014, from Math Solutions website.
- Van de Walle, John, Karp, Karen H., Lovin, Lou Ann H., & Jennifer M. Bay Williams. (2013). *Teaching Student-Centered Mathematics*. Upper Saddle River, New Jersey: Pearson Publishing, 2013.
- Vaughn, S., Hughes, M.T., Moody, S. W., Elbaum, B. (2001). Instructional grouping for reading for students with LD: Implications for practice. *Intervention in School and Clinic*, 36(3).
- Vygotsky, L. S. (1975). Thought and language. (12th Ed.) Cambridge, MA: MIT Press.
- Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University Press
- Wade, Lisa. (2013). The truth about gender and math. Retrieved March 7, 2013 from:  
<https://thesocietypages.org/socimages/2013/03/07/the-truth-about-gender-and-math/>
- Way, Jenni. “Number Sense Series: Developing Early Number Sense.” *University of Cambridge, NRICH* (2013): n. pa. Web. 26 Aug. 2013.
- Wheatley, Grayson H. & Anne M. Reynolds. *Coming to Know Number, 2nd Edition*. Bethany Beach, DE: Mathematics Learning, 2010.

1